HIV: Infection Control/Exposure Control
Issues for Oral Healthcare Workers

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Continuing Education Units: 2 hours


Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

This continuing education course presents the essential elements of an infection control/exposure control plan for the oral healthcare setting with emphasis on the human immunodeficiency virus (HIV).

Conflict of Interest Disclosure Statement
• Dr. Huber reports no conflicts of interest associated with this course.
• Dr. Terézhalmy is a consultant for P&G.

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Overview
In the absence of an effective vaccine, exposure prevention is the primary strategy for the prevention of healthcare-associated HIV infections in the oral healthcare setting. Knowledge about potential risks and concise written procedures that promote a seamless response following occupational exposure can greatly reduce the emotional impact of an accidental exposure to blood or other potentially infectious body fluids via percutaneous or mucous membrane exposure.

Learning Objectives
Upon the completion of this course, the dental professional will be able to:
• Discuss the etiology, epidemiology, clinical manifestations, and diagnosis of HIV infection.
• Develop an office infection control/exposure control protocol with exposure prevention and post-exposure strategies specific for the HIV.
• Establish policy for work restriction of HIV-positive oral healthcare workers.

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Introduction
Healthcare-associated infections (HAIs) are a potential hazard to healthcare workers (HCWs) and their patients. The most important strategy for reducing the risk HAIs is exposure prevention. For this reason federal, state, and local agencies and professional organizations repeatedly emphasize the importance of Standard Precautions as the foundations for preventing transmission of pathogenic organisms during patient care in all healthcare settings; and the implementation of Transmission-based Precautions, based on the suspected or confirmed presence of specific pathogens known not to be completely interrupted using Standard Precautions. Much of the vigilance concerning HAIs was initiated primarily in response to concerns related to the hepatitis B and the human immunodeficiency viruses. As the number of people living with immunodeficiency virus (HIV) infection in the United States is higher than ever before and an estimated 20% of persons in the United States with HIV infection are unaware that they are infected, healthcare-associated exposures are urgent medical concerns.¹

Etiology and Epidemiology
The first cases of acquired immunodeficiency syndrome (AIDS) in the United States were reported in 1981.² Soon thereafter, the human immunodeficiency virus (HIV), an RNA virus of the Retroviridae family, was identified as the underlying pathogen. HIV probably entered the human population by cross-species transmission of the ancestral virus found in wild chimpanzees in Central Africa. Based on evidence of viral sequencing diversification, establishment, and early spread of the HIV in Africa corresponds to urbanization and occurred long before the recognition of AIDS around the beginning of
the twentieth century.5 The HIV, a bloodborne pathogen, is acquired in non-occupational settings most readily either across mucous membranes or parenterally by 5 prime modes of transmission:

1. unprotected penetrative sex between men,
2. unprotected heterosexual intercourse,
3. injection drug use,
4. unsafe blood and blood by-products (primarily in developing countries),
5. and mother to child spread during pregnancy, delivery, or breast feeding.4

Estimated risk per episode of HIV transmission for receptive anal intercourse is 1 to 30%; for insertive anal or receptive vaginal intercourse it is 0.1 to 10%; for insertive vaginal intercourse it is 0.1 to 1%; and for injection drug use with needle sharing it is 0.67 per needle-sharing contact.5 Transmission risk varies depending on the specific exposure, e.g., advanced HIV disease in the source patient, cervical or anal dysplasia, circumcision status, or the presence of genital ulcer disease. Data are lacking on transmission via oral sex, although the risk is believed to be low.

With minor variations, the HIV has the same general life cycle as other viruses. Infection begins when a virion attaches to a host cell. CCR5 and CXCR4 are the two major co-receptors used by HIV-1. The viral strains can be classified on the basis of which co-receptor they use as CCR5-tropic, CXCR4-tropic, or mixed-tropic. CCR5-tropic strains predominate during early stages of infection and remain dominant in 50-60% of late stage disease.6 Viral proteins (capsid- or envelop-related) mediate attachment. Viral entry into the host cell is mediated by other viral proteins which promote the fusion of the viral capsid or envelop with host cell membrane. Once the virus has gained entry into the host cell, it loses its capsid proteins by the process known as uncoating and the viral nucleic acid now becomes available for genome replication. Replication requires the generation of protein kinase-dependent nucleoside triphosphates (ribo- or deoxyribo-) which are incorporated into the new viral genome by viral or host cell polymerases.

In most instances the viral DNA or RNA is replicated and then transcribed into mRNA. For retroviruses, such as the HIV, uncoating is followed by reverse transcription; the viral RNA is first copied into DNA before it is transcribed into mRNA. Next, the newly synthesized mRNA is translocated to host cell ribosomes. The viral proteins synthesized by host cell ribosomes are then assembled with the duplicate viral genome. Assembly is followed by maturation which involves cleavage of viral proteins by proteases essential for the newly formed virion to become infectious. In the case of HIV, maturation occurs extracellularly after viruses egress from the cell either by cell lysis or budding through the cell membrane. Replication of the HIV may include the additional step of integration, in which the viral genome may be incorporated into the host genome. Differences between viral and host cell proteins at any of these steps can be targeted for antiretroviral therapy (ART).

