Management of the Oral Infection: Part 2

A Peer-Reviewed Publication
Written by Ian Shuman, DDS, MAGD, AFAAID

Abstract
This is the second of a two-part course on oral infection. It includes the clinical and diagnostic features of infections that clinicians are most likely to encounter: fungal, viral and bacterial. Published clinical recommendations and current scientific literature are reviewed and management strategies are discussed. In addition, scientifically supported alternative therapies are mentioned where applicable. The reader should refer to current pharmacology and dosing information prior to prescribing any antifungal therapy.1

Educational Objectives
At the conclusion of this educational activity participants will be able to:
1. Identify clinical features associated with different viral, fungal and bacterial infections
2. Describe the various strategies for treating acute fungal and viral infections
3. Implement appropriate medication management of fungal, viral and bacterial infections

Author Profile
Ian Shuman DDS, MAGD, AFAAID maintains a full-time general, reconstructive, and aesthetic dental practice in Pasadena, Maryland. Since 1995 Dr. Shuman has lectured and published on advanced, minimally invasive techniques. He has taught these procedures to thousands of dentists and developed many of the methods. Dr. Shuman has published numerous articles on topics including adhesive resin dentistry, minimally invasive restorative, cosmetic and implant dentistry. He is a Master of the Academy of General Dentistry, an Associate Fellow of the American Academy of Implant Dentistry, a Fellow of the Pierre Fauchard Academy. Dr. Shuman was named one of the Top Clinicians in Continuing Education since 2005, by Dentistry Today.

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**Oral Fungal Infection**
Fungi are commonly found in the oral cavity (oral mycoses) and in healthy individuals do not pose a threat of infection. However, in a conducive environment, infection can occur for a multitude of reasons. These include but are not limited to aging, xerostomia, organ transplants, HIV and AIDS, and systemic diseases such as diabetes mellitus. There over 15 distinct Candida species that can cause human disease with Candida albicans the most common oral fungal organism associated with infection. (Figure 1) Superficial mucosal infection caused by this organism is classified as acute pseudomembranous candidiasis, acute erythematous candidiasis or chronic atrophic (erythematous) candidosis (or chronic hyperplastic candidosis). Infection caused by C. albicans also includes angular cheilitis (formed at the commissure of the lips), rhomboid glossitis (on the dorsum of the tongue) and ‘prosthetic’ stomatitis (commonly found on the palate).

(Figure 1)

(Figure 2)

(Figure 3)

(Figure 4)

Other, species in the genus Candida that can cause oral infection includes C. glabrata, C. tropicalis, C. parapsilosis, and C. krusei. Candida Glabrata a common cause of oral thrush is now estimated to be involved in about 15 to 30 percent of yeast infections. It is very common in AIDS patients, and involves white, cheese-like lesions on the inside of the cheeks, the gums and the tongue. C. glabrata infections have a higher mortality rate than most other yeast species. Another species present in otherwise healthy people, Candida dubliniensis, has been recovered primarily from the oral cavities of human immunodeficiency virus (HIV)-infected individuals and AIDS patients. The duration of fungal infection is dependent on variables such as immune suppression, and long-term antibiotic or corticosteroid use, among others. Symptoms associated with candidiasis can include taste disturbance, dry mouth, oral burning, oral ulcers and difficulty swallowing. The diagnosis of candidiasis is primarily clinical, based on observable lesions that vary in their presentation.
• **Pseudomembranous candidosis** presents with white plaques on the mucosa and tongue resembling milk curds. Wiping them exposes an underlying erythematous epithelium that may bleed.

• **Erythematous candidosis** is generally found as red areas on the palate, depapillated areas on the dorsum of the tongue, and on the buccal mucosa.

• **Chronic hyperplastic candidosis** (candidal leukoplakia) usually occur on the buccal mucosa and less commonly on the tongue. They present as raised lesions that may vary from small, palpable, translucent, or whitish, to large, dense, opaque plaque-like lesions that are hard and rough to the touch.

• **Denture-related stomatitis** is a typically asymptomatic, chronic erythema and edema of palatal mucosa that contacts the denture intaglio. It is rarely seen in mandibular mucosa in lower denture wearers. The typical presenting complaint is angular cheilitis most commonly due to an insufficiency of the vertical dimension of occlusion.

