Chapter e16: Oral Hygiene and Minor Oral Disorders

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KEY CONCEPTS

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1. Dental caries is one of the most common chronic health conditions in both children and adults. Dental caries stems from an imbalance in saliva defense, microbial load, and lifestyle habits. Modifiable risk factors include oral hygiene practices and lifestyle factors. Dental caries can lead to tooth sensitivity, cause oral pain, and have implications for overall health.

2. For oral health maintenance, teeth should be brushed twice daily with fluoride toothpaste. Patients should floss daily and follow recommended technique for brushing and flossing. Oral health maintenance also includes the use of athletic mouthguards, denture care, and regular dental care by an oral healthcare professional.

3. Toothpaste contains fluoride as its primary active ingredient to prevent tooth decay and gum disease. Other active ingredients, such as potassium salts, may be added for tooth sensitivity, as well as abrasives and carbamide peroxide for tooth whitening.

4. The first-line treatment for dental pain is nonsteroidal anti-inflammatory drugs (NSAIDs), with or without acetaminophen.

5. Benzocaine is available over-the-counter (OTC) in numerous products for adults, children, and infants as a local anesthetic for oral pain. While widely available, benzocaine has significant safety concerns and should not be used for teething pain in children younger than 2 years of age.

6. Canker sores are one of the most common ulcerative conditions of the mouth. Treatment options include pain management with topical agents and eliminating irritating food and drink from the diet.

7. Cold sores are recurrent oral lesions resulting from infection with herpes simplex virus type 1. Referral of patients to their primary care physician is likely warranted, as the most effective treatment options are available as prescription only products.

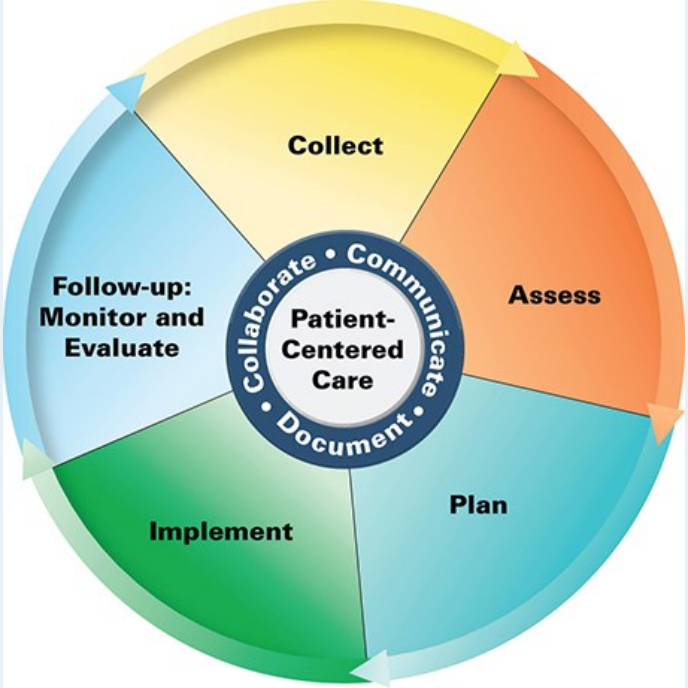
8. Xerostomia or dry mouth is a common oral condition often caused by medical conditions, medications, or medical treatments. Treatment of xerostomia greatly depends on the cause of the condition, but can be treated symptomatically with a number of OTC products.

9. Dentistry has few true emergencies; however, dental trauma where a permanent tooth is displaced or avulsed constitutes a dental emergency, and immediate referral to an oral healthcare provider or urgent care center is warranted.

10. Fluoride is effective in preventing dental caries by inhibiting the demineralization of tooth enamel, enhancing the remineralization of enamel, and inhibiting bacterial enzymes involved in the metabolism of carbohydrates by cariogenic bacteria. Sources of fluoride include toothpaste, fluoridated drinking water, professionally applied topical fluorides, and oral fluoride supplementation.

PATIENT CARE PROCESS

Patient Care Process for Xerostomia



Collect

- Patient characteristics
- Patient medical history (personal and family)
- Social history and dietary habits (eg, smoking status, daily water consumption)
- Current medications

Assess

- Hydration status
- Presence of precipitating factors (see Table e16-12)
- Emotional status (eg, presence of anxiety and/or depression)
- Impact on quality of life (eg, difficulty speaking, swallowing, chewing)
- Severity of condition (eg, affecting surrounding tissues, presence of complications)
- Willingness to quit smoking (if applicable)
- Ability/willingness to try nonpharmacologic treatment options
- Ability/willingness to pay for pharmacologic treatment options

Plan*

- Patient education (eg, dietary and lifestyle modifications, information on precipitating factor(s), frequency of use of pharmacologic treatments)
- Self-monitoring for resolution of symptoms

- Referrals to other providers when appropriate (eg, dental professional, prescriber of precipitating medication, primary care physician)

Implement*

- Provide patient education regarding all elements of treatment plan
- Use motivational interviewing and coaching strategies to maximize adherence
- Schedule follow-up

Follow-up: Monitor and Evaluate

- Resolution of symptoms (eg, dryness, redness, peeling, cracking, or oral tissues)
- Presence of treatment specific adverse effects
- Patient adherence to treatment plan

****Collaborate with patient, caregivers, and other healthcare professionals.***

BEYOND THE BOOK

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Explore the oral health section of either the Centers for Disease Control and Prevention (CDC) website: https://www.cdc.gov/OralHealth/index.html, or the oral health portion of http://healthychildren.org by the American Academy of Pediatrics (AAP): https://www.healthychildren.org/English/healthy-living/oral-health/Pages/default.aspx. You can explore overview topics, Question and Answer sections, or topics that stimulate your interest. Find at least one topic that relates directly to community pharmacy practice or the primary care setting, such as the use of OTCs or educating patients. What areas of oral health do you feel knowledgeable in, and in what areas do you have gaps in knowledge? You may wish to reflect on any patient questions you have received on oral health topics. You may also wish to explore (either online or in person) the oral health section of a pharmacy. How large are these sections, and what products are available?

INTRODUCTION

Dentists and other members of the dental community are actively encouraging the involvement of additional health professionals in identification, referral, and in some cases treatment of patients with oral health conditions. Pharmacists, particularly community and health-system pharmacists, are the most accessible health professionals for patients presenting with oral health issues or questions. Furthermore, community pharmacies carry many products for oral health ranging from toothbrushes and mouthguards to rinses and pain relievers. Patients with oral pain, poorly fitting dentures, or a need for an athletic mouth guard often first enter a pharmacy seeking a solution, making the pharmacist the first healthcare professional they meet. It is important for the pharmacist and other primary care providers to have an understanding of the dental products available and be able to provide referrals and recommendations regarding oral health. Pharmacists and other primary care providers are integral parts of the collaborative interprofessional healthcare team, and dentists, dental hygienists, dental assistants, and dental therapists are also important and sometimes unrecognized members of this team.

To enable pharmacists and other primary care providers to improve their skills and knowledge relative to oral health, this chapter begins with a review of relevant tooth anatomy and pathophysiology, providing an important foundation for understanding oral health conditions. From there, the discussion moves to oral health maintenance, specific oral health conditions, and concludes with a focus on pediatrics. Oral health prevention and maintenance are vital for both public health and individual well-being. All members of the healthcare team have an important responsibility to recognize that oral health is an important part of the overall health of each individual.

EPIDEMIOLOGY

Untreated dental disease in children can lead to complications with eating, learning, and speaking. More than 90% of adults aged 20 to 64 years of age have at least one cavity, leading to pain, loss in productivity, and increased healthcare costs. Up to 26% of adults in the United States have untreated tooth decay, and large disparities exist in oral health and access to dental treatment. Periodontal disease, often called gum disease, also affects a large portion of the population. An estimated 46% of adults aged 30 and older in the United States show signs of gum disease. Furthermore, oral health is linked to many other chronic diseases, including heart disease and diabetes, making good oral health vital for overall health.[1]

Oral cavity and pharynx cancer is estimated to occur in 54,010 people in the United States in 2021, with a lifetime risk of 1.2% of men and women diagnosed at some point during their lifetime. Men are twice as likely as women to be diagnosed with oral cavity cancer, and oral cancers are more commonly diagnosed in people over 55 years of age.[2]

Additionally, oral health issues are common in older adults, and unfortunately many older adults do not have dental insurance. By age 65, 96% of adults have at least one cavity and 68% have periodontal disease. An estimated 26% of adults 75 and older have complete tooth loss, which has significant effects on nutrition, health, and healthcare utilization. The greater incidence of polypharmacy in older adults increases the risk of dry mouth as a therapeutic side effect, which can further worsen oral health.[3]

Healthy People 2030 includes multiple objectives relating directly to oral health, including the reduction of oral health inequities and increasing access to oral health care. Indeed, use of the oral health care system by all age groups is a leading health indicator. Many of the oral health objectives focus on reducing tooth decay in the population.[4] Oral health is also an area of significant public health investment, including community water fluoridation and other oral health programs. Because pharmacists are so easily accessible, their role in promoting oral health for individual patients can positively impact public health as well.

TOOTH ANATOMY

Understanding tooth anatomy is important in order to better comprehend the mechanisms of dental disease and the treatment of oral conditions. There are four tissues of a tooth, three hard tissues—enamel, cementum, and dentin—and one soft tissue, pulp. Each tooth has a crown, covered with enamel, and a root, hidden under the gums in the bone and covered with cementum. Enamel is the most highly mineralized and hardest substance in the body. The primary mineral of enamel is hydroxyapatite, which is a crystalline calcium phosphate. Cementum is a dynamic entity with both acellular and cellular parts, surrounding the root of the tooth. Internal to the enamel and cementum, in both the crown and the root of the tooth, is dentin. Dentin makes up the bulk of the tooth structure, consisting of tubules surrounded by highly mineralized peritubular dentin and a softer intertubular matrix.[5] Encased by the hard outer layers of enamel, dentin, and cementum, the pulp occupies the most internal space of a tooth. The pulp consists of connective tissue, nerves, and blood vessels.[6]

A healthy tooth is held in place within the alveolar bone by the periodontal ligament (PDL). The PDL attaches the cementum on the root of the tooth to the alveolar bone in the tooth socket. The gums, or gingiva, cover the bone and in a healthy state are tight against the tooth. A small fold is present between the gum and the tooth, creating the gingival sulcus, or pocket, which is usually shallow when the gingiva is healthy.[6]

PATHOPHYSIOLOGY

Dental Caries

1 Dental caries is the complex bacterial biofilm disease of the oral cavity involving net demineralization of the dental tissues resulting from prolonged periods of low pH. Caries result from acid production by acidogenic bacteria that thrive in the plaque biofilm. The traditional concept of dental caries is an imbalance in salivary defense, microbial load, and lifestyle habits like sugar consumption. The ecological plaque hypothesis is generally accepted, where “cariogenic bacteria,” are understood to be normally present on all teeth, and an environmental change in the biofilm favors the growth of these specific pathogens, notably *Streptococcus mutans* and *Lactobacillus*.[8] Symptoms of dental caries are listed in Table e16-1.

TABLE e16-1

Symptoms of Dental Caries

- Tooth sensitivity
- Mild-to-sharp pain when eating or drinking something sweet, hot, or cold
- Visible holes or pits in teeth
- Brown, black, orange, or white staining on tooth surfaces
- Pain on biting
- Toothache, spontaneous pain

Data from Reference 7.

Caries risks are not static over a lifetime. Host genotypes, microbiomes, lifestyle, and oral hygiene contribute as independent influential factors to the complex etiology.[8]

Periodontal Disease

Periodontal disease is the leading cause of tooth loss. It typically begins with gingivitis, which is inflammation of the gingiva that does not result in attachment loss or loss of bone. The gums become red, swollen, and bleed easily.