The number of people living with HIV infection in the United States, i.e., the prevalence of HIV infection, is higher than ever before. The CDC has estimated that 1.2 million adults and adolescents were living with HIV infection at the end of 2008, the most recent year for which national prevalence estimates are available.1 This represents an increase of approximately 7% from the previous estimate in 2006.1 Despite
increases in the total number of people living with HIV infection, the annual number of new HIV infections, i.e., the incidence of HIV infection, has remained relatively stable in recent years. In 2010, an estimated 47,500 persons were diagnosed with HIV infection at a rate of 18.8 per 100,000.  

The number of new HIV infections was highest among individuals aged 25-34 (31%), followed by individuals aged 13-24 (26%). In 2010, blacks/African Americans accounted for 44% of the new HIV infections, followed by whites (31%) and Hispanics/Latinos (21%). The rate of new HIV infections for whites is 8.7, for Hispanics/Latinos it is 27.5, and for black/African Americans it is 68.9 per 100,000. The rate of new HIV infections among males was 4.2 times higher than that of females. The majority of new HIV infections among males are attributed to male-to-male sexual contact (78%); among females HIV infections are attributed to heterosexual contact (84%).

**Clinical Manifestations**

Immunopathologic mechanisms have only partially been identified, but the available scientific evidence clearly suggests a dynamic process in which the initial and ongoing immunological response to HIV infection is not only unsuccessful in clearing the HIV but, paradoxically, it is paralleled by a progressive reduction in immunocompetence. While individual variations exist, a common pattern of disease progression has been established consisting of three phases: (1) primary infection, (2) a period of clinical latency, and, finally, (3) clinically apparent disease.

After an incubation period of 1 to 3 weeks, 50% to 80% of patients experience an ill-defined Acute Retroviral Syndrome characterized by numerous non-specific signs and symptoms such as fever, lethargy, malaise, sore throat, arthralgia, myalgia, headache, photophobia, maculopapular rash, and lymphadenopathy. During the period of clinical latency (8 to 24 months), the patient is typically free of overt clinical illness, but HIV antibodies can be detected 3 to 6 months after exposure. The final phase is characterized by the appearance of AIDS-defining conditions (Table 1).

**HIV-associated Oral Lesions**

Many oral lesions have been associated with HIV infection (Table 2) with the most notable being candidiasis (erythematous, pseudomembranous), hairy leukoplakia, Kaposi’s sarcoma, non-Hodgkin’s lymphoma, and periodontal disease (linear gingival erythema, necrotizing ulcerative periodontitis). Hairy leukoplakia and oral candidiasis have been demonstrated to be positive predictors of HIV disease progression. However, while it is generally agreed HIV-associated oral lesions are useful markers of HIV disease, their true prevalence is unknown.

In a recent study, among 210 HIV-positive patients at the time of diagnosis, 62% had clinical oropharyngeal candidiasis. In another study, 81.1% of 122 consecutive HIV-infected patients on ART were colonized by Candida spp. and 33.3% had clinical infection. Oral candidiasis is considered a Group 1 oral condition, i.e., a condition strongly associated with HIV infection.

Approximately 5-10% of HIV infected individuals experience salivary gland disease. Diffuse infiltrative lymphocytosis syndrome (DILS) affects either the parotid or submandibular glands with a predilection for the parotids. Salivary gland disease is considered a Group 2 oral condition, i.e., a condition less commonly associated with HIV infection.

In a study of 459 HIV-positive children, the prevalence of hairy leukoplakia was significantly lower among those undergoing ART. In a study of 577 HIV infected adults, ART therapy was
associated with decreased prevalence of hairy leukoplakia and necrotizing periodontal disease and an increased prevalence of salivary gland disease. In the same study the effect of ART on the prevalence of oral candidiasis, aphthous ulcers, oral warts, herpes simplex virus lesions, and Kaposi’s sarcoma was not significant. It has been postulated the seemingly paradoxical persistence and at times worsening of HIV-associated oral lesions is due to the phenomena of immune reconstitution disease.

