Part I: Quelling Cold Sores and Aphthous Ulcers
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Part II: Relieving Xerostomia
Written by Fiona M. Collins, BDS, MBA, MA
A Peer-Reviewed Publication
Part I: Quelling cold sores and aphthous ulcers

Educational Objectives
The overall goal of this article is to provide the reader with information on the etiology, pathophysiology, and treatment of recurrent aphthous ulcers and recurrent herpes labialis. Upon completion of this course, the reader will be able to:
1. List and describe the etiology and pathophysiology related to recurrent aphthous ulcers and recurrent herpes labialis.
2. List and describe the general recommendations specific to patients experiencing recurrent herpes labialis.
3. List and describe the treatment options available for recurrent aphthous ulcers and recurrent herpes labialis.

Abstract
Recurrent aphthous ulcers (RAU) and recurrent herpes labialis (RHL) are two of the common oral/peri-oral lesions experienced in the general population. Treatment options include over-the-counter and prescription products.

Introduction
Recurrent herpes labialis (cold sores) and recurrent aphthous ulcers (canker sores) are common conditions that can be treated to relieve discomfort and, with some treatments, aid healing. Between 15% and 40% of people experience a cold sore in their lifetime, and it has been estimated that up to 80% of adults carry the herpes virus latently by age 30.1 Forty percent of carriers in the United States are under age 20.2 In addition, the age at which the virus is acquired and seropositivity vary by geography and socioeconomic status, with a greater incidence in younger patients in developing countries.3 Recurrent aphthous ulcers (RAU) are distinct from recurrent herpes labialis (RHL) in presentation and etiology. Although RAU are believed to be less prevalent than RHL, affecting around 1% of the population according to NHANES III, other studies have found an incidence of 5%-66%.4

Etiology and Pathophysiology of RAU and RHL
The precise precipitating events and mechanisms for the occurrence of RAU are as yet not fully explained. A wide range of factors have been implicated in RAU (Table 1), with nonsmokers more affected than smokers.5,6 Hypersensitivity to dairy and gluten, as well as sensitivity to sodium laurel sulfate, are considered etiological factors, and medications implicated in RAU include cardiovascular drugs, interferon, certain antibiotics, and anti-inflammatory drugs.7,8,9 In addition, a higher incidence and severity of RAU have been reported in patients with diseases that include Celiac disease, ulcerative colitis, Behcet’s syndrome, and HIV infection. No consistent association has been found with bacterial or viral factors.10 Based on research there is involvement of the immune system, with the presence of increased levels of circulating and inflammatory mediators including TNF-α, interleukin-2, natural killer cells, and antiendothelial cell autoantibodies.10

Table 1. Implicated factors and associations for RAU

<table>
<thead>
<tr>
<th>Factor</th>
<th>Association</th>
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<tr>
<td>Sensitivity to sodium laurel sulfate</td>
<td>Stress</td>
</tr>
<tr>
<td>Iron, folate, zinc or vitamin B12 deficiency</td>
<td>Local trauma</td>
</tr>
<tr>
<td>Medication use</td>
<td>Systemic diseases</td>
</tr>
<tr>
<td>Immune system involvement</td>
<td>Genetics</td>
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<tr>
<td>Hypersensitivity to dairy and gluten-containing foods</td>
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RHL, in contrast, are caused by a prior primary infection with herpes simplex virus type 1 (HSV-1). RHL are transmitted by direct contact with the secretions from herpetic lesions, resulting in a primary infection that is often asymptomatic. Once acquired, the infection lies dormant in the peripheral sensory neurons (trigeminal ganglia) until periodic reactivation is induced by a particular trigger or stressor (Table 2). Exposure to a trigger then precipitates viral migration along sensory neurons to the epithelium where the virus replicates and, upon recognition by the immune system, prompts the release of inflammatory mediators followed by a clinically evident RHL outbreak.

Table 2. Triggers and stressors for periodic reactivation of HSV-1

<table>
<thead>
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<th>Trigger</th>
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<tr>
<td>Anxiety/stress</td>
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<tr>
<td>Infection (e.g., the common cold)</td>
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<tr>
<td>Ultraviolet light</td>
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<tr>
<td>Dental treatment</td>
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<tr>
<td>Menstruation</td>
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Ultra-violet (UV) light as a trigger has been well-studied in clinical trials. Rooney et al. investigated the effect of sunscreen (SPF-15) application compared to use of a placebo in a randomized, double-blind crossover study. No patients developed active lesions while using SPF-15 sunscreen and only one had asymptomatic viral shedding, while during the placebo phase there were 27 reactivations of lesions, suggesting not only that UV light acts as a trigger but also that sunscreen can play an important role in preventing recurrences.11,15