Gingivitis is reversible with professional treatment and good oral hygiene. Untreated gingivitis can advance to periodontitis, the destruction of the tissues and bone that support the teeth. Bacterial plaque hardens the teeth, forming calculus. An inflammatory host response against the microorganisms of the bacterial plaque and their toxins occurs. The intense inflammatory reaction results in gums separating from the teeth and the creation of pockets that become infected. Genetic and systemic factors may affect these events. *Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans* bacteria have been indicated in the pathogenesis of adult periodontitis. As the pockets deepen, more gum tissue and bone is destroyed. Often only mild symptoms are present throughout progression of the disease, until the teeth become loose, and sometimes have to be removed. Periodontal disease can result in tender, red, swollen, loose, or bleeding gums, painful chewing, loose and/or sensitive teeth, as well as changes in the way teeth fit together when biting or the fit of partial dentures.[9]

Poor oral hygiene is a risk factor for development of periodontal disease. Other important risk factors include smoking, poorly controlled diabetes mellitus, stress, underlying immunodeficiencies, and dry mouth. Age, socioeconomic status, education, race, and genetics also correlate with prevalence of periodontal disease.[10]

Treatment of periodontal disease requires the intervention of an oral healthcare professional. Calculus must be removed in order to decrease the bacterial load and inflammatory response. Discussions about managing other contributing factors and developing a treatment and maintenance plan are important components of stabilizing the disease and decreasing risk of its progression.

ORAL HEALTH PREVENTION AND MAINTENANCE

2 Oral health prevention and maintenance includes both daily habits that comprise oral hygiene practices, as well as routine care by oral healthcare professionals. Most of the products recommended for daily oral health maintenance are available over-the-counter (OTC), making pharmacists and other nondental health professionals valuable resources in providing oral healthcare and patient education.

Daily Habits

Toothbrushing

It is widely recommended that patients brush their teeth with a fluoride toothpaste for a duration of 2 minutes twice daily. Brushing for a period of 2 minutes achieves clinically significant plaque removal, removing more plaque than when teeth are brushed for only 1 minute. Patients should also be

counseled to divide each brushing session into 30 second segments for each quadrant of the mouth.[11] Some toothbrushes have incorporated timers into the toothbrush design for this purpose. Although studies are lacking to evaluate the efficacy of built-in timers, these may be useful for patients who have difficulty brushing for the recommended amount of time.[12]

Toothbrushing technique is also important for plaque removal. Multiple toothbrushing techniques have been published, but studies have not reliably demonstrated one method to be superior for all patients. In general, the toothbrush should be placed at the gumline at a 45° angle to remove plaque optimally at the gingival margin. Patients should apply gentle force to insert the toothbrush into the sulcus. The toothbrush should be moved in a vibrating motion in short strokes while remaining in contact with the sulcus. All surfaces of the teeth (inner, outer, and chewing surfaces) should be brushed during each session.[13]

The choice of toothbrush bristles is important as well. Soft bristles minimize the risk of gingival abrasion or injury during brushing. While medium bristles are effective at plaque and biofilm removal, they carry a risk of gingival damage. This risk can also be minimized by educating patients to apply gentle pressure when brushing and to avoid overly forceful brushing. Multilevel or angled bristles remove plaque more effectively than conventional flat-trimmed brushes. Toothbrushes should be replaced every 3 to 4 months, replacing more frequently if bristles are visibly frayed or matted.[13]

Electric-powered toothbrushes are available in a variety of designs. Patients can be assured that electric toothbrushes are at least as effective as manual toothbrushes. Studies of electric toothbrushes have shown statistically significant improvement in dental plaque removal when compared with a manual toothbrush, but the difference may not be clinically meaningful. In general, electric toothbrushes are likely more expensive, but some patients may find them easier to use. It seems there may be meaningful benefit for using electric toothbrushes for those patients who may have difficulty with brushing technique. This may include patients with special needs, patients requiring a caregiver for activities of daily living, patients with manual dexterity deficits, as well as older adults, children, and those with braces. Electric toothbrushes are available with various types of head movements, including side-to-side, rotating oscillating, circular, and ultrasonic. A Cochrane review found that rotating oscillating and ultrasonic designs were more effective in reducing plaque than conventional manual toothbrushes. However, other studies have found conflicting results; choice of electronic toothbrush design remains largely based on patient preference.[13]

Toothbrushes can also earn the American Dental Association (ADA) Seal of Acceptance, indicating the toothbrush is safe and effective for the removal of plaque and reduction of gingivitis. The ADA Council on Scientific Affairs reviews data on defined parameters and grants the seal to those products meeting its requirements. While considering bristle softness, toothbrush shape, and manual or electric toothbrushes, patients can also examine whether or not the product has the ADA Seal of Acceptance. Overall, patients should be encouraged to choose the toothbrush they prefer and will be able to use most consistently in order to promote adequate brushing practices.[13]

Toothpaste

Fluoride is anticariogenic, meaning it prevents tooth decay. Significant clinical studies support the use of fluoride in dental care, recommending that patients brush teeth twice daily with a fluoride toothpaste. Fluoride strengthens tooth enamel by both inhibiting the demineralization of enamel, as well as enhancing the remineralization of decalcified enamel in the early stages of tooth decay. When given systemically prior to the eruption of permanent teeth, the fluoride ion is incorporated into the apatite crystal of the bone and teeth, stabilizing and strengthening the tooth.[14] Topical fluoride is also incorporated into the enamel structure, thus fluoride is still effective for caries prevention in children and adults with permanent teeth.[15] Fluoride incorporated into the enamel increases the enamel's resistance to acid, inhibiting the demineralization of enamel. Enamel with a greater concentration of fluoride has an improved structure and is more resistant to acid.[16] In decalcified enamel, fluoride present in the oral cavity can be incorporated into enamel structure and promotes remineralization of enamel, protecting the tooth from decay.[15] Additionally, fluoride inhibits the metabolism of carbohydrates by cariogenic bacteria, preventing the creation of an acidic byproduct that leads to demineralization of tooth enamel.[16]

Patients may encounter fluoride from multiple sources, including toothpaste, mouthwashes, and fluoridated water. Fluoride exerts a topical effect when in direct contact with teeth, such as when drinking fluoridated water, brushing with a fluoride toothpaste, or using a fluoride mouthwash. Additionally, any ingested fluoride increases the fluoride concentration in the saliva, extending the protective effects.[16]

Fluoride is available in toothpastes as sodium monofluorophosphate, sodium fluoride, and stannous fluoride. Prescription strength toothpastes have a greater concentration than OTC toothpastes and result in a greater prevention of caries. However, studies with OTC toothpastes have still found

them to be effective in caries prevention and control. Toothpastes may contain additional active and inactive ingredients. These are summarized in Table e16-2.[16]

TABLE e16-2

Toothpaste Ingredients and Their Functions

Category	Ingredients	Indication/Purpose
Fluoride	Sodium monofluorophosphate, sodium fluoride, and stannous fluoride	Prevention of dental caries
Antimicrobial	stannous fluoride	Reduce gingivitis
Anti-hypersensitivity	Potassium salts, stannous fluoride, calcium sodium phosphosilicate	Reduce tooth sensitivity
Abrasive agents	Modified silica abrasives or enzymes (calcium carbonate, dehydrated silica gels, hydrated aluminum oxides, magnesium carbonate, phosphate salts, silicates)	Whiten teeth by physically removing surface stains
Detergents	Sodium lauryl sulfate, sodium *N*-Lauryl sarcosinate	Foaming action. May help increase the solubility of plaque during brushing
Flavoring agents	Noncaloric sweeteners (sugar is cariogenic and is not permitted in ADA-accepted toothpaste)	Flavor
Humectants	Glycerol, propylene glycol, sorbitol	Prevents water loss in the toothpaste
Thickeners	Mineral colloids, natural gums, seaweed colloids, synthetic cellulose	Binding agents to stabilize toothpaste
Peroxides	Hydrogen peroxide, carbamide peroxide	Reduce extrinsic stains
Other	Essential oils, fragrance, menthol, zinc or potassium citrate	Flavor and fragrance

Data from Reference 16.

3 Toothpaste ingredients may cause contact dermatitis. Common allergenic ingredients in toothpastes include essential oils, such as spearmint, peppermint, or cinnamon. It is important to note that specific essential oils may not be listed in the ingredients and instead may be mentioned as flavors. Other potential irritants include citric acid in the form of zinc or potassium citrate, menthol, fragrances, sodium lauryl sulfate (SLS), propylene glycol, parabens, pyrophosphates, PEG-8, PEG-12, PEG1450, and cocamidopropyl betaine. As with toothbrushes, toothpastes may also carry the ADA Seal of Acceptance. Toothpastes must meet requirements created by the ADA Council on Scientific Affairs related to fluoride availability and absorption. Note that a variety of toothpastes marketed as having natural ingredients may not contain fluoride, and thus will not have proven anticariogenic activity nor have an ADA Seal of Acceptance.[16]

Recommendations for toothbrushing and toothpaste for children are discussed in section "Pediatrics" of this chapter.

Flossing

Flossing or interdental cleaning is recommended once daily in order to reduce the likelihood of gum disease and tooth decay. While patients may struggle to floss regularly, it is an essential part of daily oral health maintenance. The purpose of flossing is to remove debris and interproximal dental plaque, or plaque that collects between teeth. Plaque not removed from the teeth may harden into calculus, potentially leading to gingivitis.[17]

Dental floss is made of nylon or plastic filaments. Floss may have flavoring agents and is available both waxed and unwaxed. The best time of day to floss is whenever it will be performed most regularly. Flossing can occur before or after toothbrushing, or at a different time altogether.[17] Flossing is a technique-sensitive intervention, and patients should discuss proper flossing technique with their oral healthcare professional.[18] Proper flossing technique is included in Table e16-3.[19] Other interdental cleaners available include prethreaded flossers, dental picks, wooden plaque removers, interproximal brushes, and water flossers.[17] Not all interdental cleaners are appropriate for all patients, and patients should consult their oral health professionals for individualized recommendations.[18]

TABLE e16-3

Proper Flossing Technique

- Wind 18 in. (45 cm) of floss around the middle fingers of each hand
- Pinch 1-2 in. (2.5-5 cm) of floss behind thumb and index finger, keep taut between fingers
- Gently guide floss between the teeth, guiding with the thumb and index fingers
- Gently wrap floss around the side of the tooth
- Slide floss up and down against the tooth surface and under the gumline

Data from Reference 19.

Mouthwashes

Mouthwash may be used daily, offering further benefits in addition to brushing and flossing. Specifically, mouthwash may reduce bad breath, as well as reduce plaque and gingivitis. It is important to educate patients that mouthwash cannot replace brushing and flossing, but instead should be used in addition. Mouthwashes may also have the ADA Seal of Acceptance. Table e16-4 lists active ingredients that may be found in mouthwash.[20]

TABLE e16-4

Active Ingredients in OTC Mouthwash

Active Ingredients	Indication/Purpose	Clinical Pearls
Cetylpyridinium chloride	Reduce bad breath, plaque, and gingivitis	Antimicrobial action
		May cause brown staining of teeth, tongue, and/or restorations
Essential oils such as eucalyptol, menthol, thymol, methyl salicylate	Reduce bad breath, plaque, and gingivitis	May be a potential allergen or irritant for some patients
Fluoride	Prevent tooth decay	Effective topically to prevent dental caries
Peroxide	Tooth whitening	Present in whitening mouthwashes

Data from Reference 20.