Table 1. AIDS-defining Conditions.

| 1. | Candidiasis of bronchi, trachea, or lungs |
| 2. | Candidiasis, esophageal |
| 3. | Cervical cancer, invasive |
| 4. | Coccidioidomycosis, disseminated or extrapulmonary |
| 5. | Cryptococcosis, extrapulmonary |
| 6. | Cryptosporidiosis, chronic intestinal (greater than one month’s duration) |
| 7. | Cytomegalovirus disease (other than liver, spleen, or nodes) |
| 8. | Cytomegalovirus retinitis (with loss of vision) |
| 9. | Encephalopathy, HIV-related |
| 10. | Herpes simplex: chronic ulcer(s) (greater than one month’s duration); or bronchitis, pneumonitis, or esophagitis |
| 11. | Histoplasmosis, disseminated or extrapulmonary |
| 12. | Isosporiasis, chronic intestinal (greater than one month’s duration) |
| 13. | Kaposi sarcoma |
| 14. | Lymphoma, Burkitt’s (or equivalent term) |
| 15. | Lymphoma, immunoblastic (or equivalent term) |
| 16. | Lymphoma, primary, of brain |
| 17. | Mycobacterium avium complex or Mycobacterium kansasii, disseminated, or extrapulmonary |
| 18. | Mycobacterium tuberculosis, any site (pulmonary or extrapulmonary) |
| 19. | Mycobacterium, other species or unidentified species, disseminated or extrapulmonary |
| 20. | Pneumocystis jiroveci pneumonia |
| 21. | Pneumonia, recurrent |
| 22. | Progressive multifocal leukoencephalopathy |
| 23. | Salmonella septicemia, recurrent |
| 24. | Toxoplasmosis of brain |
| 25. | Wasting syndrome attributed to HIV |

**Diagnosis**

The diagnosis of HIV infection is based on laboratory criteria:

- Positive result from an HIV antibody screening test, e.g., reactive enzyme immunoassay (EIA);
  - Confirmed by a positive result from a supplemental HIV antibody test, e.g., Western blot or indirect immunofluorescence assay test.

OR

- Positive result from any of the following HIV virologic (i.e., non-antibody) tests:
  - HIV nucleic acid (DNA or RNA) detection test, e.g., polymerase chain reaction (PCR)
  - HIV p24 antigen test, including neutralizing assays
  - HIV isolation (viral culture)

A confirmed case of HIV infection meets the laboratory criteria for the diagnosis of HIV infection and based on the presence or absence of AIDS-defining conditions it is further classified.
as stage 1, stage 2, stage 3, or stage unknown (Table 3). A comprehensive review of definitive diagnostic methods for AIDS-defining conditions is presented elsewhere.

**Medical Management**
Currently available antiretroviral agents include over 20 drugs belonging to 6 different mechanistic classes (Table 4). HIV infection is treated with combinations of antiretroviral drugs depending on the patient’s HIV RNA levels (“viral load”) and the CD4 cell count. Increases in viral load while on therapy may indicate drug resistance, requiring further testing and a change in treatment regimen. ART for treatment-naive patients may be nonnucleoside reverse transcriptase inhibitor (NNRTI)-based (1 NNRTI + 2 NRTI) or protease inhibitor (PI)-based (1 or 2 PIs + 2 NRTI). ART
Table 3. Case classification of HIV infections (adults ≥13 years).

<table>
<thead>
<tr>
<th>HIV infection, stage 1</th>
<th>No AIDS-defining conditions.</th>
<th>Either CD4+ T-lymphocyte count of &gt;500 cells/µL or CD4+ T-lymphocyte percentage of total lymphocytes of &lt;29.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV infection, stage 2</td>
<td>No AIDS-defining conditions.</td>
<td>Either CD4+ T-lymphocyte count of 200–499 cells/µL or CD4+ T-lymphocyte percentage of total lymphocytes of 14–28.</td>
</tr>
<tr>
<td>HIV infection, stage 3 (AIDS)</td>
<td>At least one of the AIDS-defining conditions has been documented.</td>
<td>Either CD4+ T-lymphocyte count of &lt;200 cells/µL or CD4+ T-lymphocyte percentage of total lymphocytes of &lt;14.*</td>
</tr>
<tr>
<td>HIV infection, stage unknown</td>
<td>No information on AIDS-defining conditions.</td>
<td>No information on CD4+ T-lymphocyte count or percentage.</td>
</tr>
</tbody>
</table>

*Documentation of an AIDS-defining condition supersedes a CD4+ T-lymphocyte count of >200 cells/µL or CD4+ T-lymphocyte percentage of total lymphocytes of >14.

Table 4. Antiretroviral Drugs.