Clinical Presentation of RAU and RHL
RAU are classified as minor, major, and herpetiform recurrent aphthous ulcers. These differ in size (<1 mm to >10 mm in diameter), number and severity of the outbreak. RAU may first cause a tingling sensation before the red raised area at the ulcer site appears prior to ulceration and the appearance of a flat or cratered, grayish-yellow area surrounded by a ring of inflamed tissue. RAU typically occur on nonkeratinized surfaces of the oral mucosa, including the tongue and palate. All 3 types can cause moderate to severe pain, and result in difficulty in eating, drinking, speaking, and swallowing. Minor and herpetiform RAU typically heal within 7-10 days. The most severe are major RAU; these can cause severe debilitating pain, take up to several weeks or months to heal, and heal with scarring.
RHL proceed through 8 stages of forming and healing: prodrome; erythema; papule formation; vesicle formation; ulceration/soft crust; hard crust; desquamation (dry flake); residual swelling. During the prodromal phase, patients may experience tingling, numbness, pain or itching associated with the initial viral replication in the nerve endings. After the papules have formed, these coalesce into fluid-filled vesicles that form a crust and heal in 14-21 days during the first occurrence and within 7-10 days during recurrences. It is during the vesicle stage that the patient experiences the highest viral load, and when the vesicle bursts the patient is also at risk for bacterial superinfection, which would present with pus formation and may require the use of topical antibiotics. Along with their classical signs and symptoms, RHL can be definitively detected and identified using DNA amplification tests or by swabbing the lesion and culturing the virus. The most common location for RHL to occur is at the junction of the oral mucosa and the lip at the vermilion border.

RHL are self-limiting and typically heal without scarring; nonetheless, they can significantly affect the patient’s quality of life during outbreaks by resulting in pain, embarrassment, and temporary cosmetic disfigurement. They may also cause uncertainty about the frequency of recurrence. Treatment is most effective if initiated during the initial 48 hours of the recurrence.

**General Considerations for Patients**

It is important to enquire about the occurrence of RAU and RHL with all dental patients, particularly since both occur episodically and may or may not be present at the time of the initial dental visit. By doing so, patients can be proactively counseled on treatment options and care of RAU and RHL, if required. This is especially important for patients suffering from RHL, since treatment is best initiated during the early (prodromal) phase to reduce the severity of the recurrence.

Patients should be advised to keep the area adjacent to RHL lesions clean by using a mild antibacterial soap and water and then dabbing the area dry. Patients with RHL should also be advised to wash their hands frequently to prevent the transmission of viral secretions and infection, and to avoid triggers such as sunlight by using sunscreen. Patients experiencing RAU should be advised to avoid spicy and/or acidic foods and drinks, as these may exacerbate discomfort associated with RAU present at that time.

In recommending treatment for RAU and RHL, it is essential to stress the importance of visiting (or returning to) the dentist or physician if lesions do not heal within 14 days. Patients should also be referred to their physician for further evaluation if the severity or frequency of recurrences increases, or if they experience other signs and symptoms of infection such as a fever, as these may indicate an underlying systemic condition that needs to be investigated and addressed. If hypersensitivity to a particular food ingredient or chemical is suspected, patients can be advised to avoid these and encouraged to discuss this with their physician. Immunocompromised patients should also be referred to their primary care physician or specialist.

**Treatment and Care of RAU**

**Over-the-counter products**

The mainstay of palliative care, aimed at relieving symptoms until RAU resolve, is over-the-counter (OTC) oral pastes and rinses.
Wound-cleansing and debriding rinses are also available that can be applied directly to the lesion or used as a rinse in accordance with the recommendations of the clinician and product labeling. Pain-relieving topical analgesic pastes typically contain 20% benzocaine or 2% lidocaine, and barrier creams are also available that help prevent irritation. A mucosal adhesive patch (Canker Cover™) has been shown to help relieve pain, and forms a barrier over the lesion to help protect it from foods, drinks, and other irritants. This patch contains citrus oil, which has demonstrated antiseptic and anti-inflammatory properties. The combination of citrus oil and magnesium chloride has been found in a double-blind, placebo-controlled clinical trial to result in a shorter healing time of 1.5 days, versus 6 days for placebo (hydroxyethylcellulose base tablets containing no magnesium chloride or citrus oil) and 10 days for untreated patients. The mean time for the elimination of pain was also reduced (5 hours versus 48 hours and 134 hours, respectively). A separate study in subjects 18 years of age and older compared the use of the same patch with use of a bioadhesive oral solution (Kank-A™) containing benzocaine and compound benzoin tincture as the active ingredients. It was found that the mucosal adhesive patch reduced healing time—mean healing time was 36 hours versus 134.7 hours with the oral solution, there was greater pain reduction at 24 and 48 hours, and the patch was well-tolerated. If lesions are widespread, a bioadherent barrier rinse (Rincinol®) can be considered and will coat all of the oral mucosa.