• **Angular cheilitis/cheilosis** (angular stomatitis) is characterized by a crusting and/or fissuring erythema occurring at the corners of the mouth. As mentioned, it is a common form of oral candidiasis seen in patients with denture-related stomatitis. It may also be a sign of diabetes, HIV infection, or nutritional issues such as vitamin B-12 deficiency.

• **C. albicans** is one of many fungal organisms normally found to the skin.

• **Candidiasis** presents with white plaques on the tongue. They present as raised lesions that may vary from small, translucent, to large, dense, opaque plaque-like lesions that are hard and rough to the touch.

• **Angular cheilitis** is characterized by a crusting and/or fissuring erythema occurring at the corners of the mouth. As mentioned, it is a common form of oral candidiasis seen in patients with denture-related stomatitis. It may also be a sign of diabetes, HIV infection, or nutritional issues such as vitamin B-12 deficiency.

• **C. albicans** is one of many fungal organisms normally found in the mouth and identifying it via Gram stain or through other identifying tests does not imply infection. It is the invasion of the mucosa by the fungal organism that is definitive with respect to the diagnosis. Microbiological identification techniques incorporating biopsy and DNA testing may be necessary in questionable clinical diagnosis, resistance to treatment with antifungal medication, or determination of the responsible organism.

It should be noted that there are several noncandidal oral mycoses and include histoplasmosis, blastomycosis, aspergillosis, paracoccidioidomycosis, cryptococcosis, and zygomycosis (mucormycosis). This group is far less common than oral candidiasis, producing subclinical infection, especially pulmonary infections. Immunocompromised persons (including those with leukemia, leukopenia, solid tumors, transplants, or HIV disease) are at particular risk from these organisms. Infection caused by these fungal organisms results in solitary erosive oral ulcers. Medical management of these organisms is a must.

### Management

Management of fungal infection involves the use of topical and/or oral antifungal medication. (Table 1) In the patient with candidiasis or candidosis that does not respond to topical antifungal medication or in which the infection frequently reoccurs, systemic disease may be the underlying problem. Therefore, the patient with an untreated oral-fungal infection should be referred for additional medical evaluation to rule out immunosuppression caused by a systemic disease.

<table>
<thead>
<tr>
<th>Table 1: Adult Dosing Antifungal Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clotrimazole (Lotrimin, Mycelex)</strong>* is a broad-spectrum antifungal agent causing fungal death by altering cell membrane permeability. It is recommended when infection is widespread as it provides the greatest tissue coverage. It is only used as a topical agent as a 10-mg troche used 5 times/day.</td>
</tr>
<tr>
<td>Prescription: Clotrimazole troches 10mg (Disp. 70 troches; dissolve 1 troche in mouth five times a day. Do not chew).</td>
</tr>
<tr>
<td><strong>Miconazole (Oravig)</strong>* is prescribed for the topical treatment of oropharyngeal candidiasis. Miconazole mucoadhesive tablets (LoramyC™-Europe; Oravig™-USA) are a recent addition to the oral antifungal drugs currently available.</td>
</tr>
<tr>
<td>Prescription: Recommended prescribing is 50 mg tablet; 14 tabs; use once daily; hold one tablet in place against buccal gingiva/mucosa.</td>
</tr>
<tr>
<td><strong>Ketoconazole (Nizoral)</strong>* Oral ketoconazole can be effective for treatment of severe oral and esophageal candidosis, but patient compliance is often poor because of the drug’s taste. The cream form can be used to treat angular stomatitis. 200–400 mg/day PO</td>
</tr>
<tr>
<td>Prescription: Ketoconazole cream 2% (Disp. 15 gm. tube; apply small dab to affected areas after meals)</td>
</tr>
<tr>
<td><strong>Fluconazole (Diflucan)</strong>* is effective in patients with chronic atrophic oral candidosis, particularly when administered concurrently with an oral antiseptic such as chlorhexidine. Adhesion of candidal organisms to epithelial cells, widely recognized as an essential step in the process of candidal colonization and subsequent infection, is inhibited significantly. Since fluconazole is secreted in saliva in high concentrations, it is tempting to speculate that it may interfere with the synthesis or structure of candidal receptors on buccal epithelial cells.</td>
</tr>
<tr>
<td>Prescription: A 50 mg dose produces clinical and mycologic responses in approximately 10 days. It is active against oral candidosis in HIV disease and produces remission within approximately 1 week.</td>
</tr>
<tr>
<td><strong>Itraconazole (Sporanox)</strong>* is active against all candidal species, is well absorbed, achieves good distribution in the body, and may be more active than ketoconazole. It is eliminated hepatically and demonstrates adverse effects including hepatotoxicity and hypokalemia with hypertension. It is available in 100-mg capsules and 10-mg/mL oral solutions.</td>
</tr>
<tr>
<td>Prescription: 10 milliliters of the solution swish intraorally for approximately 20–30 seconds and swallowed, twice daily for one week. If unresponsive, continue treatment for another week.</td>
</tr>
<tr>
<td><strong>Nystatin (Mycostatin)</strong>* is used to treat esophageal candidiasis, and may be used to prevent candidiasis in those at high risk. Nystatin may be used by mouth or applied to the skin.</td>
</tr>
<tr>
<td>Prescription: oral suspension (100,000 units/mL; Disp. 240 mL; 2–5 mL qid. Rinse for two minutes and swallow), Nystatin ointment (15 gm. tube; apply thin coat to inner surface of denture and to affected area after each meal).</td>
</tr>
</tbody>
</table>