<table>
<thead>
<tr>
<th>Class</th>
<th>Drugs</th>
<th>Mechanisms of Action</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCR5 antagonists</td>
<td>maravirex</td>
<td>Blocks CCR5, one of two major co-receptors used by HIV-1 to attach to host cells.</td>
<td>Approved for use in combination therapy of treatment-experienced adults with CCR5-tropic HIV-1 infection.</td>
</tr>
<tr>
<td>Fusion inhibitors</td>
<td>enfuvirtide</td>
<td>An anti-HIV peptide structurally similar to a segment of the HIV protein (gp41). Blocks membrane fusion.</td>
<td>Approved for use in combination therapy of treatment-experienced adults with ongoing HIV replication despite current ART.</td>
</tr>
<tr>
<td>Nucleoside/nucleotide reverse transcriptase inhibitors (NRTIs)</td>
<td>abacavir, didanosine, emtricitabine, lamivudine, stavudine, zidovudine, tenofovir (the only nucleotide RTI)</td>
<td>Mimic deoxyribonucleoside triphosphate, the natural substrate for reverse transcriptase. As they become incorporated into the growing DNA chain, they terminate elongation and decrease or prevent HIV replication in infected cells.</td>
<td>Approved for use in combination therapy of treatment-naïve patients. ART therapy may be NNRTI-based (1 NNRTI + 2 NRTIs) or PI-based (1 or 2 PIs + 2 NRTIs).</td>
</tr>
<tr>
<td>Non-nucleoside reverse transcriptase inhibitors (NNRTIs)</td>
<td>efavirenz, etravirine, nevirapine</td>
<td>Bind near the catalytic site of reverse transcriptase and inhibit a crucial step in the transcription of the RNA genome into a double-stranded retroviral DNA.</td>
<td></td>
</tr>
<tr>
<td>Protease inhibitors (PIs)</td>
<td>atazanavir, darunavir, fosamprenavir, indinavir, lopinavir, nelﬁnavir, ritonavir, saquinavir, tipranavir</td>
<td>Prevent cleavage of viral proteins during assembly and maturation, a process essential for the newly formed virus to become infectious.</td>
<td></td>
</tr>
<tr>
<td>Integrase strand transfer (InST) inhibitors</td>
<td>raltegravir</td>
<td>Blocks HIV-1 integrase, preventing viral DNA from integrating with host cell DNA.</td>
<td>Approved for use in combination therapy of treatment-experienced adults infected with HIV strains resistant to multiple antiretroviral agents.</td>
</tr>
</tbody>
</table>
for treatment-experienced adults may also include a CCR5 antagonist, a fusion inhibitor, or an InST inhibitor. The treatment of injection drug users, HIV-infected women of reproductive age and pregnant women, and patients with co-infections (HBV, HCV, and tuberculosis) require special antiretroviral regimens.

**Modes of Transmission**
The modes of transmission vary by type of organisms and some pathogens may be transmitted by more than one route. Some are transmitted primarily by direct or indirect contact, others by airborne droplets or droplet nuclei, and bloodborne pathogens via percutaneous or mucous membrane exposure.

**Contact Transmission**
Direct contact transmission occurs when pathogens are transferred between individuals without a contaminated intermediate person, object, or environmental surface. For example: when (1) blood or other potentially infectious material (OPIM) from an infected person directly enters the body of a susceptible person through contact with mucous membrane or breaks in the skin; or when (2) an infectious agent is directly transferred from an infected person to a susceptible person during ungloved contact with mucous membrane or skin.

Indirect contact transmission occurs when pathogens are transferred between individuals through a contaminated intermediate person, object, or environmental surface. For example: when (1) the hands of HCWs transmit pathogens after touching an infected body site on one patient, or a contaminated inanimate object, or a contaminated environmental surface and hand hygiene is not performed before touching another patient; or when (2) patient-care devices, contaminated with blood or OPIM, are shared between patients without being adequately cleaned, disinfected, or sterilized.

**Respiratory Transmission**
The nasal mucosa, conjunctivae, and less frequently the mouth, are susceptible portals of entry for respiratory viruses. Particles of respirable size are generated when people are talking, breathing, coughing, or sneezing; during procedures such as suctioning; or when water is converted to a fine mist by medical/dental devices, such as high-speed handpieces, ultrasonic instruments, or by lasers and electrosurgical units.

Droplet transmission may occur when particles of moisture greater than 5 μm, containing potentially infectious microorganisms, are inhaled. The risk of disease transmission is generally limited to
within 3 feet of the source person. Exposure to pathogens in droplets constitutes a form of contact transmission, i.e., inhalation of droplets containing infectious pathogens in close proximity to the droplet source. Droplet transmission may also result from direct body surface to body surface contact and physical transfer of microorganisms between a susceptible host and an infected/colonized person, or contact of a susceptible host with contaminated intermediate objects or environmental surfaces.

Airborne transmission may occur when droplet nuclei, containing potentially infectious pathogens, are inhaled. Droplet nuclei are residuals of droplets that, while suspended in air, dried out and produced particles ranging in size from 1-5 µm. Exposure to pathogens in droplet nuclei constitutes a form of contact transmission, i.e., inhalation of droplet nuclei containing infectious pathogens that may be transported over a long distance (beyond 3 feet of the source of these particles) and remain suspended in air indefinitely in a dry, cool atmosphere. Airborne transmission may also result from contact of a susceptible host with contaminated intermediate objects or environmental surfaces.