**Prescription products**

Prescription products have also been utilized for the treatment of RAU. Five percent tetracycline rinse has been found to reduce healing time and duration of lesions, and to be well-tolerated when used 4 times daily for 5 days or less. It should be noted that this is contraindicated during tooth development due to the risk of tetracycline staining. Corticosteroid rinses may be effective in reducing the duration of lesions when used 3-4 times daily, especially where multiple larger ulcers are present and topical application of pastes is impractical. Viscous lidocaine rinse (2%) may be prescribed for pain relief, for rinsing and expectoration, or direct application to the lesion. A bioadherent barrier rinse is also available (Gelclair®). Corticosteroid creams of various potencies have also been investigated for their ability to reduce inflammation and relieve pain, including medium-potency triamcinolone acetonide paste (Kenalog in Orabase®), which has been shown to reduce pain, inflammation, and ulceration when applied 2 or 3 times daily for 5 days. One topical cream containing 5% amlexanox (Aphpthasol®) has been found in a placebo-controlled, double-blind clinical trial with 1335 subjects to increase the rate of healing while reducing the duration of pain, when applied 4 times daily. It is indicated for use in patients 18 years of age and older. A number of systemic treatments have been tested for severe RAU, including the use of thalidomide, orally administered corticosteroids, and levamisol. Due to their toxicity and contraindications, these are reserved for only the most severe cases of RAU; thalidomide is teratogenic and must never be used in pregnant women or women who may become pregnant. With both topical and systemic higher potency corticosteroids, consideration must be given to adrenal suppression, which would require tapering off of their use.

**Table 3. Treatment options for RAU**

<table>
<thead>
<tr>
<th>Over-the-counter</th>
<th>Prescription - topical</th>
<th>Prescription - systemic</th>
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</thead>
<tbody>
<tr>
<td>Pain-relieving topical analgesic pastes</td>
<td>Viscous lidocaine rinse (2%)</td>
<td>Corticosteroids</td>
</tr>
<tr>
<td>Barrier creams and liquid</td>
<td>Tetracycline rinse (5%)</td>
<td>Levamisol</td>
</tr>
<tr>
<td>Mucosal barrier adhesive patch (Canker Cover)</td>
<td>Corticosteroid creams</td>
<td>Thalidomide*</td>
</tr>
<tr>
<td>Bioadherent barrier rinse (Rincinol)</td>
<td>Amlexanox (5%)</td>
<td></td>
</tr>
<tr>
<td>Bioadherent barrier analgesic rinse (Kank-A)</td>
<td>Bioadherent barrier rinse</td>
<td></td>
</tr>
<tr>
<td>Prescription - systemic</td>
<td>Prescription - systemic</td>
<td></td>
</tr>
</tbody>
</table>

* Must never be used in women who are/may become pregnant

**Treatment and Care of RHL**

Major goals of treatment of RHL include pain relief, reduction of inflammation, improved (faster) healing, avoidance of secondary bacterial infections, and prevention of transmission of viruses to others or self (e.g., autoinoculation to the eyes, which can result in severe infections and blindness). To date no cure is available. A number of controlled clinical trials have demonstrated the efficacy of oral and topical antiviral agents for the prevention and treatment of RHL.  

**Over-the-counter treatments**

A number of OTC products are available for the relief of pain associated with RHL, thereby offering palliative care. These contain topical analgesics such as benzocaine and camphor, lidocaine, or pramoxine. In addition, some contain an antiseptic ingredient such as benzalkonium chloride and some contain sunscreen, skin softener (to soften the crust), and skin protectants. Most of these OTC products are safe for use in young children—the indications and directions on the product labeling should be followed. Nonprescription 10% docosanol cream (Abrevia®) is FDA-approved for the treatment of RHL in patients 12 years of age or older, and works by inhibiting viral fusion to the host cell. In a randomized, double-blind, placebo-controlled study of 743 patients age 18 or over who experience more than 2 recurrences of RHL per year, the application of 10% docosanol cream 5 times daily resulted in a reduced healing time and time to cessation of pain, but did not reduce lesion formation. Patients were included only if their lesions had not progressed beyond the erythema phase. The median reduction in healing time was 17.5 hours and the median reduction in time to pain cessation was 13.4 hours.
Natural products
A number of natural products have efficacy claims for treating or preventing RHL. These include tannic acid, tea tree oil, lemon balm and rhubarb-sage topical cream. Tannic acid has been found to be ineffective, and there is insufficient data to determine the efficacy of tea tree oil.23 limited data is available to show efficacy for lemon balm and rhubarb-sage topical cream.