* The reader should refer to current pharmacology and dosing information prior to prescribing any antifungal therapy.
In the denture patient, treatment of fungal infection must involve disinfection of the appliances as well. Soaking in an antifungal solution followed by the application of antifungal powder (e.g. Nystatin topical powder) or an antifungal cream to the surfaces of the prostheses contacting the mucosa helps to prevent reinfection. Antisepetic mouth rinses may also serve as a useful antifungal rinse, but chlorhexidine (Peridex® or Periogard®) is incompatible with Nystatin so the two should not be combined as an intervention. The soaking of dentures or partial dentures in benzoic acid or an alkaline protease solution is also effective in removing C. albicans, but the latter should be combined with brushing of the appliance to insure complete eradication. Topical antifungal agents include rinses, suspensions, ointments and creams. Regardless of the formulation, all of these agents should be applied for ten to fourteen days.

Treatment of angular cheilitis/cheilosis is best managed by the application of an antifungal medication such as Nystatin that is coupled with an antibiotic because this infection is often mixed (staphylococci and streptococci as well as C. albicans organisms), particularly in patients with immunosuppression. Mycolog II™ or Mytrex™ dispensed in a 15 gm. tube with ointment applied after each meal and at bedtime coupled with the correction of predisposing factors such as lip licking can be an effective treatment strategy. Systemic antifungal drugs are also used to treat cases where the use of topical therapy is either impractical or ineffective. However a medical specialist should prescribe systemic medications as drug interactions and adverse reactions involving organ systems are not uncommon. Systemic antifungal drugs are typically used in patients with significant underlying medical pathology (e.g. AIDS, immunosuppression, diabetes, organ transplants).

Of note is also the antimicrobial resistance demonstrated by C. albicans in biofilms. The antifungal medications with known resistance include fluconazole, amphotericin B, nystatin and chlorhexidine. The azoles class of topical drugs typically used to treat C. albicans has seen the development of significance resistance, allegedly because of over prescribing during the 1990s and as a result fluconazole, the gold-standard for antifungal drug treatment, is now reported to be virtually ineffective against most mycotic infections. Hence, antifungal medication management should be considered carefully in a patient with oral fungal infection. It is worth noting that a number of alternative antifungal therapies are being studied and many may prove useful for treating superficial oral fungal infections.

Oral Viral Infection

In the oral cavity, viral infections can affect the oral cavity as localized or systemic infections. Infective agents responsible for the most common primary viral infections of the oral cavity are the human herpesvirus (HHV) and human papillomavirus (HPV). Other viral infections that can affect the oral cavity either as localized or systemic infections include coxsackievirus, mumps, measles, rubella, HIV. This course will focus on the causes and oral manifestations of these viruses. For treatment guidelines, the reader should refer to the latest pharmacotherapentic information.

Human Herpesvirus (HHV)

HHV infections are common in the oral cavity. They may be primary or recurrent infections. Eight types of HHV have been linked with oral disease. These types have different disease patterns in their hosts.