Oral malodor, also called halitosis or bad breath, can result from volatile sulfur compounds arising from breakdown of foods and plaque or bacteria associated with oral disease. Antimicrobial-containing mouthwashes may be effective for more long-term control of oral malodor. The use of mouthwashes containing antimicrobials are associated with a decreased risk of gingivitis and periodontal disease. Cosmetic mouthwashes are those

that contain no antimicrobials or fluoride, and these provide only a temporary benefit for bad breath. Mouthwashes may also contain alcohol. Alcohol consumption is a risk factor for oral cancers, although studies have not demonstrated an association between mouthwash use and oral cancer. Since alcohol may also worsen xerostomia, alcohol-containing mouthwashes should be avoided in patients experiencing xerostomia. Mouthwashes should not be used in children under 6 years of age because of the concern that they may swallow a large quantity.[20]

Chlorhexidine mouthwash is available only by prescription and is indicated for treatment of gingivitis and periodontitis.[21] Chlorhexidine rinse may also prevent alveolar osteitis (dry sockets) after a tooth extraction. Potential adverse reactions include staining of teeth, dentures, and tongue, as well as altered taste.[20]

Dental Visits

The ADA recommends all patients regularly visit a dentist or oral healthcare professional for the prevention and treatment of oral disease. The frequency of dental visits should be determined by an individualized case management protocol based on the patient's caries risk level, age, and compliance or engagement with oral health preventive strategies. Frequency of visits range from every 12 months for a patient with low risk of oral disease to every 3 months for patients at high risk. Visits include regular cleanings, assessments for oral conditions, such as dental caries, periodontitis, and oral cancer, and guidance on oral health maintenance. Patients should expect their oral healthcare professional to design an oral health maintenance regimen that is tailored to the patient, provide education on lifestyle changes related to oral health, and provide guidance on the use of oral healthcare products.[11] The chronic condition of oral disease dictates that oral health recommendations should focus on prevention and maintenance protocols.[4]

Denture Care

Edentulism, defined as the loss of all permanent teeth, affects an estimated 26% of the US population over 75 years of age.[22] Many of these individuals wear complete dentures as a prosthetic to enhance esthetics and function. Dentures accumulate plaque, stain, and calculus similar to the natural dentition. In 2009, the American College of Prosthodontists developed evidence-based guidelines for the care and maintenance of complete dentures (see Table e16-5).[23]

TABLE e16-5

Guidelines for Care and Maintenance of Complete Dentures

1. Careful daily removal of the bacterial biofilm present in the oral cavity and on complete dentures is important to minimize oral tissue irritation (denture stomatitis).
2. Dentures should be cleaned daily by soaking and brushing with an effective, nonabrasive denture cleanser. Afterward, they should be thoroughly rinsed before putting them back inside the mouth.
3. Commercially available denture cleansers use various active agents, including hypochlorites, peroxides, enzymes, acids, and oral mouth rinses to remove biofilm from dentures. Denture cleansers are not to be used inside the mouth.
4. Dentures should never be placed in boiling water.
5. Dentures should not be soaked in bleach, or products containing bleach, for periods of more than 10 minutes.
6. Dentures should be stored immersed in water when not in use.
7. Dentures should not be worn continuously (24 hours per day) as this can cause denture stomatitis.
8. Patients who wear dentures should see a dentist annually for maintenance of the denture and evaluation of the health of the oral cavity and associated tissues.

Data from Reference 23.

Use of Denture Adhesives

Denture adhesives can improve the retention and stability of dentures, helping prevent the accumulation of food particles beneath the dentures. However, evidence regarding the effects of denture adhesives on the oral tissues when used for periods longer than 6 months is lacking. Thus, extended use of denture adhesives should only be undertaken with periodic assessment by a dental professional.[23]

Denture adhesives are available in multiple forms, including paste, cream, powder, and pads. The necessary quantity of denture adhesive should be minimal and should be completely removed from the prosthesis and the oral cavity on a daily basis. Manufacturers instructions for use should be followed. If increasing amounts of adhesive are necessary for the patient to feel comfortable, a dental professional should be consulted in order to evaluate the prosthesis and oral tissues.[23]

Temporomandibular Disorders

Temporomandibular disorders (TMDs) encompass a wide group of clinical problems involving the masticatory musculature, the temporomandibular joint, and the surrounding bone and soft tissue. TMD is a multifactorial disease process with various causes including parafunctional habits (bruxing, clenching, lip or cheek biting), instability or laxity of the temporomandibular joint, trauma to the jaw, and comorbidity with other rheumatic or musculoskeletal disorders. The prevalence of TMD is thought to be 6% to 12% of the population, with about 5% having signs and symptoms warranting treatment. TMD symptoms are more prevalent in women than men, with peak occurrence between 20 and 40 years of age. See Table e16-6 for common symptoms of TMD.[24]

TABLE e16-6

Symptoms of Temporomandibular Disorder

- Muscle and joint pain, acute or chronic
- Radiating pain to the ears, neck, and head
- Joint noise (clicking, popping, crepitus)
- Functional limitations such as decreased range of motion and jaw locking

Data from Reference 24.

Diagnosis of TMD requires a focused history and physical examination. The use of radiographs and magnetic resonance imaging may aid in determining degenerative changes. Images combined with clinical presentation, signs, and symptoms will allow the clinician to develop a diagnosis and treatment plan. Treatment should initially center on conservative, reversible, and evidence-based modalities. Only after failure of noninvasive options should invasive and nonreversible treatments be performed.[24]

Bite Guards

A variety of bite guards, also known as occlusal splints, oral orthotics, and oral appliances, are available with differing designs and functions. Patients often seek them out to alleviate symptoms of TMD and bruxism. Bite guards can be custom made or bought OTC. They seem to be an effective treatment for many temporomandibular disorders and nocturnal use may improve sleep quality. Evidence also supports oral appliance treatment for sleep bruxism and protection of teeth, but it is insufficient to support its role in the long-term reduction of sleep bruxism activity. Therapeutic mechanisms of occlusal splints are not yet clarified; suggestions have been made that occlusal splints can reestablish symmetric activity in the temporal and masseter muscles. An occlusal splint may contribute to reducing myofascial pain, improving quality of life, and protection of teeth, although it does not cure temporomandibular dysfunction.[25]

There is little evidence to prove the theory behind any one bite guard design[26]; however, full coverage splints (covering the biting surfaces of all teeth of one arch) are often recommended to evenly distribute forces from the masticatory muscles to the teeth and to prevent unwanted changes in tooth or bite position.[27] With the availability of OTC splints in the community pharmacy, patients may bypass their dentist, which can have many significant risks. Not least, it relies on the consumer to diagnose their condition without the help of a dental professional, which may be inaccurate and delay appropriate treatment. Additionally, there is little consistency across safety warnings or stated indications for use of OTC splints, which can result in

confusion or improper treatment of a condition.

The use of poorly fitting appliances can have unintended consequences. Changes in the dentition, tooth movement, gingival trauma, and increased TMD symptoms are all possible risks of using occlusal splints.[28] In general, patients should use caution in self-selecting OTC occlusal splints and consultation with an oral healthcare professional is recommended prior to purchasing an oral appliance for daily use.

Athletic Mouthguards

A mouthguard, also known as a mouth protector or sports guard, is an appliance that covers the teeth and surrounding mucosa with the aim of preventing or reducing trauma to the teeth, gingival tissue, lips, and jaws. Mouthguards may also play a role in preventing and reducing concussion by absorbing impact forces, although the evidence for this is less conclusive. Nearly one-third of all dental injuries are sports related. Dental traumatic injuries can carry a hefty financial and physical burden over an individual's lifetime. Numerous surveys of sports-related dental injuries have documented that participants of all ages, genders, and skill levels are at risk of sustaining dental injuries in sporting activities, including organized and unorganized sports at both recreational and competitive levels. While collision and contact sports, such as boxing and football, have inherent injury risks, dental injuries are also prevalent in noncontact activities and exercises, such as gymnastics, bicycling, baseball, and skating. Mouthguards can be effective in reducing the incidence of dental injury in sport.[29]

Mouthguards are typically composed of a thermoplastic copolymer (usually ethylene vinyl acetate), and designed to fit over the upper teeth. There are three types of mouthguards: ready-made, mouth-formed "boil-and-bite," and custom-made. An effective mouthguard should be resilient, tear-resistant, properly fitting, and comfortable. It should also be easy to clean. A mouthguard should be cared for similarly to any oral appliance. Prior to and after each use, it should be rinsed with cold water or mouthrinse. It may also be brushed gently with a toothbrush. Mouthguards should be stored in a firm, closed container allowing for adequate airflow. High temperatures should be avoided to prevent distortion of the device. Mouthguards that are loose or have holes, are sharp, or causing irritation, should be replaced.[29,30]

It is necessary that mouthguards actually perform as required in order to keep teeth safe. Importantly, the ADA and the American National Standards Institute (ANSI) have developed a standard for Athletic Mouth Protectors and Materials. Very few OTC mouthguards meet these standards; ones that do will carry the ADA seal of acceptance.[30]

ORAL PAIN

Epidemiology

Dental pain is one of the most common reasons for OTC treatment for oral health.

Oral diseases, which range from cavities to gum disease to oral cancer, cause pain and disability for millions of Americans. Dental caries is one of the most common chronic conditions in the United States. Furthermore, more than 40% of adults have felt pain in their mouth in the last year. About 4 in 10 of US adults have some form of periodontal disease. In adults aged 65 and older, 68% have periodontal disease.[1] The 3 most common oral health issues seen in emergency departments are pain, trauma, and infection; 750,000 visits in the United States annually are for dental complaints.[31]

Etiology

Years of clinical and animal studies have indicated that the oral microbial flora is responsible for dental caries and periodontitis. Oral microbial communities are one of the more complex bacterial floras in the human body, with more than 700 different bacterial species identified from the human oral cavity.[32]

Dental caries often progresses without symptoms of the disease until a large area of the tooth is involved. Dental caries left untreated can result in bacterial infection of the pulp of a tooth, which can result in pulpal inflammation and eventual necrosis of the pulp tissue. An abscess, which is a collection of pus within the tissue, may develop as a result of pulpal infection, and is then called an apical abscess. If left unattended, the abscess can penetrate through the bone to involve the surrounding tissue structures. Once a dental abscess extends beyond the bone into the surrounding soft tissue, cellulitis develops.

Oral pain may also be caused by acute periodontal abscesses. Periodontal abscesses may be caused by an exacerbation of untreated chronic periodontitis, foreign body impaction into the tissue around a tooth, any alteration in the integrity of a tooth root (eg, fracture of root), or as a complication of treatment of periodontitis. They are characterized by swelling and purulent exudate of the affected area, mild discomfort to severe pain, and discomfort on palpation or percussion of the affected tooth. Periodontal abscesses may also advance to causing fever or malaise. Acute periodontal abscesses should be referred for urgent treatment by a dentist or oral health professional.

The aforementioned infections are polymicrobial, comprising of various facultative anaerobes, such as the viridans group streptococci and the *Streptococcus anginosus* group, and strict anaerobes, especially anaerobic cocci, *Prevotella* species, and *Fusobacterium* species.[33] One retrospective study found gram-positive cocci (*Streptococcus viridans*) to be the predominant bacteria, followed by gram-negative rods. *Staphylococcus aureus* is rarely involved in dental infections.[34]

Systemic involvement indicates a need for immediate intervention and treatment; patients should be referred to an oral healthcare professional or urgent care center for immediate care. Evidence of systemic involvement is listed in Table e16-7. Systemic antibiotics should only be prescribed when systemic involvement is evident. Apical abscesses are treated by removal of the infected pulp via root canal therapy or extraction of the infected tooth. Periodontal abscesses are addressed by cleaning the root surfaces of the involved teeth, establishing drainage of an abscess if present, extraction of teeth if necessary, and long-term follow-up to manage the periodontal disease.[35]

TABLE e16-7

Evidence of Systemic Infectious Involvement in Patients with Dental Caries and/or Periodontal Disease

- Swelling of the mouth and oral tissues
- Fever
- Malaise
- Cellulitis
- Difficulty breathing or swallowing

Data from Reference 35.