Lysine has also been used to treat RHL. After it was found that arginine deficiency suppressed HSV growth in the laboratory, lysine—an analog of arginine—was investigated for the treatment of RHL with the hypothesis that it would prevent the utilization of arginine by HSV.24 Lysine can be given orally or applied topically. Studies on orally administered lysine, which is sold as a dietary supplement, have produced conflicting results. One crossover study in 65 patients receiving either 500 mg lysine or placebo for 12 weeks found no reduction in the number of recurrences of RHL with either treatment.25 A separate randomized study found no differences in recurrence rates whether patients were taking 624 mg or 1248 mg of lysine daily, but did find significant reductions in recurrences compared to use of placebo.26 Topical lysine (e.g., Lip Clear® Lysine+) has been shown to reduce healing time and to provide relief. An open label trial with 30 patients found that 40% of patients reported a full cure (complete disappearance and resolution of the eruption) by day 3 and 86% by day 4.27

Finally, an over-the-counter homeopathic formulation of zinc oxide with glycine (Novitra®) was studied in a randomized, double-blind clinical trial with 46 patients, where it was used every 2 hours during waking hours. The investigators found that it reduced mean healing time by 1.5 days compared to placebo (based on patient diaries and telephone interviews) and was well-tolerated.28

Prescription products
FDA-approved prescription products for the treatment of RHL include topical treatments and orally administered systemic treatments. Topical agents include acyclovir cream (Zovirax®) and penciclovir cream (Denavir®). Acyclovir is applied as a cream and works by interfering with the replication of the herpes simplex virus; it is recommended for use in patients age 12 years and older and should be used for 4 days, 5 times a day, as soon as the prodromal (initial) phase begins.29 In 2 randomized, double-blind, placebo-controlled clinical trials with Zovirax®, reduced length of time to healing and reduced duration of pain were found, but acyclovir did not prevent the progression of lesions to the vesicular phase.30

Penciclovir (1%) is available for use in people age 12 and older and should be applied every 2 hours for 4 days (while awake) as soon as symptoms occur. The efficacy of penciclovir was demonstrated in a randomized, double-blind, placebo-controlled trial with 1573 patients 18 years of age and older who experienced at least 3 RHL per year. The median time to healing was reduced by 0.7 to 1 day, and the time to loss of pain was reduced by a median of 0.6 days.31 Two other identical, randomized, double-blind, placebo-controlled multicenter studies with a total of 2537 patients demonstrated the efficacy of penciclovir in reducing healing time when applied within 1 hour of the onset of symptoms. A difference was also found when the cream was used at the papule stage; its use did not prevent lesions from progressing to the vesicle stage.32 A separate small study also demonstrated reduced time to healing by 1 day compared to use of acyclovir.33

Systemic orally administered tablets containing acyclovir have been found to reduce time to healing when given as 400 mg 5 times per day in a subset of patients, but not at doses of 200 mg, 5 times per day for 5 days.34,35 Valacyclovir is approved by the FDA for the treatment of RHL, administered as a dose of 2000 mg given twice for 1 day, which has been shown to decrease the median time to healing by 0.8 days and to decrease the median number of days of pain by 0.5-0.7 days. There was no effect on lesion progression.36 Oral famciclovir is also approved for the treatment of RHL. Famciclovir as 1500 mg in a single dose or 750 mg given twice for 1 day have both been found to reduce the median time to healing by 1.8-2.2 days, based on a double-blind, randomized trial of 701 patients age 18 or older who experienced at least 3 episodes of RHL annually. However, the single dose of 1500 mg was found to offer greater reduction in the time to resolution of pain or discomfort.37

Summary
Recurrent aphthous ulcers and recurrent herpes lesions occur frequently in the general population. After a diagnosis has been made, patients should be given general advice regarding care of these and, in the case of RHL, avoiding transmission of the herpes virus to others. When recommending or prescribing medications and drugs, the severity and frequency of the lesions, health status of the individual patient and clinical efficacy of the product should be considered.
Educational Objectives
The overall goal of this article is to provide the reader with information on xerostomia and treatments for the relief of dry mouth. Upon completion of this course the reader will be able to:
1. List the etiological factors for xerostomia.
2. List and describe the signs and symptoms of xerostomia.
3. List and describe the treatment options available for the relief of dry mouth.