Pathophysiology of HHV: Herpesviruses are icosahedral DNA viruses, replicating in the host cell nucleus. Infected saliva or droplets in the oral cavity or via oral-genital contact may transmit the viruses. In a localized primary infection, the virus penetrates the mucosal epithelium and invades the cells of the basal layer, where the viral DNA inserts into the host DNA. Viral shedding has been detected before, during, and after the appearance of clinical lesions in patients with recurrent HHV-1 and HHV-2 infections; therefore, lack of visible lesions does not correlate with lack of potential infectivity.

In HHV-1 and HHV-2 oral infections, viral replication within the oral epithelium may cause lysis of epithelial cells, with vesicle formation. Shallow ulcers with scabs that heal without scarring follow this. Herpesviruses establish latent permanent infections in their hosts, although clinical signs of disease may not be detected. HSVs may persist in a quiescent but persistent form known as latent infection, notably in neural ganglia.

• HHV-1 also known as nongenital herpes simplex virus type 1 (HSV-1) (Figure 5, 6) is an infection usually acquired during childhood from ages 6 months to five years.

Oral Manifestations begin with an initial presentation of primary herpetic gingivostomatitis. It is perhaps the most common viral infection of the mouth with painful vesicles on a red, swollen base that occur on the lips, gingiva, oral palate, or tongue. The lesions ulcerate and the pain can be severe. The onset is abrupt and is accompanied by anterior cervical lymphadenopathy, chills, and a high fever (103°-105°F). The lesions usually heal within 10 to 14 days.

All subsequent presentations of this virus are known as herpes labialis. These are cold sores that involve the oral mucosa or lips. Approximately 90 percent of recurrent HSV-1 infections cause the orofacial lesions known as herpes labialis. Persistent herpes labialis is indicative of an immunocompromised status, including HIV infection.
Treatment is Acyclovir (Zovirax) for both HHV-1 and HHV-2. Other antivirals include Valtrex, Famvir, and De-navir topical cream. Additional prescribing information can be found in the Drug Information Handbook for Dentistry, Wynn R, Meiller T, Crossley H. Lexicomp 21st Edition, Hudson, OH.

Rx: Zovirax 200mg capsules, Disp: 50-60 capsules, Sig: Take 1 capsule 5x/day for 10 days or 2 capsules 3x/day for 10 days.

• HHV-2 also known as herpes simplex virus type 2 (HSV-2) causes genital herpes. Oral Manifestations are occasional with causes of oral disease expression clinically similar to that of HHV-1 infection.

• HHV-3 also known as varicella-zoster virus (VZV) causes the primary infection chickenpox and the secondary reactivation disease herpes zoster. Oral Manifestation In Ramsay Hunt syndrome, VZV affects the geniculate ganglion giving lesions that follow specific branches of the facial nerve. Symptoms may include painful blisters on the tongue and ear along with one-sided facial weakness and hearing loss.

• HHV-4 also known as Epstein-Barr virus (EBV), causes the primary infectious mononucleosis, and it is implicated in various diseases, such as African Burkitt lymphoma, other immunoproliferative disorders, and nasopharyngeal carcinoma. Oral Manifestation Most common in young adults, with petechiae of hard palate, NUG, lymphadenopathy, pharyngitis and tonsillitis, and fever. oral hairy leukoplakia in patients who are immunosuppressed.

• HHV-5 also known as cytomegalovirus (CMV), which may be the most researched of the human herpesvirus, causes a commonly widespread herpes virus that is usually harmless and rarely causes illness. Because it is typically asymptomatic, most of those infected have no symptoms. Once infected, the virus remains alive but dormant. Manifestations: Pregnancy and those with a compromised immune system present with concern. Individuals with a compromised immune system can present with symptoms that may include enlarged lymph nodes, sore throat, muscle aches, fever, fatigue, rash, and malaise. Oral Manifestation primary infection of the salivary glands and other tissues, and it is believed to have a chronic form. In patients with deficient immune systems (common in AIDS) and in transplant patients.

• HHV-6 which can produce acute infection in CD4 + T lymphocytes, causes roseola infantum, a febrile illness that affects young children.

Oral Manifestation It is believed to chronically persist in salivary gland tissue in some hosts, and oral shedding is the probable route of disease transmission. Although it has been linked to apical periodontitis in some studies, the evidence so far is mixed, so such an association remains currently unproved.

• HHV-7 has been implicated as one cause of roseola infantum and febrile seizures in children.