Treatment of Oral Pain

Patients may approach the pharmacist for recommendations concerning the treatment of oral pain, especially as many OTC options are available.

Oral Pain Relievers

4 The first-line therapy for the treatment of dental pain is nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, or a combination of both. Opioids are not recommended as first-line treatment for dental pain, and the ADA statement on opioid prescribing recommends providers consider NSAIDs as the first-line therapy for the treatment of acute dental pain. Recommendations also include educating patients on the benefits and risks of opioids, utilizing state prescription drug monitoring programs, and seeking continuing education on opioid prescribing.[36] ADA recommendations are based on evidence that NSAIDs, with or without acetaminophen, offer the best balance between efficacy for treating acute dental pain and avoiding potential harms of opioid use.[37]

Topical Pain Medications

Local Anesthetics

5 Benzocaine is a local anesthetic available in a wide variety of OTC products. For oral conditions, benzocaine is approved by the Food and Drug Administration (FDA) for toothache, ulcer of the mouth, and disorder of dental prosthesis causing pain. More than 500 products on the market contain benzocaine, including products intended for use on oral mucous membranes, as well as topical preparations for additional conditions, such as

sunburn. Benzocaine is available OTC as an oral rinse, oral liquid with concentrations of 10% or 20%, oral dissolvable strips, oral gel, oral paste, oral swabs, and gum. Benzocaine blocks nerve conduction by inhibiting the depolarization of the neuronal membrane, thus blocking the initiation and conduction of nerve impulses. Depolarization is inhibited by a decrease in sodium ion permeability, which leads to a reversible stabilization of the neuronal membrane. Onset for toothache pain relief is 7 minutes and pain relief lasts 3 to 5 hours following topical application.[38]

Contraindications to the use of benzocaine include a hypersensitivity to benzocaine. Benzocaine is also contraindicated for teething pain or other indications in infants and children younger than 2 years of age due to the risk of methemoglobinemia. Other populations also have an increased risk of methemoglobinemia with benzocaine use, including patients with breathing problems, such as asthma, bronchitis, or emphysema, adults age 65 years or older, patients with heart disease, smokers, and those with genetic disorders such as glucose-6-phosphodiesterase deficiency. Large doses and large treatment areas, as well as the use on irritated or broken skin, increase the risk of systemic absorption and toxicity, although methemoglobinemia has been reported after a single benzocaine spray. Signs and symptoms of methemoglobinemia include pale, gray, or blue-colored skin, lips, and nails beds, shortness of breath, fatigue, confusion, headache, lightheadedness, and tachycardia. Symptoms may appear within minutes to 1 or 2 hours after use, and methemoglobinemia can occur with first application.[38]

Benzocaine-containing products should be applied according to package directions. Generally, patients are advised to apply product onto the affected area with cotton, cotton swab, or fingertip up to four times daily. When using the oral rinse, patients should swish with 15 mL up to four times daily and should be advised to spit, not swallow, remaining solution. The 20% benzocaine oral gel may also be used up to four times daily, applying a thin layer to the affected area. With all products, patients should be advised to use the product sparingly and no more than four times per day. The product should not be applied to broken or irritated skin, and no heat or occlusion should be used on the area. Patients should be educated on the signs and symptoms of methemoglobinemia and should seek medical care immediately at the first sign of symptoms.[38]

Magic Mouthwash

A prescription preparation, magic mouthwash is commonly compounded by the community, health-system, long-term care, or hospice pharmacist. Magic mouthwash is often prescribed for oral mucositis secondary to chemotherapy or radiation, as well as other conditions, such as canker sores. There is a lack of controlled, clinical studies demonstrating efficacy of magic mouthwash in treating oral mucositis, with some studies suggesting it no more effective than normal saline rinses. However, it is still commonly used in practice.[39]

Numerous formulations and recipes are available for magic mouthwash, and most institutions have their own institution-wide recipe for compounding. Ingredients commonly include topical local anesthetics, antihistamines for the local anesthetic effect, and a coating agent to enhance coverage of the ingredients to the affected oral tissue. Protectants, antifungals, antibiotics, and corticosteroids may also be included. According to a survey study of institutional pharmacies, the top five active ingredients used for magic mouthwash were diphenhydramine, viscous lidocaine, aluminum/magnesium hydroxide, nystatin, and corticosteroids. Many magic mouthwash formulations include equal parts viscous lidocaine 2%, diphenhydramine liquid, and aluminum/magnesium hydroxide antacid.[40] The inclusion of nystatin in magic mouthwash may not be appropriate as studies have not demonstrated efficacy of topical nystatin in preventing or treating oral fungal infections in patients with oral mucositis.[39] Similarly, the use corticosteroids is not supported by studies demonstrating efficacy, and risks may outweigh any benefits of use.[40]

Most formulations of magic mouthwash should be used every 4 to 6 hours. Ideally, irrigation of the mouth should be performed prior to applying topical medications in order to remove debris and allow for better coating of the oral tissue.[41] The solution should be held in the mouth for 1 to 2 minutes, and then patients should either swish and spit (if the solution contains lidocaine) or swallow. Lidocaine should not be swallowed as it may impact the gag reflex and can lead to systemic absorption. Patients should be advised to avoid eating or drinking for 30 minutes after use to prevent the removal of the anesthetic and coating agents, as well as to prevent trauma to the oral tissue when the mouth is numb.[39,40]

Concerns about the absorption of lidocaine have been raised, especially with possible absorption from damaged mucosas.[42] The use of compounded topical rinses should be carefully considered, including the cost of the product, potential adverse effects, and efficacy.[41] Adverse effects may include taste disturbances, burning or tingling of oral tissues, drowsiness, and gastrointestinal symptoms.[40] No formula of magic mouthwash has been shown to be superior to another, so patient preference should be the primary consideration. Regular assessment of the efficacy and acceptability of the compounded mouthwashes should be considered.[39]

TOOTH SENSITIVITY

Tooth sensitivity has a number of causes including dental caries, dentin hypersensitivity, tooth grinding, fractured teeth, and failing dental restorations. OTC products for sensitive teeth are indicated for dentin hypersensitivity, defined as the pain arising from exposed dentin. Dentin hypersensitivity typically occurs in response to chemical, thermal, tactile, or osmotic stimuli, and cannot be explained as arising from any other form of dental defect or pathology. It is classically short, sharp, and of rapid onset and short duration. Risk factors include gingival recession, periodontal disease, overenthusiastic brushing, an erosive diet, bulimia nervosa, and tooth wear.[43]

Dentin exposure is sometimes a result of physical wear of the enamel or erosion due to acidic breakdown. Physical wear of the enamel is caused by mechanisms such as tooth-to-tooth contact and the mechanical force from brushing. Erosion of enamel can be caused by chronic exposure to gastric acids, such as in gastric reflux and bulimia nervosa, and acidic foods and beverages (see Table e16-8).[44] Loss of enamel can be significant enough to warrant professional intervention and protection of teeth with fillings and restorations. Chronic enamel loss can be difficult to manage; treatment should be supervised by an oral healthcare professional. Teeth damaged due to caries or fracture may also be sensitive; thus, evaluation by an oral healthcare professional for proper diagnosis is important prior to beginning any home treatment regimen.

TABLE e16-8

Examples of Agents That Can Erode the Enamel of the Teeth

- Carbonated beverages
- Fruit juices
- Wine
- Fruits
- Gastric acid
- Tooth whitening products
- Abrasive toothpastes

Data from Reference 44.

Treatment for dentin hypersensitivity has historically involved either self-applied or professionally applied topical agents meant to alleviate symptoms. These agents are available in a variety of formulations and delivery mechanisms, such as toothpaste, gel, mouthrinse, and professionally applied medicaments. Potassium-containing toothpastes are the most widely used OTC treatments. Toothpastes should be applied with a soft-bristle toothbrush. Studies have shown that mouthwashes containing potassium nitrate and sodium fluoride can also reduce dentin hypersensitivity. However, sometimes more aggressive professional intervention is necessary if topical agents do not provide adequate relief. Treatment should also include avoidance of abrasive toothpastes and erosive agents, correction of misaligned teeth if they are contributing to the problem, and treatment of periodontal disease if present.[44] A variety of treatment agents available are noted in Table e16-9.[45]

TABLE e16-9

Agents Used in Tooth Desensitization

Active Ingredients	Types of Products	Availability of Evidence
Potassium salts (potassium nitrate, potassium chloride, potassium citrate)	Found in many OTC desensitizing toothpastes, also as aqueous solution or adhesive gel. Potassium ions reduce nerve excitability.	Evidence for use is low, but studies show positive effects of potassium nitrate and fluoride
Arginine	Found in toothpastes, powders, mouthrinse, and soft chews, as well as professionally applied paste	Evidence for use as a self-administered toothpaste is strong, and as a professionally applied treatment is fair
Strontium acetate	Available in OTC toothpastes	Moderate quality evidence supports use as a self-administered toothpaste
Fluorides (sodium fluoride, stannous fluoride)	Available in OTC and prescription toothpastes and gels. Decrease the permeability of dentin.	High-quality evidence, though limited, supports use as a self-administered toothpaste

Data from Reference 45.

TOOTH WHITENING

Tooth whitening has become a frequently requested dental procedure. In response to demand, many whitening products have become available. Whitening of a tooth can be achieved by bleaching or nonbleaching agents. Bleaching products help remove intrinsic and extrinsic stains, while nonbleaching agents work by physical or chemical action to remove extrinsic stains only. The efficacy of a whitening product is dependent upon its mechanism of action and the particular discoloration that is being treated.

Intrinsic staining can be attributed to factors such as antibiotics, like tetracyclines, high levels of fluoride resulting in fluorosis, exposed dentin from loss of enamel, demineralization or hypocalcification of the enamel, genetics, and developmental disorders resulting in enamel malformation. Extrinsic staining frequently results from environmental factors such as smoking; consumption of heavily pigmented foods and beverages such as coffee, tea, and wine; bacteria; metals such as iron or copper, and dental restorations that do not match the tooth color or amalgam fillings that cause grayish staining over time. Certain factors predispose children and adults to extrinsic stains, including enamel defects, salivary dysfunction, and poor oral hygiene.

Treatment

Bleaching and nonbleaching agents include OTC products, such as whitening pastes, films, gels, and rinses, as well as in-office products where more abrasive polishing pastes and/or highly concentrated bleaching agents are applied by oral healthcare professionals. The majority of bleaching products contain carbamide peroxide or hydrogen peroxide. Hydrogen peroxide is a weak acid with strong oxidizing properties that destroys the stain-causing substances by breaking apart the molecules. Carbamide peroxide breaks down on contact with water into hydrogen peroxide and urea.

Whitening toothpastes contain polishing or chemical agents that remove surface stains. They do this through abrasion, chemical chelation, or other nonbleaching actions. In-office bleaching products use hydrogen peroxide concentrations ranging from 25% to 40% and are sometimes used in conjunction with a light or laser. Though it has increased in popular use, light activation of bleaching agents seems to offer no benefit. Home-use products involve the application of a 10% to 20% carbamide peroxide-containing gel; due to the lower hydrogen peroxide concentration multiple treatments are typically necessary to achieve visible effects.[46] See Table e16-10 for a summary of the various treatment options.[47]

TABLE e16-10

Tooth Whitening Products

Teeth Whitening Systems	Whitening Agent	Application	Effectiveness
Whitening toothpastes	Abrasives, may contain carbamide peroxide, hydrogen peroxide	Brush on teeth, spit, rinse per manufacturer instructions	Effective on extrinsic stains, lighten by 1-2 shades
OTC whitening strips and gels	Peroxide-based gels	Apply adhesive strip to teeth or brush-on gel	Effective on extrinsic and some intrinsic stains, lighten by 1-2 shades
Whitening rinses	Oxygen sources such as hydrogen peroxide	Rinse for 30-60 seconds twice daily	Effective on extrinsic and some intrinsic stains, may take up to 3 months of use to lighten 1-2 shades
Tray-based tooth whiteners	Carbamide or hydrogen peroxide	Apply bleaching gel to inside of tray, insert and wear tray, time is variable depending on strength of bleaching agent	Effective on extrinsic and some intrinsic stains. Teeth may lighten 1-2 shades within a few days.
In-office whitening	Highly concentrated peroxide	Applied by dental health professional in office, usually with protection of soft tissues	Effective on extrinsic and some intrinsic stains. Whitening effects may be noticed immediately after one treatment and increase with more treatments.