Abstract
Xerostomia (dry mouth) affects a significant number of adults and its prevalence increases with age, primarily as the result of the increased use of medications and an increased risk and incidence of diseases/conditions associated with xerostomia. The symptoms of xerostomia can be debilitating and result in a reduced quality of life. Treatment options for the relief of dry mouth include prescription and over-the-counter products, and recommendations should be tailored for the individual patient.

Introduction
Xerostomia, or dry mouth, is a common affliction in the general population. An extensive and increasing number of medications are associated with xerostomia, including antidepressants and psychotropics, antihistamines, antihypertensives, and cardiovascular drugs. Estimates on the number of medications with xerostomia as a side effect range from more than 500 to more than 1500.\(^1,2,3\) Diseases associated with xerostomia include Sjögren’s syndrome, diabetes, AIDS, and Parkinson’s disease.\(^4\) While chemotherapy can also result in xerostomia and changes to the consistency of saliva, head and neck radiation results in severe xerostomia and, as with nerve damage, can completely destroy functioning of the salivary glands. Tobacco and alcohol use also result in a dry mouth. In addition, breathing through the mouth (and snoring) result in dry mouth – this, however, is of a temporary nature and resolves once nose breathing resumes. There is an increased prevalence of xerostomia with age, and it has been estimated that around 25% of adults in the over-65 age group experience xerostomia and at least 10% of all adults are affected.\(^5\) While older patients experience dry mouth more frequently, this is related to medication use or other conditions rather than aging itself.\(^6\)

Table 1. Factors in xerostomia

<table>
<thead>
<tr>
<th>Medication use</th>
<th>Nerve damage</th>
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<tr>
<td>Auto-immune diseases</td>
<td>Tobacco use</td>
</tr>
<tr>
<td>Parkinson’s disease</td>
<td>Alcohol use</td>
</tr>
<tr>
<td>Head and neck radiation therapy</td>
<td>Mouth breathing</td>
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<tr>
<td>Chemotherapy</td>
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Oral Signs and Symptoms
Individual patients may experience the signs and symptoms of xerostomia to varying degrees depending on the residual level of function of the salivary glands. Symptoms associated with xerostomia include a sticky and/or dry feeling in the mouth, a sensation of pain and burning mouth, alterations in taste, stringy or ropey saliva, difficulty speaking, and a reduced ability to chew and swallow a bolus of food due to a (relative) lack of saliva. Signs of xerostomia include an increased level of carious lesions, the appearance of dryness of the oral mucosa intraorally, increased levels of plaque, bad breath, and oral irritations including angular cheilitis, dry and cracked lips. In addition, xerostomia patients are at increased risk for candidal and other oral infections. The chief complaints of patients with xerostomia are the feeling of dryness in the mouth and difficulties experienced with swallowing and speaking.\(^7\)

Detecting and Diagnosing Xerostomia in the Dental Office
Patients should be screened for xerostomia. The medical and dental history forms used in the dental office should include questions on medication use, diseases, and medical conditions, and should be reviewed for any present that may result in xerostomia. The medical and dental history forms should also include specific questions on symptoms related to dry mouth, including...
whether the patient has the sensation of dryness in the mouth, dry lips, or difficulty speaking, chewing, or swallowing. Asking whether the patient has to sip water to chew and swallow helps elucidate problems. Detecting xerostomia is best accomplished in the dental office. The oral mucosa may be observed to be dry and parched in appearance, there may be dry or cracked areas on the lips or at the corners of the lips, and an increased caries experience may also indicate xerostomia.

Clinical assessment should include placing the mirror against the buccal mucosa to see if it sticks to the mucosa (indicative of inadequate salivary flow). If it is suspected that a patient may have xerostomia, unstimulated and stimulated salivary flow tests will help objectively determine if xerostomia is present and to what degree. In both cases the patient salivates for five minutes and expectorates his or her saliva into a cup or other vessel. A recent protocol for collecting unstimulated saliva recommends that the patient refrain from eating, drinking anything (except water), smoking, chewing gum, and consuming caffeine for one hour before the test is conducted, and that the patient sit still while saliva is collected. For stimulated saliva, the standardized protocol recommends that the patient chew gum in time with a metronome prior to collection of saliva. It should be noted that while an objective salivary flow test could indicate that a patient has mild, moderate, or severe xerostomia, the patient may subjectively experience this differently (better or worse). When assessing xerostomia prior to and after initiation of dry mouth–relief treatment, subjective assessment by the patient is a key factor and is performed using either a specific questionnaire designed for the purpose or a visual analog scale (VAS).