Oral Manifestation has been isolated from the saliva of healthy adults.

• HHV-8 evidence links it with body-cavity lymphomas and Castleman disease.

Oral Manifestation is associated with Kaposi sarcoma. The “potential for oral epithelial cells to serve as replicative sites for HHV-8, as they do for its closest related human herpesvirus--EBV, is supported by the localization of HHV-8 messenger RNA to oral epithelial cells using in situ hybridization, the detection of HHV-8 latent antigens in salivary glands, and the finding of infectious HHV-8 virions in saliva.

Human Papillomavirus (HPV)
HPV is a 50-nm virus composed of double-stranded DNA with no envelope. The virus penetrates the mucosal epithelium and invades the cells of the basal layer, where the viral circular DNA inserts into the host DNA. Common oral conditions include primary herpes gingivostomatitis, recurrent herpes labialis and intraoral recurrent herpes, infectious mononucleosis, oral shingles (herpes zoster), hand-foot-and mouth disease, herpangina and erythematous stomatitis.

HPV infections have received particular attention in recent years, as high-risk strains have been linked to some cases of oral squamous cell carcinoma.

Pathophysiology of HPV: In addition to the viruses that cause ulcers, various subtypes of the human papillomavirus are the cause of exophytic papules or nodules occurring on the intraoral mucosa. (Figure 7, 8) Lesions may be single or multiple, smooth or corrugated and white or tan in appearance. The
conditions related to this virus include papilloma (squamous papilloma), verruca vulgaris, condyloma acuminatum and focal epithelial hyperplasia (Heck’s disease). Infection with the human immunodeficiency virus (HIV) indirectly contributes to the development of a number of oral problems including papilloma (as well as candidiasis, linear gingival erythema, necrotizing ulcerative gingivitis, HIV-related periodontal disease and severe HIV-related aphthous erosions).

Dentists are most likely to encounter patients with intraoral nodules or papules suggesting verruca vulgaris or condyloma acuminatum and ulcerations suggesting recurrent intraoral or lip HSV infection. The remaining intraoral viral conditions are usually associated with constitutional symptoms such as fever, malaise or fatigue and severe oral and throat pain. As a result, patients will typically seek medical attention before presenting to a dentist. However, when there is significant pain and limited involvement of the oral mucosa, patients often seek dental evaluation and treatment.

**Enteroviruses**

This family of viruses is divided into 5 groups: Poliovirus, Coxsackie A & Coxsackie B, Echovirus, and Enterovirus. Herpanginia, hand-foot-and-mouth disease, and acute lymphonodular pharyngitis characterize them.

**Rubeola (Measles)**

Rubeola is caused by the Paramyxov RNA virus. Rubeola can often be diagnosed by the presence of Koplik’s spots.\(^8\) (Figure 9) These are small, red, irregular spots with blue-white centers on intraoral mucosal surfaces and are a classic sign for diagnostic purposes of this virus.

**Treatment** includes the MMR vaccine. The virus is self-limiting.

**Mumps (Endemic Parotitis)**\(^5^4\)

Single stranded RNA virus causes the mumps. It is typically found in parotid, salivary and submandibular glands, with moderate to severe pain. The affected parotid glands may be unilateral or bilateral.

**Human Immuno Deficiency Virus (HIV)**

HIV is the etiologic viral agent of Acquired Immunodeficiency Syndrome (AIDS). Oral manifestations are fungal (candidiasis, histoplasmosis, cryptococcosis), viral (herpes simplex, herpes zoster, CMV, EBV with hairy leukoplakia, HHV-8 with Kaposi Sarcoma (Figure 10), HPV with oral warts), and bacterial (linear gingival erythema, NUP, TB).\(^6^0\)