Data from Reference 47.

Risks associated with tooth bleaching include increased tooth sensitivity and gingival irritation. In vitro studies have also demonstrated tooth erosion, increased tooth surface roughness, increased susceptibility to enamel demineralization, and pulpal damage. Aggressive bleaching can chemically react with composite fillings, glass ionomer cements, sealants, and ceramic crowns, reducing their integrity. When used according to manufacturer's instructions, hydrogen peroxide- and carbamide peroxide-based bleaching agents are safe and effective. However, individual conditions should be accounted for such as extent and cause of staining, previous dental restorations, tooth and tissue current health status, and other intraoral conditions. Supervision of one's bleaching strategy by an oral healthcare professional will reduce risks of adverse outcomes and optimize benefits of bleaching.[47]

CANKER SORES

Etiology/Pathophysiology

Canker sores, also referred to as aphthous stomatitis or aphthous ulcers, are among the most prevalent ulcerative conditions of the mouth. Canker sores generally appear as painful lesions on inner oral tissues, including the labial and buccal mucosa, as well as the, tongue.[48] Recurrent aphthous stomatitis (RAS) is the most common oral mucosal disease, affecting about 20% of patients.[49]

Unfortunately, the developmental mechanism of canker sores is not well understood. Genetics, emotional and physical stress, and certain nutritional deficiencies are amount the most commonly accepted etiologies.[48] However, immunological pathways, microbes, hormonal changes, and food sensitivities appear to play a precipitating role in the formation of canker sores as well.[50] In addition, chemical compounds and medications, including chemotherapy agents, NSAIDs, angiotensin converting enzyme inhibitors, angiotensin II receptor blockers, and SLS, have been implicated as causative

agents.[48,50] Of these agents, NSAIDs are most often suspected medication-related cause, possibly related to a decrease in mucoprotective prostaglandins.[48]

Clinical Presentation

As mentioned previously, canker sores occur within the inner tissues of the mouth. They are further categorized by major, minor, and clusterform.[48]

Major aphthous ulcers are largest, over 1 cm in diameter with a healing time of 4 to 6 weeks. They may also result in scarring of the oral tissues. Clusterform are least common, often presenting in clusters of 10 to 100 ulcers at a single time. These ulcers may fuse together forming a larger ulcer irregular in shape. Clusterform ulcers typically take 10 to 14 days for healing.[48]

Minor ulcers are the most common type of aphthous ulcer, making up 80% of all types of canker sores. Minor ulcers are usually 4 to 6 mm in size, round to oval in shape, with a white to yellowish pseudomembrane surrounded by an erythematous ring.[48,50] They often heal within 7 to 10 days without leaving a scar.[48]

The lesions are generally painful and can even interfere with eating and/or speaking. Some patients report prodromal tingling or burning prior to the formation of the ulcer.[50] An example of a canker sore can be seen in Fig. e16-1.

FIGURE e16-1

Example of a canker sore. (*Source*: *MedlinePlus. Canker Sores.* https://medlineplus.gov/cankersores.html. *Accessed August 12, 2021.*)

Assessment

Fortunately, minor aphthous ulcers are typically self-limiting and do not require treatment or referral. However, appropriate assessment for self-care of canker sores depends on the severity of the condition, as well as the presence of signs and symptoms of underlying immune or mucocutaneous conditions.[48] Patients with large numbers of sores, sores greater than 5 mm in depth, slow healing canker sores, frequent episodes, significant discomfort, or the suspected presence of an underlying condition would benefit from referral to their primary care provider or otolaryngologist.[51]

Treatment

Treatment goals for canker sores include reducing pain, inflammation, and frequency of recurrent episodes. Patients should be educated to avoid substances that can worsen or trigger episodes and on ways to alleviate painful or bothersome symptoms. Patients would benefit from eliminating nuts, chocolate, acidic food and drink, salty and/or spicy foods, alcoholic and/or carbonated beverages from their diets. Patients may also benefit from avoiding oral products containing SLS.[49] These agents may trigger the formation or delay the healing of canker sores.

The current literature regarding the relationship between oral exposure to SLS and development of canker sores is unclear. A systematic review of double-blinded randomized controlled trials comparing SLS-containing and SLS-free dental cleaning products suggests that patients with RAS may

benefit from choosing SLS-free oral health products. According to reviewers, SLS-free products reduced the number of ulcers, duration of ulcers, number of episodes, and average reported pain. However, this review only included 124 participants in total.[49] Larger well-designed trials are still necessary to strengthen the evidence linking SLS to RAS.

The use of topical products is most commonly recommended for the treatment of canker sores. Specifically, gel products are preferred due to their ease of application and appealing consistency. Patients should be instructed to dry the affected area prior to applying topical agents and avoid eating, drinking, and excessive speaking for at least 30 minutes following application. Classes of topical agents for the treatment of canker sores are listed in Table e16-11.[50–53]

TABLE e16-11

Topical Agents for Treatment of Canker Sores

Therapeutic Classes	Examples of Products	Clinical Pearls
Glucocorticoids	Clobetasol propionate cream, fluocinonide cream, triamcinolone acetonide cream	• Clobetasol and fluocinonide more effective than triamcinolone • Commercially available creams/ointments • Compounded rinses • Rinses preferred for diffuse area of lesions • Adverse effects: candidiasis • Prescription only
Antimicrobials	Tetracycline rinses, chlorhexidine rinse	• Tetracyclines reduce size, duration, and pain • Adverse effects: tooth staining • Prescription only
Anti-inflammatories	Amlexanox paste or patches, sucralfate liquid	• Amlexanox promotes healing, but does not reduce frequency of episodes • Prescription only
Tissue denaturants	Debacterol®	• Available as prefilled swabs for ease of use • Prescription only
Local anesthetics	Viscous lidocaine, benzocaine lozenges	• Lidocaine: prescription only • Benzocaine lozenges: OTC
Protectants	Sucralfate, mucoadhesive buccal patch	• Sucralfate: prescription only • Adhesive buccal patches: OTC
Combination products	Compounded magic mouthwash	• Typically made with equal parts viscous lidocaine 2%, aluminum/magnesium hydroxide antacid, and diphenhydramine liquid • Prescription only

Data from References 50–53.

Amlexanox (Aphthasol) is a prescription-only product available for the treatment of canker sores. The exact mechanism is unknown; however, it is

believed amlexanox is anti-inflammatory, inhibiting the release of histamine and leukotrienes. Amlexanox is available as a paste or a patch. Patients should apply 0.25 in. (~0.6 cm) of the paste or one patch directly to the sore four times daily for 10 days. Up to three patches may be used at the same time if needed. Safety and efficacy have not been established in children younger than 12 years old. Those with a hypersensitivity to any of the ingredients of amlexanox should not use these products. Common adverse effects include stinging, irritation, or burning at the application site.[52]

Debacterol is the brand name of an additional topical agent indicated for the treatment of canker sores. This prescription-only product contains 50% sulfonated phenolics and 30% sulfuric acid. These chemicals act as tissue denaturants to alter the affected tissues and make them unsuitable to maintain the sores. Like other topical products, the affected area should be dried prior to administration. Once the tissue is dry, Debacterol should be applied directly to the lesion for at least 5 seconds using a cotton tipped applicator. It is not recommended to treat the same lesion with Debacterol more than once. Safety has not been determined in children under 12 years old or pregnant women. Stinging and local tissue irritation can occur during administration. Debacterol is available in a vial or prefilled single-use swabs.[53]

COLD SORES

Etiology/Pathophysiology

Cold sores, also known as oral herpes or herpes labialis, are the most common viral infections affecting the soft tissues of the mouth. Oral herpetic infections result from exposure to herpes simplex virus (HSV), most often herpes simplex type 1 (HSV-1).

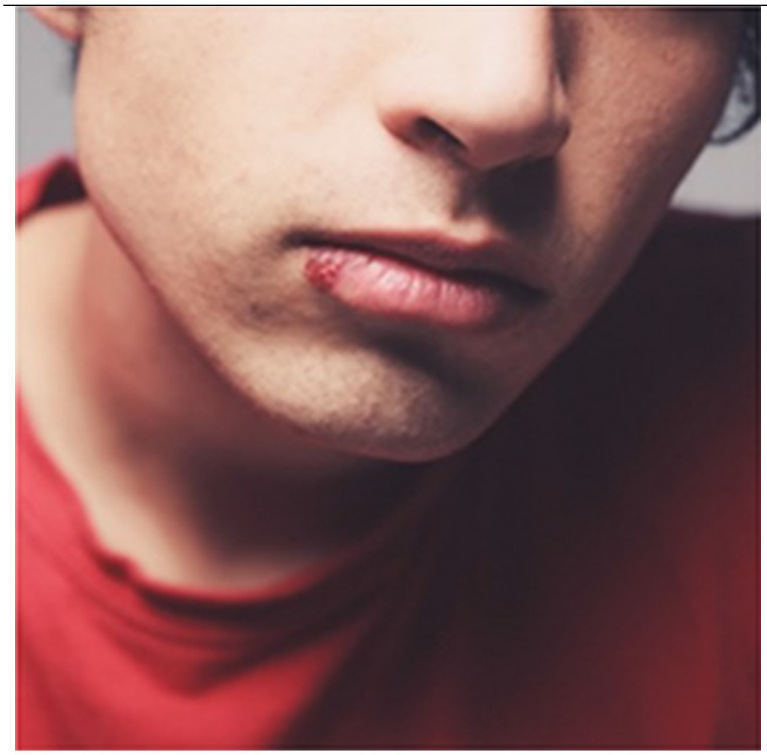
Generally, primary infections occur when HSV is transmitted during childhood, most individuals being exposed by age 5.[54] Transmission occurs by direct contact of the virus with mucous membranes or open skin. HSV enters and replicates within the neurons, where it lies latent after a primary infection.[55] Recurrent herpes labialis infections occur in up to 40% of those exposed to HSV, resulting from the reactivation of HSV. HSV can be reactivated by a variety of stressors, such as physical or emotional stress, fever, menstruation, and sun exposure.[55,56]

Clinical Presentation

Primary infection generally appears within 10 days following initial exposure to HSV, but it may take up to 3 weeks. Cold sore lesions begin on the lips as small vesicles, which rupture and fuse, forming a larger, painful, lesion. Intraoral lesions have a yellowish gray pseudomembrane, whereas extraoral lesions often appear crusty in nature.[54] Lesions also may be associated with localized prodromal symptoms such as tingling, burning, pain, or itching 24 to 48 hours prior to an outbreak.[51] Refusing food or drink may also be an indicator of an active HSV infection in children.[56] Healing typically begins within a few days, with complete healing up to 3 weeks for more severe cases.[51] An example of a cold sore can be seen in Fig. e16-2.

FIGURE e16-2

Example of a cold sore. *(Source: MedlinePlus. Cold Sores. https://medlineplus.gov/coldsores.html. Accessed August 12, 2021.)*



Source: Joseph T. DiPiro, Gary C. Yee, Stuart T. Haines, Thomas D. Nolin, Vicki L. Ellingrod, L. Michael Posey: *DiPiro's Pharmacotherapy: A Pathophysiologic Approach, 12e*

Assessment for Self-Care

Referral to the patient's primary care provider is likely necessary, as the most effective treatment options are available by prescription only. OTC options are available, but unfortunately these products are less effective than prescription treatments. Furthermore, patients suffering from frequent and/or severe reactivation infections would benefit from referral. Children and adolescents should be referred to a primary care provider as well.