Healthcare-associated Transmission of HIV

Patient-to-provider Transmission
Through December 2001, there were 57 documented cases of occupational HIV transmission to HCWs in the United States (none of whom were OHCWs), and no confirmed cases have been reported since 1999. A retrospective case-control study found that the risk of infection among HCWs following percutaneous exposure to HIV-infected blood was more likely: (1) in the presence of visible blood on the instrument before injury, (2) if the injury involved a needle which was placed directly into the patient’s vein or artery, (3) if the injury caused by the contaminated instrument or needle was deep, or (4) if the source patient had an increased viral load.

Prospective studies estimate the average risk for HIV infection after percutaneous and mucous membrane (eyes, nose, and mouth) exposure to HIV-infected blood to be approximately 0.3% (1 infection associated with 2,885 exposures) and 0.09%, respectively. The transmission of HIV infection after nonintact skin exposure has been documented, but the risk is estimated to be less than the risk following mucous membrane exposure. The risk of infection associated with intact skin is below detection in the few studies that have attempted to measure it. Finally, the risk of transmission after exposure to OPIM is probably considerably lower than the risk following exposure to blood.

Provider-to-patient Transmission
Since HIV was isolated 25 years ago, only 4 instances of HIV transmission from infected provider-to-patient have been documented worldwide and no cases have been reported since 2003. One cluster of infections occurred in the United States in 1990, 2 cases occurred in France, and one case of transmission occurred in Spain. The U.S. cluster involved a dentist with AIDS (6 of his patients became HIV infected). Although all HIV isolates were linked to the dentist, both epidemiologically and by DNA sequencing, the precise mechanisms of transmission were never determined and no data were uncovered suggesting intentional transmission. Since then, more than 4 dozen look-back studies have been conducted evaluating the HIV antibody status of patients retrospectively identified as having been treated by an HIV-infected physician or dentist and none of these studies identified evidence of provider-to-patient transmission.

Exposure Prevention in Oral Healthcare Settings
Historically, infection control/exposure control guidelines focused primarily on the risk of transmission of bloodborne pathogens among HCWs and patients and the use of Universal Precautions to reduce the risk. Universal Precautions were based on the concept that patients with bloodborne infections can be asymptomatic and unaware that they are infectious; therefore all blood and body fluids contaminated with blood were treated as infectious. The CDC expanded Universal Precautions into the concept of Standard Precautions. Standard Precautions were intended to apply not only to contact with blood and body fluids contaminated with blood; but also to contact with all body fluids, secretions and excretions, nonintact skin, and mucous membranes.
Today, there are two tiers of precautions to prevent HAIs: Standard Precautions and Transmission-Based Precautions. Standard Precautions (expanded by new components as may be necessary, e.g., Respiratory Hygiene/Cough Etiquette and Safe Injection Practices) constitutes the primary strategy for the prevention of healthcare-associated transmission of pathogenic organisms in all healthcare settings, regardless of the suspected or confirmed presence of an infectious agent (Table 5). Transmission-Based Precautions (e.g., Contact Precautions, Droplet Precautions, and Airborne Precautions) are used when the route of transmission of a suspected or confirmed pathogenic organism is known not to be completely interrupted using Standard Precautions alone.

### HIV-related Precautions

In 2008, the most recent year for which national estimates are available, the proportion of persons in the United States who do not know that they are infected with the HIV is estimated to be 20%.\(^1\) Consequently, Standard Precautions, having been confirmed as effective to prevent exposure to infected blood or OPIM, constitutes the primary strategy for the prevention of healthcare-associated transmission of HIV in all healthcare settings regardless of the suspected or confirmed presence of an HIV infection.\(^2\) Since HIV infection is now successfully being managed as a chronic disease, patients are living longer and are healthier. As a consequence, an increasing number of these patients are likely to seek dental care. OHCWs have both a moral and legal obligation to treat HIV-infected patients within the scope of their practice.\(^45,46\) Issues related to the dental management of patients with HIV infection are discussed elsewhere.

#### Management of OHCWs Potentially Exposed to HIV

Oral healthcare facilities should have, as part of their infection control/exposure control protocol, the organizational infrastructure that promotes a seamless response following occupational exposure. It should include clear written procedures for prompt reporting, evaluation, treatment, and follow-up.\(^42\) Access to clinicians who are familiar with post-exposure evaluation and treatment protocols should be made available during all working hours (including nights and weekends). HCWs should be familiar with

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**Table 3. Standard Precautions and Transmission-Based Precautions.**