**Oral Bacterial Infection**

The oral cavity is home to a wide variety of bacteria, most of which are beneficial and non-pathologic.\(^6^1\) Bacterial infection of the oral mucosa is caused by loss of epithelial integrity that allows inoculation of the underlying tissue by aerobic or anaerobic bacteria. Patients who have underlying immune dysfunction (or who are high risk because of sexual activity) may have a greater chance of developing bacteria-related mucosal disease.\(^6^2\) The most common oral disease, dental caries, is caused by Streptococcus mutans, an intraoral bacterium associated with tooth biofilm.\(^6^3\)
Another common oral condition, periodontal disease, is associated with initial gingival inflammation and subsequent bone loss. It is caused by a variety of bacteria (e.g. Porphyromonas gingivalis and Aggregatibacter actinomycetemcomitans among others). The management of dental caries and periodontal disease is a primary function of dental professionals and dental treatment has been extensively covered in multiple textbooks, monographs and other courses. The rationale for treating dental caries and periodontal disease is underscored by recent science suggesting that oral bacteria may be associated with systemic disease. Thus, it is important to educate patients to the fact that untreated dental and periodontal disease could increase the risk of developing cardiovascular diseases, atherosclerosis and diabetic complications, among others.

Other mucosal conditions caused by bacteria include the sexually transmitted diseases and opportunistic infections. The two sexually transmitted diseases most likely to be seen in practice are gonorrhea and syphilis.

Other diseases associated with bacteria are tuberculosis, NOMA (a rapidly progressive, polymicrobial, opportunistic infection that occurs during periods of compromised immune function), actinomycosis and acute necrotizing ulcerative gingivitis (ANUG). The identification of gonorrhea, syphilis, tuberculosis, actinomycosis and NOMA by dental professionals is important as a first step in containing disease, but treatment is best pursued through the patient’s medical provider. Two bacterial conditions where dentists should provide treatment are acute necrotizing ulcerative gingivitis (ANUG) (Figure 11) and superinfection involving major or minor aphthous ulceration. Small oral spirochetes and Prevotella intermedia in combination with psychological stress, debilitation, immunosuppression, smoking, local trauma, poor oral hygiene and nutrition are thought to contribute to the development of acute necrotizing ulcerative gingivitis. In this disease the papillae between the teeth demonstrate erythema and ultimately become ulcerated and necrotic. The condition is painful and there may be a blunting of the papilla and loss of structure. Symptoms can include fever, malaise and lymphadenopathy.

Recommended ANUG treatment includes warm water lavage, rinses with oxygen-releasing formulations or chlorhexidine (0.12% - rinse twice daily) and physical debridement. Antibiotics should be prescribed when there are systemic symptoms such as fever and malaise or when the patient is known to be immunocompromised. The antibiotic that has historically been used to treat the condition is metronidazole (250 mg taken 3 x daily for seven days) but amoxicillin may also be useful (250 mg 3 x daily for 7 days). Frequently reoccurring ANUG infection in a seemingly healthy person suggests there may be compromise of the immune system with medical referral a necessity. Regardless of the cause, mucosal ulcerations may become infected by bacteria. The presence of persistent and increasing pain, expansion of the surrounding erythema and a deepening of the lesion suggest a superinfection. A useful strategy to treat an ulcer with superinfection is to mix 250mg of tetracycline (removed from a capsule) with 8 oz. of sterile water. The resulting slurry can be used as a rinse when there are multiple ulcers (one tsp. swished throughout the mouth four times a day for seven days with expectoration) or delivered directly to a single lesion via cotton swabs (sig: four times a day for seven days). If the infected lesion is small it may also be helpful to cover it with a dissolvable adhesive patch (e.g. CankerMelts GX®, Orahealth Inc.), which slowly releases glycyrrhiza (licorice) extract. The use of CankerMelts® has been shown to reduce lesion size, duration and the pain associated with inflammation. Other topical and systemic pain relieving medications may be used as described above.

Conclusion
Fungal, viral and bacterial organisms can cause infection of the oral mucosa. In most cases the management of intraoral infectious disease simply involves assurance and education regarding risk, palliative home care instructions, recommendations regarding over-the-counter medications and when appropriate, prescribed antifungal, antibacterial and antiviral medication. The patient with persistent fungal or bacterial lesions may need to be further assessed medically to rule out underlying systemic pathology. The patient with primary herpetic stomatitis is likely to experience reoccurring secondary lip or oral lesions not related to immune suppression. These lesions can be managed by topical and in some cases systemic antiviral medication.