Prevention

Patients should adopt preventive methods in order to inhibit formation or exacerbation of cold sores. Certain modifiable risk factors, such as stress, fatigue, sun exposure, and oral trauma, have been known to initiate the formation of cold.[55,56] Patients should be instructed to implement lifestyle modifications to reduce stress and fatigue. Patients should also avoid excessive sun exposure and use lip products with a sun protection factor of 15 or greater.

Treatment

Nonpharmacologic Methods

Symptoms, particularly pain and swelling, can be managed with application of cool and/or soothing materials. Patients may alleviate pain by eating foods such as ice cream or popsicles, applying cool washcloths, or gently icing the affected area. Additionally, patients should avoid spicy or acidic food and beverages as these have the potential to irritate existing sores and exacerbate associated symptoms.

Over-the-Counter Products

Topical docosanol (Abreva) is indicated for the treatment of cold sores and is available as a 10% cream in either a tube or a pump applicator.[57] Docosanol keeps HSV from fusing to the plasma membrane, preventing the virus from entering healthy skin cells, thereby suppressing viral replication.[58] When compared with placebo, docosanol shortens the time to complete healing by approximately 18 hours and alleviation of all

symptoms by approximately 12 hours. This medication should be avoided by those allergic to any components of the preparation. OTC use is not approved for children younger than 12 years of age without direction from a healthcare provider.[57]

Adverse effects are rare (reported by fewer than 2% of patients) and limited to localized site reactions. Educate patients to wash hands before and after applying cream. Topical docosanol should be applied to the affected area and rubbed in gently at the first sign of symptoms, often prodromal burning or tingling, in order to ensure optimal results. Docosanol should be applied five times daily until the cold sore has healed.[57] In clinical trials, patients using docosanol is minimally effective over placebo, noting a decrease in duration of pain by less than 24 hours.[59] Overall, docosanol appears to be mildly effective, but is moderately expensive for the small size of the tube available.

Oral supplementation with lysine has been studied for the prevention of recurrent herpes labialis. Review of the current literature suggests recurrence rates can be decreased with daily doses exceeding 3 grams. These large doses were also associated with an improvement in patients' self-reported symptoms. However, studies focusing on lysine for prevention of recurrent cold sores often have small sample sizes and use lower doses of lysine (1.2 grams or less). Larger placebo-controlled trials with doses exceeding 3 grams per day are needed.[60]

Prescription Products

Topical acyclovir and penciclovir are available for the treatment of herpetic lesions. However, like topical docasanol, topical antivirals appear to be only mildly more effective than placebo.[59]

Oral antiviral agents, such as acyclovir and valacyclovir, are appropriate options for cases of recurrent oral herpes. Both agents are efficacious; however, valacyclovir would be the preferred agent. A systematic review and meta-analysis of the current literature notes that valacylovir was more effective in reducing the time to healing and resolution of pain compared to acyclovir.[61] Additionally, valacyclovir is more convenient in terms of dosing. Treatment with acyclovir requires three daily doses of 400 mg for a total of 5 to 10 days,[62] while valacyclovir requires only two doses of 2 g 12 h apart.[63] For additional information regarding mechanism of action and side effects, please refer to Chapter 135 "Sexually Transmitted Diseases."

XEROSTOMIA

Etiology/Pathophysiology

Xerostomia, commonly referred to as dry mouth, is one of the most prevalent oral conditions due to its numerous causes. Xerostomia affects approximately 22% of the population worldwide, most often affecting older individuals due to frequency of polypharmacy and a higher number of chronic medical conditions.[64]

Xerostomia is typically the result of impaired salivary secretion. Saliva promotes oral health by providing antimicrobial, physical, and chemical protection. It assists in chewing, swallowing, digestion, and speech formation. Saliva is largely composed of water, but also contains substances responsible for maintaining a neutral pH and healthy oral tissues.[64] Unfortunately, xerostomia is often overlooked, which is problematic given the important biological functions of saliva.

Xerostomia has a variety of causes. Acutely, dry mouth may simply be the result of dehydration of the oral tissues due to excessive mouth-breathing or systemic dehydration. Chronically, issues with the neuronal input and dysfunction of the salivary glands may cause dry mouth. Chronic xerostomia and/or salivary dysfunction is often the result of various chronic conditions, medications, and medical treatments (Table e16-12). These causes can have an additive effect and further exacerbate the condition. It is important to note that both OTC and prescription products may be to blame. Common medical conditions, including seasonal allergies, nasal congestion, motion sickness, and diarrhea, are often treated with OTC medications associated with dry mouth. Additionally, mental health disorders may be treated with medications associated with dry mouth and may also increase the awareness of the condition.[64]

TABLE e16-12

Causes of Xerostomia

Chronic Conditions	Medications	Medical Treatments
• Sjögren's syndrome • Graft vs host disease • Lymphoma • Diabetes • Human immunodeficiency virus • Methamphetamine abuse	• Anticholinergics • Antihistamines • Angiotensin receptor blockers • Angiotensin converting enzyme inhibitors • Beta blockers • Diuretics • Opioids • Antidepressants • Antipsychotics	• Radiation • Chemotherapy

Data from Reference 64.

Clinical Presentation

Xerostomia has a number of different signs and symptoms depending on the severity of the condition. Primarily, it is characterized by a generalized feeling of dry oral tissues. Patients may also exhibit redness, peeling, and cracking in and around the mouth. Oral dryness may also result in frothy saliva and difficulty speaking, swallowing, or chewing. Additionally, patients may mention the need to continually sip liquids throughout the day and immediately upon waking.[64]

Complications

In addition to bothersome symptoms, xerostomia can cause a number of complications. Those suffering from xerostomia may notice difficulty speaking, chewing, and swallowing due to lack of necessary oral lubrication. Patients may experience halitosis or recurrent ulcers of the tongue and oral mucosa. Dry mouth increases the likelihood of dental caries, periodontitis, and thrush. Outside of the oral tissues, xerostomia may result in hoarseness, sore throat, and dry nasal passages. Some of these complications, like difficulty swallowing or halitosis can be resolved simply by alleviating dry mouth with methods outlined below. However, more severe complications, like dental caries and periodontitis, will not resolve with xerostomia treatment. Instead, these conditions must be treated by an oral health professional, so prevention is key. In order to prevent the development complications, adequate dental hygiene is vital, including daily brushing, regular use of fluoride, and routine dental visits.[64]

Assessment for Self-Care

Referral to a primary care or an oral health professional is determined by the cause and the severity of xerostomia. Cases resulting from the use of OTC medications can be appropriately managed by a pharmacist; however, patients and/or pharmacists would need to contact a healthcare professional with prescribing authority when prescription products have been identified as the cause.

Mild xerostomia can be appropriately treated with nonpharmacologic methods or OTC products. More severe cases of dry mouth, especially those causing additional complications, would warrant referral to the appropriate medical professional. Additionally, patients experiencing dry eyes along with dry mouth should be assessed for Sjögren's syndrome.[64]

Treatment

Nonpharmacologic Methods

Patients should ensure they are maintaining adequate hydration of the entire body, paying particular attention to the mouth, in order to establish sufficient lubrication of the oral tissues. This can be accomplished through frequent sipping of water, sucking on ice chips, and using a humidifier at night. Patients may also benefit from the use of sugar-free gum or candies in an attempt to stimulate salivary flow and alleviate dry mouth.[64]

Additionally, because tobacco use is commonly associated with dry mouth, patients would benefit from smoking cessation (see Chapter 45 "Chronic Obstructive Pulmonary Disease," and Chapter 86 "Substance-Related Disorders: Alcohol, Nicotine, and Caffeine" for more information on smoking cessation), or at the very least, reducing the number of cigarettes smoked each day. Like tobacco, caffeine use can also impede the formation of saliva; patients would benefit from reducing or eliminating caffeine-containing products from their diets.[64]

Over-the-Counter Products

Artificial saliva or saliva substitutes are designed to resemble biologic saliva, matching both its physical and chemical components. They are available as rinses, sprays, and gels. In order to alleviate the symptoms of xerostomia, artificial salivas generally contain ingredients that increase viscosity and act as oral lubricants, such as carboxymethylcellulose or xanthan gum. These ingredients help saliva substitutes adhere to the oral cavity for a longer period of time. Artificial saliva also contains sweeteners, such as sorbitol or xylitol, as they stimulate the production of saliva but are noncariogenic. Oral use of such sweeteners is generally regarded as safe. Adverse effects, such as diarrhea and flatulence, are associated with the consumption of large amounts of these sweeteners. Oral patches, chewing gum, and lozenges containing sorbitol or xylitol are also available. These products are not artificial saliva, and instead are intended only to stimulate saliva secretion. Table e16-13 contains a summary of directions for using OTC dry mouth products.[65–67,75–77]

TABLE e16-13

Directions for Use—Xerostomia Products

Product	Directions
Rinse	Swish 15 mL for 30 seconds, then spit; can be used up to five times a day
Spray	Apply to all affected tissues in the mouth; apply as needed
Gel	Place 0.5-in. (~1.5 cm) strip on tongue, spread evenly throughout the mouth
Toothpaste	Use a small amount to brush teeth at least twice daily
Patch	Place adhesive side on roof of mouth at least half way back, hold in place for at least 10 seconds
Chewing gum	Chew one piece as needed
Lozenge	Allow lozenge to dissolve in mouth as needed

Data from References 65–67.

While artificial saliva products rapidly alleviate symptoms, they have a short duration of action (~15 minutes). More viscous products, like gels, may have a longer duration of action compared to rinses and sprays. While the wetting effect of artificial saliva does not last long, these products can be used frequently and are relatively inexpensive, easy to use, and safe. As regards product selection, the ADA recommends using products with its Seal of Acceptance, as these products have been deemed both safe and effective.[64]

Prescription Products

Pilocarpine and cevimeline are two prescription products available to treat xerostomia. Pilocarpine is FDA-approved to treat xerostomia as a result of radiation and Sjögren's syndrome,[68] while cevimeline is only approved to treat xerostomia from Sjögren's syndrome.[69] Both medications are

cholinergic agonists, working to increase secretion from the salivary gland.[68,69] Because they work by increasing secretion, pilocarpine and cevimeline treatment would only be appropriate in patients who have maintained at least some function of their salivary gland(s). Recommended dosing for pilocarpine is 5 mg by mouth four times daily,[68] and for cevimeline is 30 mg by mouth three times daily.[69] These medications are generally well tolerated. Their adverse effects include cholinergic-associated effects, such as sweating, indigestion, nausea, and rhinitis.[68,69]

TRAUMA

9 Traumatic dental injuries (TDIs) occur frequently in children and young adults, comprising 5% of all injuries for which people seek treatment.[70] A 12-year review of the literature reports that 25% of all school children experience dental trauma and that 33% of adults have experienced trauma to the permanent dentition.[71] Luxation injuries, or displacement of the tooth from its position, are the most common TDIs in the primary dentition, whereas crown fractures are more commonly reported for the permanent dentition.[72]

Any type of traumatic dental injury warrants referral to a dental professional. However, a few dental injuries involving the permanent teeth require immediate action, as well as referral to a dental professional who can determine whether or not the injury is an emergency and recommend appropriate treatment. For displaced primary teeth, consult a dental professional. Primary teeth that are completely displaced should not be reimplanted due to the risk of damaging developing permanent teeth.[73]

If a permanent tooth is partially displaced, one should attempt to replace and reposition the tooth within the socket using finger pressure and barrier protection. The patient should bite down on a sterile gauze pad to temporarily splint the tooth. If the tooth is entirely displaced, it should be located and verified that it is whole, and then gently rinsed with saline solution for no more than 10 seconds. Attempts should be made to reimplant the tooth within 5 minutes by observing the placement of adjacent teeth for proper placement.[73] Both of these situations are classified as dental emergencies, and the patient should be immediately referred to an oral healthcare provider or emergency facility.