<table>
<thead>
<tr>
<th>Hierarchy</th>
<th>Objective</th>
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<tbody>
<tr>
<td>Education and training</td>
<td>Establish the rationale for the policies and practices intended to prevent work-related infections.</td>
</tr>
<tr>
<td>Immunization</td>
<td>Reduce the risk of vaccine preventable diseases.</td>
</tr>
<tr>
<td>Personal protective equipment</td>
<td>Prevent or reduce the risk of occupational exposure.</td>
</tr>
<tr>
<td>Engineering controls</td>
<td>Eliminate or isolate the hazard in the workplace.</td>
</tr>
<tr>
<td>Work-practice controls</td>
<td>Promote safer behavior in the workplace.</td>
</tr>
<tr>
<td>Environmental infection control</td>
<td>Provides a safer work environment.</td>
</tr>
<tr>
<td>Respiratory hygiene/cough etiquette</td>
<td>Reduce the risk of respiratory infections.</td>
</tr>
<tr>
<td>Transmission-based precautions</td>
<td>Prevent the potential spread of specific pathogens.</td>
</tr>
<tr>
<td>Post-exposure follow-up</td>
<td>Establish policies and practices to reduce the risk of post-exposure infection.</td>
</tr>
<tr>
<td>Administrative Controls</td>
<td>Establish administrative policies related to the protection of “at risk” HCWs and patients.</td>
</tr>
</tbody>
</table>

**Table 4. Work Restrictions: Herpes Simplex Virus Infections.**

<table>
<thead>
<tr>
<th>Infectious state of HCW</th>
<th>Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSV</td>
<td>Restrict from the care of patients at high-risk until lesions heal.</td>
</tr>
<tr>
<td>Acute herpetic whitlow</td>
<td>Exclude from duty until lesions heal.</td>
</tr>
<tr>
<td>Acute genital herpes</td>
<td>No restrictions.</td>
</tr>
</tbody>
</table>
the principles of post-exposure management, in particular with the importance of reporting exposures immediately after they occur, because post-exposure prophylaxis (PEP) is most likely to be effective if administered as soon after exposure as possible (ideally within two hours).

**Treatment of the Exposure Site**
The injured area contaminated with blood or OPIM should immediately be washed with soap and water. Exposed mucous membranes should be flushed with water. While the use of an antiseptic is not contraindicated, using an antiseptic for wound care or squeezing the wound to express fluid has not been shown to reduce the risk of infection. The application of caustic agents or the injection of antiseptics into the wound is not recommended.

**Exposure Report**
The recording and reporting of occupational injuries and exposures should be in accordance with all federal and state requirements. When an occupational exposure occurs, the circumstances of the incident should be recorded on a form appropriate for the oral healthcare setting (Table 6). Data about susceptibility, i.e., hepatitis B vaccine and vaccine response status, and HBV, HCV, and HIV immune status, may be available from the exposed person’s confidential medical record and should be included in the report. Similarly, information about the source person may be available from the medical (dental) records. All of the data collected is to be carried by the exposed HCW to the healthcare facility or physician providing the post-exposure evaluation, treatment, and follow-up.

**Clinical Evaluation of the Source Person**
If the HIV infectious status of the source person is unknown, he/she should be informed of the incident and tested for serologic evidence of infection. If the exposure source is unknown, the likelihood of exposure to a source at high risk for infection is based on a determination of the likelihood of bloodborne pathogen infection among patients in the exposure setting. The collection and release of HIV status information on a source person should follow all local, state, and federal laws.

**Clinical Evaluation and Baseline Testing of Exposed OHCWs**
The consultant (the healthcare facility or physician) responsible for the post-exposure management of HCWs should determine:

1. The potential for the transmission of HIV based on the type of body substance involved and the route and severity of the exposure.
2. The infectious status of the source.
3. The susceptibility of the exposed person.

HCWs potentially exposed to HIV should be evaluated within two hours after their exposure and should be tested for HIV to establish their infection status at the time of exposure. If the source person is seronegative for HIV, baseline...
testing and further follow-up of the exposed person normally is not necessary. The likelihood of the source person being in the “window period” of HIV infection in the absence of symptoms of acute retroviral syndrome is extremely remote.49

Post-exposure Prophylaxis (PEP)
PEP is to be initiated as soon as possible, preferably within two hours of exposure.35 This recommendation is based on evidence that following primary exposure systemic infection does not occur immediately, leaving a brief window of opportunity during which PEP might limit the proliferation of HIV in initial target cells or lymph nodes.34 In a retrospective case-control study of HCWs, PEP with zidovudine reduced the risk of HIV infection by approximately 81%.34 Failures appear to be related to higher titer and/or large inoculum exposures, delayed initiation and/or short duration of PEP, antiretroviral drug resistance, and the lack of adequate host cellular immune responsiveness.50,51

The U.S. Public Health Service recommends stratification of HIV PEP regimens based on (1) the potential for the transmission of HIV based on the type of body substance involved and the route and severity of the exposure, (2) the infectious status of the source, (3) the presence of antiretroviral drug resistance in the source, and (4) the susceptibility of the exposed person.36,52 For most HIV exposures that warrant PEP, a basic 4 week, two-drug regimen is recommended. For HIV exposures that pose an increased risk of transmission, a three-drug regiment may be recommended. If PEP is initiated and the source is subsequently determined to be HIV negative, PEP is discontinued.