References
1. Oral fungal infections can occur for which of the reasons:
   a. aging
   b. xerostomia
   c. diabetes
   d. all of the above

2. The most common oral fungal organism is:
   a. C. glabrata
   b. C. tropicalis
   c. C. albicans
   d. C. parapsilosis

3. Which of the following is estimated to be involved in about 15 to 30% of yeast infections:
   a. histoplasmosis
   b. blastomycosis
   c. aspergillosis
   d. C. Glabrata

4. Solitary erosive oral ulcers are caused by which of the following:
   a. C. dubliensis
   b. C. tropicalis
   c. C. parapsilosis
   d. none of the above

5. The duration of fungal infection is dependent on which of the following variables:
   a. immune suppression
   b. long-term antibiotic use
   c. a short course of corticosteroids
   d. a and b

6. Symptoms associated with candidiasis can include all but which of the following:
   a. taste disturbance
   b. oral burning
   c. hypersalivation
   d. dry mouth

Author Profile
Ian Shuman DDS, MAGD, AFAAID maintains a full-time general, reconstructive, and aesthetic dental practice in Pasadena, Maryland. Since 1995 Dr. Shuman has lectured and published on advanced, minimally invasive techniques. He has taught these procedures to thousands of dentists and developed many of the advanced. Dr. Shuman has published numerous articles on topics including adhesive resin dentistry, minimally invasive restorative, cosmetic and implant dentistry. He is a Master of the Academy of General Dentistry, an Associate Fellow of the American Academy of Implant Dentistry, a Fellow of the Pierre Fauchard Academy. Dr. Shuman was named one of the Top Clinicians in Continuing Education since 2005, by Dentistry Today.

Author Disclosure
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7. Pseudomembranous candidosis presents with white plaques on the mucosa and tongue resembling:
   a. smooth butter
   b. milk curds
   c. swiss cheese
   d. b and c

8. Red areas on the palate, and depapillated areas on the dorsum of the tongue are indicative of:
   a. Erythematous candidosis
   b. Pseudomembranous candidosis
   c. Chronic hyperplastic candidosis
   d. Angular cheilitis/cheilosis

9. Denture-related stomatitis is often associated with:
   a. white plaques on the mucosa and tongue
   b. depapillated areas on the dorsum of the tongue
   c. angular cheilitis
   d. chronic hyperplastic candidosis

10. Angular cheilitis/cheilosis may be a sign of:
    a. diabetes
    b. vitamin B-12 deficiency
    c. HIV infection
    d. all of the above

11. Which of the following noncandidal oral mycoses may cause oral infection:
    a. Arapaima gigas
    b. Aspergillosis
    c. Actinopterygii
    d. Atractosteus spatula

12. In questionable clinical diagnosis, which of the following microbiological identification techniques may be required:
    a. biopsy
    b. Gram stain
    c. DNA testing
    d. a and c

13. Which of the following broad-spectrum antifungal agents causes fungal death by altering cell membrane permeability:
    a. Glycerin trinitrate
    b. Betnovate
    c. Scheriprost
    d. Mycelex

14. Which agent is particularly effective in patients with chronic atrophic oral candidosis when administered concurrently with an oral antiseptic such as chlorhexidine:
    a. Balamitit
    b. Tri-Preferm
    c. Fluconazole
    d. keratolytics

15. An in vitro animal study showed inhibition of C. albicans invasion of mucosal surfaces and adhesion to denture acrylic resins by which microorganism:
    a. HHV-1
    b. Epstein-Barr virus
    c. S. salivarius K12
    d. none of the above

16. Viral infections that can affect the oral cavity either as localized or systemic infections include all but which of the following:
    a. coxsackievirus
    b. sporanox
    c. mumps
    d. rubella

17. Nongenital herpes simplex virus type 1 (HSV-1) is an infection usually acquired:
    a. during childhood
    b. from ages 6 months to five years
    c. before 6 months of age
    d. a and b

18. Which of the following is true of primary herpetic gingivostomatitis:
    a. it presents with painful vesicles
    b. It is perhaps the most common viral infection of the mouth
    c. The lesions ulcerate and the pain can be severe
    d. all of the above

19. All subsequent presentations of HSV-1 is known as:
    a. herpes zoster
    b. genital herpes
    c. CMV
    d. herpes labialis

20. HHV-4 is also known as:
    a. Epstein-Barr virus
    b. Burkitts lymphoma
    c. varicella-zoster virus
    d. Ramsay Hunt syndrome

21. Varicella-zoster virus (VZV) affects the geniculate ganglion giving lesions that follow specific branches of the:
    a. trigeminal nerve
    b. facial nerve
    c. accessory nerve
    d. hypoglossal nerve