Teeth that cannot be replaced should be stored in physiologic medium (eg, Hank's Balanced Salt Solution), saline, or milk, in order to prevent the tooth from drying out and to prevent the death of cells during transport of the tooth.[74–76] When an appropriate solution is not available, patients should place the tooth in the mouth between the cheeks and gums.[73]

PEDIATRICS

Oral health is a vital component of health for infants and children. Community and health-system pharmacists may be approached with questions regarding oral health in infants and children. The AAP recommends that primary care providers conduct oral health risk assessments on children at every well-child visit, and that children begin seeing an oral health professional within 6 months after the first tooth appears or no later than 1 year of age. Risk factors for caries in infants and children include sleeping with a bottle and continual use of a sippy cup with liquids other than water. Dietary counseling should emphasize reducing exposure to sugars. Additionally, caregiver oral health impacts the oral health of children, including by the transmission of *Streptococcus mutans*, a risk factor for dental caries. Thus, good caregiver oral health should be encouraged and emphasized.[77]

Fluoride

Dental caries is the most common chronic condition in children in the United States, making caries prevention an important focus.[77] Fluoride is effective in preventing dental caries in both systemic and topical dosage forms.[15] Systemic fluoride exerts its effects both through incorporation into teeth before eruption, as well as through an additional topical effect from absorbed fluoride present in the saliva. The anticariogenic property of fluoride is predominantly through its topical effects, which is why fluoride remains effective in children and adults whose permanent teeth have erupted. Drinking fluoridated water also has topical effects as the teeth are exposed to fluoride when drinking.[15] For more information on fluoride, please refer to section "Oral Health Prevention and Maintenance" earlier in this chapter.

Children may encounter fluoride from multiple sources including fluoridated drinking water, fluoride toothpaste, fluoride varnish, and dietary fluoride supplements. Fluoridated drinking water is a common source of fluoride supplementation. Indeed, the Centers for Disease Control and Prevention (CDC) considers water fluoridation one of the 10 most important public health measures of the 21st century.[78] The US Public Health Service

recommends an optimal fluoride concentration of 0.7 mg/L for drinking water. This recommendation considers both the positive caries prevention effects, as well as the potential for fluorosis. Ultimately, the decision of whether to fluoridate community drinking water rests with state and local governments.[79] Other sources of fluoride include beverages, such as soda and juice, infant formula, prepared foods, topical fluoride varnishes, fluoride toothpaste, and oral fluoride supplementation.[80]

Fluorosis of permanent teeth results from an excess of cumulative fluoride intake during tooth development when tooth enamel is being mineralized. Fluorosis risk is influenced by both dose and frequency of fluoride ingestion, and is possible in children younger than 8 years with the period of most susceptibility between 15 and 30 months of age. Mild fluorosis causes minor cosmetic discoloration of the teeth that may include small white spots or streaks (Fig. e16-3). Mild fluorosis is not readily noticeable to casual observation. Moderate and severe fluorosis may include cosmetic and structural concerns but are uncommon in the United States.[80] In the United States, greater than 99% of fluorosis cases are classified as mild. Still, the risk of fluorosis must be compared to the advantages of fluoride on oral health when making decisions concerning the use of fluoride-containing products and supplements.[81]

FIGURE e16-3

Mild fluorosis. *(From the Centers for Disease Control and Prevention. Fluorosis. https://www.cdc.gov/fluoridation/faqs/dental_fluorosis/. Accessed July 23, 2018.)*

Source: Joseph T. DiPiro, Gary C. Yee, Stuart T. Haines, Thomas D. Nolin, Vicki L. Ellingrod, L. Michael Posey: *DiPiro's Pharmacotherapy: A Pathophysiologic Approach, 12e*

Oral Fluoride Supplementation

10 The ADA guidelines on fluoride supplementation offer recommendations aimed at finding the optimal balance between the benefits and risks of fluoride use. Oral fluoride supplementation reduces the incidence of caries in both primary and permanent teeth in children. However, as described above, dietary fluoride also increases the risk of fluorosis when given during tooth development.[82]

Clinical recommendations from the ADA and AAPD (American Academy of Pediatric Dentists) for the use of dietary fluoride supplementation is based both on risk for dental caries and fluoride concentration in drinking water. Dietary fluoride supplementation is recommended for children at high risk for caries and whose primary source of drinking water is deficient in fluoride.[82,83] Note that recommendations from the US Preventive Services Task Force (USPSTF) vary is that these only consider fluoride concentration of drinking water.[81] Healthcare providers can contact health departments at the local, county, or state level to determine fluoride levels in drinking water. For patients with water from individual wells, certified laboratories can conduct a fluoride test. There are many dental caries risk assessments available, and healthcare providers should assess caries risk on a regular basis.[82] Note that even if children drink primarily bottled water, fluoride is still consumed through tap water used in cooking and toothbrushing.[83]

Dosing of dietary fluoride supplements are based on patient age and fluoride concentration of drinking water. Supplementation is only recommended when fluoride concentration of drinking water is below 0.6 ppm and the patient is at a high risk of caries.[82] This recommendation is echoed in the AAPD guidelines on fluoride therapy,[83] the USPSTF Recommendation Statement[81], and the AAP.[80] Fluoride dosing recommendations are listed in Table e16-14. Once permanent teeth have erupted, the benefits of fluoride supplement result from the direct topical effect of the supplement, as well as the indirect topical effect from increased concentration of fluoride in the saliva.[82]

TABLE e16-14

Recommended ADA Dietary Fluoride Supplement Dosing Schedule for Children at High Risk of Developing Caries

Age	Fluoride Concentration in Drinking Water (parts per million)		
	<0.3	0.3-0.6	>0.6
Birth to 6 months	None	None	None
6 months-3 years	0.25 mg/d	None	None
3-6 years	0.5 mg/d	0.25 mg/d	None
6-16 years	1 mg/d	0.5 mg/d	None

Data from Reference 82.

Fluoride supplements should be kept out of the reach of children as fluoride can be toxic in higher concentrations. Fluoride supplements must be used daily for maximum effect. It is recommended that patients chew or suck fluoride tablets for 1 to 2 minutes prior to swallowing in order to maximize the topical effect of the fluoride.[82] Liquid formulations are available, but chewable products are preferred because of increased topical exposure to fluoride.[80]

Fluoride Varnish

The AAP recommends that primary care providers apply fluoride varnish for early childhood caries prevention and bases these recommendations on those by the AAPD and ADA.[80] Fluoride varnish is concentrated topical fluoride applied to the teeth and allowed to set. This allows for a prolonged therapeutic effect. The AAPD recognizes evidence from controlled trials demonstrating the efficacy of professionally applied topical fluoride treatments in reducing dental caries in children.[83] The USPSTF recommends fluoride varnish for all infants and children at the age of tooth eruption, and under the Patient Protection and Affordable Care Act, this preventive service should be covered without cost-sharing.[80]

Fluoride Toothpaste

Fluoride toothpaste consistently demonstrates efficacy in reducing dental caries in children, and toothbrushing should begin with the first eruption of primary teeth. Regular use with adult supervision is most effective. Children should be taught to spit instead of swallowing toothpaste to reduce systemic exposure to fluoride, but children younger than 6 years of age are much more likely to swallow toothpaste. Children younger than 3 years of age should use a smear or rice-sized amount of fluoridated toothpaste. Fluoride consumption associated with swallowing toothpaste can increase the risk for fluorosis. Children 3 to 6 years old should use a pea-sized amount. Parents should be advised to supervise toothbrushing, especially for children under 8 years of age, and to store toothpaste out of reach of young children. It is recommended to advise parents to teach children to spit without water, as this lessens the amount of toothpaste swallowed and leaves more fluoride available in the saliva.[80]

Teething

Etiology and Clinical Presentation

The process of tooth eruption, in which teeth move through the mucosa into the oral cavity, is commonly referred to as teething. This can be associated with increased irritability, crying, drooling, and chewing, although many children may have no symptoms or apparent difficulties during tooth eruption.[84] Symptoms may include local irritation including swelling and tenderness in the gums.[85,86] A meta-analysis found teething signs and symptoms present in 70.5% of infants aged 0 to 36 months, with the most prevalent symptoms being gingival irritation (87%), irritability (68%), drooling (56%).[87] Parents often associate many additional symptoms with teething, including fever, decreased oral intake, and diarrhea. Interestingly, these beliefs are consistent worldwide. Some studies do show a small rise in body temperature during tooth eruption, but this rise is not characterized as fever. Studies do not support teething causing diarrhea, decreased liquid intake, or other symptoms, such as rash or vomiting. Primary teeth eruption usually begins between 4 and 7 months of age, beginning with the central incisors, which are the two lower front teeth. Most children have a complete set of 20 primary teeth by 30 months of age.[84]

Assessment

Teething may be stressful for parents, and parents may not feel confident in treating teething symptoms.[87] Symptoms such as crying, fever, and ear pain may be incorrectly ascribed to teething, so education on the common symptoms of teething is useful in determining the proper level of care. Parents may approach a community pharmacist or other primary care provider asking about recommendations for treating teething pain; while products are available and are advertised for teething, those containing benzocaine are contraindicated in infants and children younger than 2 years of age.[85]

Treatment

Nonpharmacologic Methods

Pediatric guidelines recommend the use of chilled rings, often made of firm rubber, for infants to chew or gum. Biting applies pressure to the gums, giving the infant relief of teething discomfort. Some teething toys filled with liquid can be chilled. The cold causes vasoconstriction, thus decreasing inflammation. However, frozen teething toys or rings should be avoided as the extreme cold can cause damage to the gums.[86] Liquid-filled toys should not be sterilized in extreme temperatures, such as in the dishwasher or boiling, because of concerns that this may cause leakage of the liquid. There are some reports of contaminated liquid in fluid-filled teethers.[84]

Complementary and Alternative Medicine

Amber teething necklaces may be used by parents to decrease pain associated with teething. When worn by the infant, manufacturers claim that small amounts of oil are released into the skin, thus reducing pain, drooling, and inflammation. However, there is no scientific evidence to support the claims. The AAP recommends that infants should not wear any jewelry, as there is a risk of strangulation and choking.[88]

Pharmacologic Agents

Oral Analgesics

The AAP recommends oral analgesics for pain associated with teething if needed. Before 6 months of age, only acetaminophen is recommended. However, after 6 months of age either acetaminophen or ibuprofen is appropriate, with further recommendations to receive dosing instructions based on infant weight from child's healthcare provider.[86]

Topical Anesthetics

Topical anesthetics, such as benzocaine, are not recommended due to potential toxicity.[86] Benzocaine is found in many OTC teething gels and teething products. The FDA released a safety announcement warning that the use of benzocaine in OTC gels or liquids applied to the gums or mouth is associated with methoglobinemia, a rare but potentially fatal condition. The FDA has asked manufacturers to stop marketing OTC oral drug products for teething in infants and children younger than 2 years of age. Benzocaine is now contraindicated for children under 2 years of age, so parents should not use these products in this population. Brand names of teething products containing benzocaine include Baby Orajel.[89]

In studies, the majority of reported cases of methoglobinemia occurred with the use of benzocaine for teething in children under 2 years of age. Symptoms develop within minutes to hours after use of benzocaine. Signs and symptoms include pale, gray or blue colored skin, lips, and nail beds; headache, lightheadedness, shortness of breath, nausea, fatigue, or tachycardia.[89]

The AAP states that teething gels are not effective as excessive salivation often washes gels off gums quickly. There is also concern that benzocaine may numb the throat and interfere with the infant's ability to swallow.[86] Oral viscous lidocaine should also not be used for the treatment of teething pain in children for these same concerns.[89]

CONCLUSION

The entire healthcare team—including pharmacists and other primary care providers—plays an important role in promoting oral health. The AAP recommends that primary healthcare providers play a larger role in oral health by measures such as conducting regular caries risk assessments, offering counseling on diet and oral hygiene, and applying fluoride varnish for infants and children.[77,80] Pharmacy can support this greater focus on integrating oral health into primary care. Given their accessibility, community pharmacists are well-placed to be advocates for good oral healthcare and maintenance. All pharmacists should be familiar with oral health basics and the numerous OTC products available in order to play a vital role in educating patients and improving public health.