Monitoring Patients for PEP Toxicity
If PEP is used, HCWs should have a complete blood count and renal and liver function tests done at baseline and again two weeks after starting PEP.35 In selected cases other tests may be required. HCWs who experience nausea, diarrhea, rash, fever, back and abdominal pain, increased thirst, or frequent urination should seek immediate medical attention.

Post-exposure Follow-up Testing
After baseline testing at the time of exposure, follow-up testing should be performed at six weeks, 12 weeks, and six months to monitor for HIV seroconversion.35 Extended follow-up (for up to 12 months) is recommended after exposure to a source co-infected with HIV and HCV.
Post-exposure Counseling and Education
Access to a counselor knowledgeable about occupational HIV transmission is a cardinal element of postexposure management.\textsuperscript{35} Exposed HCWs should be advised to seek medical evaluation for any acute illness during the follow-up period. They should be advised to avoid donating blood or tissue, breastfeeding, pregnancy, and to practice sexual abstinence or safe sex, especially during the first six to 12 weeks after exposure.

Those who take PEP should be advised of the importance of completing the prescribed drug regimen. Information should be provided about (1) possible drug toxicities (common with all antiretroviral agents), (2) drug-drug interactions (most common with NNRTIs and PIs), (3) measures to be taken to minimize side effects, and (4) methods for clinical monitoring of toxicity.

Administrative Controls for HIV-positive OHCWs
In 1991, the U.S. Public Health Service published guidelines for HBV-infected and HIV-infected healthcare providers, but these recommendations regarding practice restrictions have never been revised.\textsuperscript{53} The recommendations articulated here are based on the latest revision of a guideline for the management of healthcare workers who are infected with the HBV, HCV, and/or HIV developed by the Society of Healthcare Epidemiology of America (SHEA).\textsuperscript{41} Specific to HIV, the revised recommendations take into consideration: (1) evidence that tests to monitor HIV RNA viral load are now routine, and that (2) highly active antiretroviral therapy is routinely given to HIV-infected persons, including HIV-infected healthcare providers.

The SHEA guideline emphasizes the importance of Standard Precautions to minimize healthcare-associated transmission of bloodborne pathogens and recommends that infected healthcare providers should not be totally prohibited from patient care solely on the basis of an infection with HBV, HCV, and/or HIV. Recommended clinical privileges are graduated according to the likelihood of procedure-related provider-to-patient transmission of these pathogens and the relative viral load of the infected provider. Table 7 lists oral healthcare-associated procedures according to the level of risk for bloodborne pathogen transmission.\textsuperscript{41,54}

Healthcare providers have the duty to ensure patient safety. Routine voluntary, confidential testing of providers is encouraged, emphasizing that providers who perform Category III procedures should know their immune or infection status with respect to the HIV.\textsuperscript{41} A clinician who is institutionally based and who develops HIV infection is ethically bound to report it to the institution’s occupational medicine department. A clinician in private practice and who develops HIV infection is ethically bound to report it to the local public health department. Healthcare providers infected with HIV should have their clinical status and laboratory data reviewed by an Expert Review Panel convened in congruence with state and local laws.\textsuperscript{41} Table 8 lists recommended clinical privileges for healthcare providers with HIV infection.\textsuperscript{41}

Conclusion
The risk of HIV transmission in the oral healthcare setting is extremely low. However, the emotional impact of a needlestick injury can be substantial. Consequently, HCWs must be knowledgeable about the potential risks of occupational exposure and the importance of post-exposure management strategies for those potentially exposed to HIV. Clear, written procedures related to prompt reporting, evaluation, treatment, follow-up, and administrative controls for HIV-positive HCWs should promote a seamless response to an incident of occupational exposure.
Table 7. Oral healthcare-associated procedures according to the level of risk for bloodborne pathogen transmission.

- **Category I: Procedures with minimal risk of bloodborne pathogen transmission**
  - History-taking
  - Extraoral physical examination
  - Intraoral examination
    - Including the use of a tongue depressor, mirror, explorer, or a periodontal probe
  - Routine preventive dental procedures - not requiring the administration of local anesthesia
    - Application of sealants or topical fluoride
    - Prophylaxis – not to include subgingival scaling with a hand instrument
    - Orthodontic procedures
    - Prosthetic procedures
    - Fabrication of complete dentures
  - Hands-off supervision of surgical procedures

- **Category II: Procedures for which bloodborne pathogen transmission is theoretically possible but unlikely**
  - Dental procedures requiring the administration of local anesthesia
    - Operative, endodontic, and prosthetic procedures and periodontal scaling and root planning
      - Use of ultrasonic instruments greatly reduce or eliminate the risk of percutaneous injury to the provider
      - If significant physical force with hand instruments is anticipated to be necessary, scaling and root planning and other Category II procedures could reasonably classified as Category III
  - Minor surgical procedures
    - Simple tooth extraction not requiring excessive force
    - Soft tissue flap procedures
    - Minor soft tissue biopsy
    - Incision and drainage of an abscess
  - Insertion of, maintenance of, and drug administration into arterial and central venous lines