Treatment Options for Xerostomia

Dental professionals are oral care experts and thus positioned to detect, diagnose and recommend primary treatment for xerostomia. Patients should be counseled on the importance of home care – extra thorough brushing and flossing to remove plaque is necessary to help prevent caries and periodontal disease and to reduce halitosis. Patients with xerostomia are at increased risk for caries; professional fluoride therapy is indicated as is home use of fluoride toothpaste. Toothpastes formulated for dry-mouth patients containing lower levels of sodium lauryl sulfate (SLS), or without SLS, and with low foaming activity to reduce the possibility of irritation are available (Biotene Dry Mouth Toothpaste; Biotene PBF Fluoride Toothpaste). As appropriate, patients can be advised to use prescription level paste/gel or over-the-counter alcohol-free adjunctive fluoride rinses. Patients should also be advised to avoid consumption of sugar-containing foods, drinks, and snacks and other fermentable carbohydrates in order to reduce caries risk, as well as to avoid tobacco, caffeine, alcohol, and alcohol-containing rinses due to their drying effect. Sipping water and sleeping with a humidifier have also been shown to help relieve the symptoms of dry mouth. Palliative care of oral irritations can be achieved using topical analgesic pastes containing 20% benzocaine or 2% lidocaine, or using a barrier cream or rinse. The main focus of this article is on the relief of the chief symptom and complaint with xerostomia – the sensation of dryness and the discomfort this brings. A number of treatment options are available for xerostomia relief, including prescription and over-the-counter products.

Dry Mouth Relief

Prescription Products

Prescription products used to treat xerostomia include those that stimulate salivary production and those that relieve symptoms. Orally administered systemic treatments that stimulate the production of saliva include pilocarpine hydrochloride (Salagen) and cevimeline hydrochloride (Evoxac). Side effects can include dizziness, alterations in vision, stomach upset, and, rarely, rapid or slowed heart rate and breathing trouble. Ca-phaseol is a unit-dose prescription rinse containing calcium and phosphate ions and has been clinically proven to lubricate dry mouth and to reduce the occurrence and severity of mucositis associated with head and neck radiation. A second prescription rinse, Numoisyn Liquid, is indicated for relief of dry mouth, has a similar viscosity to saliva, and produces a barrier bioadhesive film on the dentition and oral mucosa. The linseed extract contained in Numoisyn has been found to relieve the symptoms of dry mouth.

Over-the-counter products

Over-the-counter products available for relief of dry mouth include mouthwashes, liquids, sprays, gums, lozenges, and a patch. Mouthwashes are formulated to help relieve dry mouth, soothe the oral mucosa, help cleanse the oral cavity, and combat halitosis. These typically contain a base of water and either hydroxyethylcellulose (Biotene Dry Mouth and PBF Mouthwashes) or carboxymethylcellulose (Oasis Moisturizing Mouthwash). Natural-based mouthwashes containing plant extracts and essential oils are also available. Over-the-counter saliva substitute gels and liquids are also available. The primary goals for these are rapid relief of dry mouth and soothing of the oral mucosa. Oral Balance Gel (Biotene) contains protective enzymes as the active ingredient in a hydroxyethylcellulose base. It has been found to be effective in relieving dry mouth, including in head-and-neck-radiation patients and patients who had received whole-body irradiation and chemotherapy. Biotene saliva substitute has also been shown to be effective in elderly patients for relief of dry mouth. The use of Oral Balance Gel and Dry Mouth Toothpaste has been clinically shown to provide greater relief and palliative care in head-and-neck-radiation patients than use of a carboxymethylcellulose gel and regular toothpaste. A second saliva substitute containing the same enzymes is available as a liquid in a small portable bottle (Oral Balance Liquid), while another product (Numoisyn Liquid) contains linseed extract. Another option is office-dispensed GC Dry Mouth Gel which can be applied with a finger. Over-the-counter spray and atomizer saliva substitutes have also been found to provide relief from xerostomia.
These may contain glycerin, glycerol, mucin, or carboxymethylcellulose in the base formulation (Salivart; Biotene and Oasis Moisturizing Mouth Sprays; Mouth-Kote; Moi-Stir). Spray saliva substitutes have been found to be effective and their application easy and acceptable to patients.\(^1\)

Sugar-free lozenges and chewing gums are available that can be used ad libitum to stimulate saliva if salivary gland function is still present\(^19,20\) (Wrigley chewing gums). These may also contain xylitol (SalivaSure lozenges, Epic chewing gum, Biotene Dry Mouth Gum), or casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) (Trident Extra chewing gum), which has been shown to help reduce demineralization.\(^21\) One brand of lozenge contains essential oils and zinc gluconate and claims to impede biofilm and to kill bacteria associated with halitosis (Salese with Xylitol).\(^22\) In addition to stimulating saliva, chewing gum may also help remove plaque and debris through the process of mastication; for many patients chewing gum is a habit they already enjoy and can modify simply by changing to the recommended gum for dry mouth. Patients should be cautioned against using chewing gums containing sugar, which would further increase their high risk for caries.