22. HPV infections have received particular attention in recent years, as high-risk strains have been linked to some cases of oral:
    a. malignant melanoma
    b. squamous cell carcinoma
    c. glioblastoma
    d. neuroblastoma

23. Human papillomavirus is the cause of exophytic papules or nodules occurring on the intraoral mucosa. The appearance of these lesions may be:
    a. single or multiple
    b. smooth or corrugated
    c. white or tan
    d. all of the above

24. The conditions related to the human papillomavirus include:
    a. papilloma (squamous papilloma)
    b. verruca vulgaris
    c. condyloma excomunicata
    d. Shrek's disease

25. The family of Enteroviruses includes all but which of the following:
    a. Echovirus
    b. Poliovirus
    c. Coxsackie A & Coxsackie B
    d. Marburg virus

26. Endemic Parotitis may present with which of the following:
    a. hemorrhagic fever
    b. pulmonary edema
    c. vasovagal syncope
    d. unilateral or bilateral swollen parotid glands

27. Which of the following is an oral manifestation of HIV:
    a. Pica
    b. hydrophobia
    c. cryptococcosis
    d. salmonellosis

28. The oral cavity is home to a wide variety of bacteria, most of which are:
    a. beneficial and pathologic
    b. non-beneficial and pathologic
    c. non-beneficial and non-pathologic
    d. beneficial and non-pathologic

29. The most common oral disease is:
    a. gingivitis
    b. dental caries
    c. periodontitis
    d. a and c

30. The two sexually transmitted diseases most likely to be seen in the dental practice are:
    a. chancroid and trichomoniasis
    b. chlamydia and herpes
    c. human papillomavirus and genital warts
    d. gonorrhea and syphilis
Management of the Oral Infection: Part 2

Educational Objectives
1. Identify clinical features associated with different viral, fungal and bacterial infections
2. Describe the various strategies for treating acute fungal and viral infection
3. Implement appropriate medication management of fungal, viral and bacterial infections.

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

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

2. To what extent were the course objectives accomplished overall? 5 4 3 2 1 0
3. Please rate your personal mastery of the course objectives 5 4 3 2 1 0
4. How would you rate the objectives and educational methods? 5 4 3 2 1 0
5. How do you rate the author’s grasp of the topic? 5 4 3 2 1 0
6. Please rate the instructor’s effectiveness. 5 4 3 2 1 0
7. Was the overall administration of the course effective? 5 4 3 2 1 0
8. Please rate the usefulness and clinical applicability of this course. 5 4 3 2 1 0
9. Please rate the usefulness of the supplemental webliography. 5 4 3 2 1 0
10. Do you feel that the references were adequate? Yes No
11. Would you participate in a similar program on a different topic? Yes No
12. If any of the continuing education questions were unclear or ambiguous, please list them.
13. Was there any subject matter you found confusing? Please describe.
14. How long did it take you to complete this course?
15. What additional continuing dental education topics would you like to see?

Please photocopy answer sheet for additional participants.

If not taking online, mail completed answer sheet to:
PennWell Corp.
Attn: Dental Division,
1421 S. Sheridan Rd., Tulsa, OK, 74112
or fax to: 918-831-9804

For IMMEDIATE results, go to www.DentalAcademyOfCE.com to take tests online.
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Answer sheets can be faxed with credit card payment to 918-831-9804.

Payment of $59.00 is enclosed.
(Checks and credit cards are accepted.)

If paying by credit card, please complete the following:

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Charges on your statement will show up as PennWell.

Requirements for successful completion of the course and to obtain dental continuing education credits: 1) Read the entire course. 2) Complete all information above. 3) Complete answer sheets in either pen or pencil. 4) Mark only one answer for each question. 5) A score of 70% on this test will earn you 3 CE credits. 6) Complete the Course Evaluation below. 7) Make check payable to PennWell Corp. For Questions Call 800-633-1681

PennWell maintains records of your successful completion of any course for a minimum of six years. Please contact our office for a copy of your continuing education credits report. This report, which will list all credits earned to date, will be generated and mailed to you within five business days of receipt.

Completing a single continuing education course does not provide enough information to give the participant the feeling that s/he is an expert in the field related to the course topic. It is a combination of many educational courses and clinical experience that allows the participant to develop skills and expertise.

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