ABBREVIATIONS

AAP	American Academy of Pediatrics
AAPD	American Academy of Pediatric Dentists
ADA	American Dental Association
AND	Academy of Nutrition and Dietetics
ANSI	American National Standards Institute
CDC	Centers for Disease Control and Prevention
FDA	Food and Drug Administration
HSV	herpes simplex virus
HSV-1	herpes simplex virus type 1
HSV-2	herpes simplex virus type 2
NSAID	nonsteroidal anti-inflammatory drug
OTC	over-the-counter
PDL	periodontal ligament
RAS	recurrent aphthous stomatitis
SLS	sodium lauryl sulfate
TDI	traumatic dental injury
TMD	temporomandibular disorder
USPSTF	United States Preventive Services Task Force

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SELF-ASSESSMENT QUESTIONS

1. Which of the following is TRUE regarding the selection of a toothbrush?
   A. Soft, flat bristles are most effective for plaque removal.
   B. Multilevel or angled bristles improve plaque removal.
   C. Toothbrushes should be replaced every 3 to 4 months.
   D. Both B and C are correct.
2. Fluoride strengthens teeth by:
   A. Inhibiting the demineralization of enamel
   B. Enhancing the remineralization of decalcified enamel
   C. Incorporating into the apatite crystal of the bone and teeth
   D. All of the above.
3. A patient enters your pharmacy complaining of sore gums. Upon examination, you determine he is likely suffering from denture stomatitis. He tells you he cleans his dentures daily, wears them continuously, and uses a denture adhesive. What is the most likely cause of his denture stomatitis?
   A. Cleaning his dentures daily
   B. Wearing his dentures continuously

C. Occasional use of a denture adhesive

D. None of the above—he is caring for his dentures appropriately

4. Which of the following is TRUE regarding dental injuries in sport?

A. Mouthguards are only necessary for contact sports as dental injuries do not occur in other sports.

B. Mouthguards should be placed in boiling water after each use to prevent the spread of infection.

C. An improperly fitted mouthguard may be associated with noncompliance.

D. All of the above alternatives are correct.

5. The following symptoms may indicate that a dental infection has systemic involvement:

A. Tenderness of the tooth

B. Yellowing of the tooth

C. Xerostomia

D. Fever

6. Dental caries:

A. May be transmitted from person to person, such as from caregiver to child.

B. Result in similar symptoms as periodontal disease.

C. Is treated with antibiotics, as bacteria are a large causative factor.

D. All of the above alternatives are correct.

7. A patient approaches with a question regarding an OTC tooth whitening product. She wonders what the difference is between a whitening toothpaste and OTC whitening strips, and which would be more effective. Which of the following would be an appropriate point of education?

A. Whitening strips contain abrasives as a whitening agent.

B. She can expect OTC whitening strips to be effective against coffee stains, and lighten teeth by 1 to 2 shades.

C. Staining from the use of tetracyclines can always be treated with OTC products.

D. Light-based activation of bleaching agents offers additional benefits over the use of OTC products alone.

8. A patient comes to your pharmacy complaining of recurrent canker sores. Which of the following questions would be appropriate to ask when assessing the patient?

A. What types of food/drink do you typically consume?

B. Have you been exposed to herpes simplex virus type 1?

C. Do you have Sjögren's syndrome?

D. None of the above would be appropriate questions.

9. A patient comes to your pharmacy complaining of a sore on her mouth. As you are speaking with the patient, you notice that the sore is a crusty lesion on her lip. She mentions that she has had similar sores before and that they often begin with a burning or tingling sensation. It is likely this

patient is suffering from a:

A. Dental abscess.

B. Canker sore.

C. Cold sore.

D. None of the above alternatives is correct.

10. At the pharmacy, a patient approaches you about the treatment options for cold sores. Which of the following statements could you tell him?

A. Docosanol cream is available without a prescription, but it is only mildly effective.

B. Eating cold foods (like popsicles and ice cream) may temporarily relieve cold sore pain.

C. The most effective treatment options are prescription-only products.

D. All of the above alternatives are correct.

11. Which of the following would **NOT** help alleviate the symptoms of dry mouth?

A. Smoking cessation

B. Maintaining adequate hydration

C. Chewing sugar-free gum

D. Frequent sips of coffee

12. You see a patient running into the pharmacy with his 7-year-old son. The child tripped in the parking lot and knocked out one of his teeth. The father is in a panic and asks what he should do. Which of the following questions should you ask?

A. Did you locate the tooth, and is it whole or broken?

B. Is the displaced tooth a permanent or primary tooth?

C. How many minutes ago did this occur?

D. All of the above alternatives are correct.

13. Which of the following is true regarding fluoride?

A. Only systemic fluoride is effective in preventing tooth decay, and so all fluoride exposure must occur before permanent teeth have erupted.

B. In adults, systemic fluoride may exert anticariogenic effects through increased concentration of fluoride in the saliva.

C. Almost all bottled waters contain concentrations of fluoride similar to fluoridated drinking water and can be considered an adequate source of fluoride.

D. Fluoride toothpaste should not be used in children under 6 years of age.

14. Oral fluoride supplements are most likely indicated for which of the following patients?

A. A 36-year-old with a high risk of caries and drinking water with fluoride concentration of 0.2 ppm

B. A 4-month-old baby with a moderate risk of caries who is entirely formula-fed with nonfluoridated water

C. A 6-year-old with low risk of caries and drinking water with fluoride concentration of 0.1 ppm

D. A 10-year-old with high risk of caries and drinking water with fluoride concentration of 0.4 ppm

15. A mother approaches with a question regarding teething pain in her 8-month-old infant. She is holding a brand-name teething product containing benzocaine, and wonders whether this would be effective. What would be appropriate advice?

A. A benzocaine-containing product may not be effective, but amber teething necklaces are recommended by pediatric organizations.

B. This product may not be effective, but oral analgesics should always be used for teething pain as nonpharmacologic methods of treatment are not effective.

C. The benzocaine-containing product should be avoided, and oral acetaminophen or ibuprofen may be used if necessary for teething pain.

D. The benzocaine-containing product is safe and is preferred to prevent the use of unnecessary oral analgesics.

SELF-ASSESSMENT QUESTION-ANSWERS

1. **D.** Multilayered or angled bristles are more effective for plaque removal than flat bristles. It is recommended that toothbrushes or toothbrush heads are replaced every 3 to 4 months to ensure adequate plaque removal. See subsection "Toothbrushing" under section "Oral Health Prevention and Maintenance" for more information.

2. **D.** Fluoride inhibits the demineralization of enamel and enhances the remineralization of enamel as it is incorporated into the apatite crystal of bone and teeth. See subsection "Toothpaste" under section "Oral Health Prevention and Maintenance" for more information.

3. **B.** Regular denture maintenance includes daily cleaning by soaking and brushing with an effective, nonabrasive denture cleanser. Dentures should not be worn continuously in order to minimize the risk of developing denture stomatitis. The effects of long-term use of dental adhesives have not been established, but the occasional use is likely not associated with the development of denture stomatitis. See subsection "Denture Care" under section "Oral Health Prevention and Maintenance" for more information.

4. **C.** While contact sports have inherent dental injury risk, dental injuries are prevalent in noncontact sports and activities as well. Mouthguards should be rinsed with cold water or mouthrinse and may be gently brushed with a toothbrush. Placing them in boiling water may damage the appliance. Studies have shown that dental injury rates do not differ between types of mouthguards. However, ill-fitting or uncomfortable mouthguards are associated with decreased compliance, so patients should be advised to choose a comfortable appliance. See subsection "Athletic Mouthguards" under section "Oral Health Prevention and Maintenance" for more information.

5. **D.** Symptoms that indicate possible systemic infection include swelling, fever, malaise, cellulitis, or difficulty breathing or swallowing. See subsection "Etiology" under section "Oral Pain" for more information.

6. **A.** Dental caries is a chronic disease that may be transmitted from caregiver to child. This is why good caregiver oral health is vital for child oral health. Symptoms are different than periodontal disease, with the focus on the tooth rather than the gums. While bacteria have been implicated with dental caries, treatment does not usually include antibiotics. See subsection "Etiology" under section "Oral Pain" and "Pediatrics."

7. **B.** OTC products are effective for extrinsic stains, such as from food or drinks, and typically lighten teeth by 1 to 2 shades. Whitening toothpastes contain abrasives, while strips do not. Light activation of bleaching agents does not seem to offer additional benefits over the use of the bleaching agent alone. Intrinsic staining, such as from tetracyclines, can often only be treated by an oral health professional. See subsection "Treatment" under section "Tooth Whitening" for more information.

8. **A.** Certain types of foods and drinks, such as acidic and/or spicy foods and carbonated beverages, can trigger the development of canker sores and potentially prolong the duration of the episode. Discussing the patient's diet may help identify food or beverages to avoid to prevent frequent episodes. See subsection "Treatment" under section "Canker Sores" for more information.

9. **C.** While dental abscesses, cold sores, and canker sores all affect the oral tissues and often cause pain, there are some distinct differences among these conditions. Cold sores develop as crusty lesions on the lips. Canker sores present as pseudomembranous lesions inside the oral cavity. A

dental abscess is characterized by swelling and purulent exudate of the tissues around the affected tooth. See subsection "Clinical Presentation" under section "Cold Sores" for more information.

10. **D.** All of these statements are true and would be appropriate to tell a patient regarding cold sore treatment. See subsection "Treatment" under section "Cold Sores" for more information.

11. **D.** Frequent sips of coffee would not help the symptoms of dry mouth as caffeine-containing beverages can often make dry mouth worse. All the other options would be appropriate for the relief of dry mouth. See subsection "Treatment" under section "Xerostomia" section for more information.

12. **D.** A displaced tooth should be located if possible and assessed whether it is whole or broken. It is recommended that an attempt should be made to replace and reposition a displaced tooth within the socket. However, this is only for permanent teeth, and primary teeth should not be reimplanted. Attempts to reimplant the tooth should be made within 5 minutes of injury. See section "Trauma" for more information.

13. **B.** Systemic fluoride increases fluoride concentration of saliva, providing anticariogenic effects in adults and children with permanent teeth. Bottled waters often do not contain adequate amounts of fluoride. Fluoride toothpaste is recommended for small children, but only a smear for children under 3 and a pea-sized amount in children 3 to 6 years old to prevent fluorosis. See subsection "Fluoride" under section "Pediatrics" for more information.

14. **D.** Oral dietary fluoride supplements are only indicated for children ages 6 months to 16 years who are at a high risk for caries. They would not be indicated for a child at low risk of caries, even if drinking water fluoride concentration is low. They are not indicated for adults, or infants under 6 months. See subsection "Oral Fluoride Supplementation" under section "Pediatrics" for more information.

15. **C.** Infants may have only mild discomfort with teething, and pediatric guidelines recommend the use of chilled rings for infants to chew to relieve pain. If necessary, oral acetaminophen or ibuprofen could be used in an 8-month-old infant with no medical conditions. Products containing topical benzocaine are contraindicated in children under 2 because of the risk of methoglobinemia. Amber teething necklaces are not recommended because of the risk of strangulation or choking. See "Treatment" under subsection "Teething" (section "Pediatrics") for more information.