An innovative patch has been introduced for dry mouth relief (OraMoist Dry Mouth Patch). Using a finger, this small mucoadhesive patch is applied to the side of the palate, or in denture/appliance wearers to the cheek, and dissolves over the course of 2–4 hours to moisturize the mouth and stimulate saliva to provide relief from xerostomia. A recent small study comparing this patch with mouthwash found the patch to be more effective in relieving dry mouth, based on patient self-reporting. Twice as many subjects reported relief using the patch, and its use resulted in a 1.5-fold increase in unstimulated whole salivary flow.\(^23\)

Intraoral devices have recently also been investigated for the relief of xerostomia. One study found that a night guard fabricated as an ethylene vinyl acetate sheet covering the palate and dental arches, without any reservoir, provided relief from nocturnal xerostomia (assessed using a visual analog scale);\(^24\) replacement full dentures with reservoirs containing saliva substitute may also provide relief.\(^25\)

**Summary**

Xerostomia is a debilitating condition that affects a significant percentage of the population and results in reduced quality of life. Treatment is aimed at relieving dry mouth through the stimulation of saliva and use of oral moisturizing products, and at helping to reduce the risk of conditions associated with xerostomia. Once a patient has been diagnosed with xerostomia, treatment planning and recommendations can be made for its management. When making recommendations on products for the relief of dry mouth, the patient’s preferences and subjective assessment of relief attained should be explored – taste, vehicle, ease-of-use and portability, and perceived relief are all factors in patients’ acceptance and use of these treatments.\(^26\) Drymouth can be relieved using a number of vehicles that include toothpastes, mouthwashes, saliva substitutes, chewing gums, lozenges, or a mucoadhesive patch, and combinations of these can be used for effective relief of dry mouth.

**References Part I**

Questions

1. It has been estimated that up to ________ of adults carry the herpes virus latently by age 30 and that ________ of carriers in the United States are under age 20.
   a. 60%; 20%
   b. 70%; 30%
   c. 80%; 40%
   d. 90%; 50%

2. ________ is an implicated factor/association for RHL.
   a. Hypersensitivity/sensitivity to foods/chemicals
   b. Medication use
   c. Genetics
d. all of the above

3. RHL is caused by a ________ with herpes simplex virus type 1.
   a. primary infection
   b. secondary infection
   c. tertiary infection
d. none of the above

4. RHL is transmitted by ________.
   a. aerosols
   b. direct contact with the secretions from herpetic lesions
   c. sneezing and coughing
d. all of the above

5. ________ is a potential trigger/stressor for periodic reactivation of HSV-1.
   a. UV light
   b. Anxiety/stress
   c. Dental treatment
d. all of the above

6. ________ can play an important role in preventing recurrences of RHL.
   a. Bitter aloe
   b. Sunscreen
   c. Lip salve
d. all of the above

7. Recurrent aphthous ulcers ________.
   a. result in the appearance of a flat or cratered, grayish-yellow area surrounded by a ring of inflamed tissue
   b. occur on nonkeratinized surfaces of the oral mucosa
   c. can cause moderate to severe pain
d. all of the above

8. It is during the vesicular stage of RHL that the patient experiences ________.
   a. the highest viral load
   b. bacterial superinfection
   c. viral superinfection
d. the lowest viral load

9. Patients with RHL should be advised to ________.
   a. wash their hands frequently to prevent the transmission of viral secretions and infection
   b. avoid triggers such as sunlight
   c. avoid spicy and/or acidic foods and drinks
d. a and b

10. It is essential to stress the importance of visiting (or returning to) the dentist or physician if lesions do not heal within ________ days.
    a. 7
    b. 10
    c. 14
d. 21

11. ________ are the mainstay of palliative care for RAU.
    a. Prescription oral pastes and rinses
    b. Over-the-counter (OTC) oral pastes and rinses
    c. Corticosteroids
d. none of the above

12. A mucosal adhesive patch containing citrus oil and magnesium chloride ________.
    a. has been shown to help relieve pain
    b. forms a barrier over the lesion to help protect it
c. has been shown to reduce healing time
d. all of the above

13. Pain-relieving topical analgesic pastes used for RAU typically contain ________.
    a. 10% benzocaine or 1% lidocaine
    b. 15% benzocaine or 2% lidocaine
    c. 20% benzocaine or 2% lidocaine
d. none of the above

14. 5% amlexanox has been found to ________ , when applied 4 times daily.
    a. increase the rate of healing of RAU
    b. reduce the duration of pain
c. provide only palliative relief
d. a and b

15. 10% docosanol cream ________.
    a. has been found to reduce healing time
    b. has been found to reduce the time to cessation of pain
c. is a nonprescription cream
d. all of the above

16. Topical lysine has been shown to reduce healing time and to provide relief for ________.
    a. RAU
    b. RHL
    c. RAU and RHL
d. none of the above

17. ________ is an FDA-approved prescription product for the treatment of RHL.
    a. Acyclovir cream
    b. Penciclovir cream
c. Fanclover cream
d. a and b

18. ________ are factors in the occurrence of xerostomia.
    a. Medication, alcohol and tobacco use
    b. Chemotherapy and head and neck radiation therapy
c. Auto-immune diseases
d. all of the above

19. ________ is a symptom of xerostomia.
    a. A sticky and/or dry feeling in the mouth
    b. Stringy or ropey saliva
c. Difficulty speaking, chewing or swallowing
d. All of the above

20. ________ can be a sign of xerostomia.
    a. The appearance of dryness of the oral mucosa and oral irritation
    b. An increased level of carious lesions
c. An increased level of plaque and bad breath
d. all of the above

21. If it is suspected that a patient may have xerostomia, ________ will help objectively determine if xerostomia is present and to what degree.
    a. an unstimulated salivary flow test
    b. a visual analog scale
c. a stimulated salivary flow test
d. a and c

22. The results of the ________ of xerostomia are important to proper treatment of the patient.
    a. objective assessment
    b. subjective assessment
    c. objective and subjective assessments
d. none of the above

23. If a mouth mirror sticks when placed against the buccal mucosa ________.
    a. this suggests enzymatic activity
    b. this is indicative of inadequate salivary flow
c. this is indicative of adequate salivary flow
d. a and c

24. Toothpastes specifically formulated for dry-mouth patients contain ________.
    a. lower levels of SLS or no SLS
    b. lower levels of zinc
c. higher levels of antibacterial agents
d. all of the above

25. Patients with xerostomia should be advised to avoid ________.
    a. consumption of sugar-containing foods, drinks, and snacks and other fermentable carbohydrates
    b. tobacco, caffeine, and alcohol
c. alcohol-containing rinses
d. all of the above

26. Xerostomia associated with mouthbreathing is ________.
    a. sometimes permanent
    b. always permanent
c. always debilitating
d. none of the above

27. ________ has been shown to help relieve the symptoms of dry mouth.
    a. Sipping water
    b. Chewing gum
c. Sleeping with a humidifier
d. all of the above

28. Mouthwashes for the treatment of xerostomia are formulated to effectively ________.
    a. help relieve dry mouth
    b. soothe the oral mucosa
c. help cleanse the oral cavity, and combat halitosis
d. all of the above

29. A small mucoadhesive patch used to treat xerostomia has been found to ________.
    a. effectively relieve dry mouth
    b. dissolve over 2-4 hours to moisten the mouth
c. increase whole salivary flow
d. all of the above

30. Dry mouth can be relieved using ________.
    a. toothpastes, mouthwashes and saliva substitutes
    b. chewing gums and lozenges
c. a mucoadhesive patch
d. combinations of the above
Part I: Quelling Cold Sores and Aphthous Ulcers

COURSE EVALUATION and PARTICIPANT FEEDBACK

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Educational Objectives

Part I.

1. List and describe the etiology and pathophysiology related to recurrent aphthous ulcers and recurrent herpes labialis.

2. List and describe the general recommendations and first patient experience related to recurrent aphthous ulcers and recurrent herpes labialis.

3. List and describe treatment options available for recurrent aphthous ulcers and recurrent herpes labialis.

Part II.

1. List the etiological factors for xerostomia.

2. List and describe the signs and symptoms of xerostomia.

3. List and describe the treatment options available for the relief of dry mouth.

Course Evaluation

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met? Objective #1: Yes No
   Objective #2: Yes No
   Objective #3: Yes No

2. To what extent were the course objectives accomplished overall? 5 4 3 2 1 0

3. Please rate your personal mastery of the course objectives. 5 4 3 2 1 0

4. How would you rate the objectives and educational methods? 5 4 3 2 1 0

5. How do you rate the author’s grasp of the topic? 5 4 3 2 1 0

6. Please rate the instructor’s effectiveness. 5 4 3 2 1 0

7. Was the overall administration of the course effective? 5 4 3 2 1 0

8. Do you feel that the references were adequate? Yes No

9. Would you participate in a similar program on a different topic? Yes No

10. If any of the continuing education questions were unclear or ambiguous, please list them.

11. Was there any subject matter you found confusing? Please describe.

12. What additional continuing dental education topics would you like to see?

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