- **Category III: Procedures for which there is a definite risk of bloodborne pathogen transmission or that have been classified as "exposure prone"**
  - General oral surgery
    - Surgical extractions
      - Removal of an erupted or unerupted tooth requiring elevation of a mucoperiosteal flap, removal of bone, or sectioning of tooth and suturing
  - Apicoectomy and root amputation
  - Periodontal curettage, gingivectomy, and mucogingival and osseous surgery
  - Alveoplasty and alveoloectomy
  - Endosseous implant surgery
  - Open extensive head and neck surgery involving bone
  - Trauma surgery, including open head injuries, facial fracture reductions, and extensive soft tissue trauma
  - Any open surgical procedure with a duration of more than 3 hours, probably necessitating glove change
Table 8. Recommended clinical privileges for healthcare providers with HBV or HCV infection.

- Circulating viral burden < $5 \times 10^2$ GE/mL
  - Category I, II, and III procedures – no restrictions as long as the infected healthcare provider:
    - no evidence of having transmitted infection to patients
    - obtained advice from an Expert Review Panel about continued practice
    - follow-up twice a year to demonstrate the maintenance of a viral burden < $5 \times 10^2$ GE/mL
    - follow-up by a personal physician who has expertise in the management of HIV infection and who is allowed to communicate with the Expert Review Panel about the infected provider’s clinical status
    - consulted with an expert about optimal infection control procedures and strictly adheres to the recommended procedures
      - routine use of double gloving and frequent glove changes during procedures (particularly when performing tasks known to compromise glove integrity) for all instances in patient care for which gloving is recommended
    - agreed to and signs a contract or letter from the Expert Review Panel that characterizes the infected providers responsibilities

- Circulating viral burden $\geq 5 \times 10^2$ GE/mL
  - Category I and II procedures – no restrictions as long as the infected provider meets the criteria noted above for infected providers with a viral burden of < $5 \times 10^2$ GE/mL
  - Category III procedures – these procedures are permissible only when the viral burden is < $5 \times 10^2$ GE/mL
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1. The HIV is acquired in non-occupational settings either across mucous membranes or parenterally by _______________.
   a. unprotected penetrative sex between men
   b. unprotected heterosexual intercourse
   c. injection drug use
   d. All of the above.

2. Which of the following statements with respect to the prevalence or incidence of the HIV infections in the United States is correct?
   a. The prevalence of HIV infection (estimated to be 1.2 million) is higher than ever.
   b. The annual number of new HIV infections (estimated to be about 47,500) has remained stable in recent years.
   c. The rate of new infections for whites is 8.7, for Hispanics/Latinos it is 27.5, and for blacks/African Americans it is 68.9 per 100,000.
   d. All of the above.

3. All of the following statements with respect to the pattern of disease progression are correct except which one?
   a. After an incubation period of 1 to 3 weeks, 50 to 80 percent of patients experience an ill-defined Acute Retroviral Syndrome.
   b. Non-specific signs and symptoms associated with primary infection include malaise, lethargy, and a sore throat, arthralgia, myalgia, headache, photophobia, maculopapular rash and lymphadenopathy.
   c. During the period of clinical latency, which typically lasts 10 years, the patient is usually free of overt illness.
   d. The final phase is characterized by the appearance of AIDS-defining conditions.

4. Which of the following oral conditions have been demonstrated to be positive predictors of HIV-associated disease progression?
   a. Oral candidiasis
   b. Hairy leukoplakia
   c. Salivary gland disease
   d. A and B

5. The diagnosis of HIV infection is established by which of the following method?
   a. Positive result from an HIV antibody screening test (e.g., reactive enzyme immunoassay [EIA]).
   b. Positive EIA confirmed by a positive result from a supplemental HIV antibody test (e.g., Western blot or indirect immunofluorescence assay test).
   c. Positive result from any of the following HIV virologic tests: PCR, HIV p24 antigen test, or HIV isolation.
   d. B and C

6. A confirmed care of HIV infection classified as HIV infection, stage 2, meets which of the following criteria except which one?
   a. No AIDS-defining conditions.
   b. At least one of the AIDS-defining conditions has been documented.
   c. No information on AIDS-defining conditions.
   d. No information on CD4+ T-lymphocyte count or percentage.
7. **Which of the following statements concerning antiretroviral drug therapy is not true?**
   a. HIV infection is treated with single antiretroviral agent.
   b. ART for treatment-naïve patients may be NNRTI-based or PI-based.
   c. The treatment of injection drug users, HIV infected women of reproductive age and pregnant women, and patients with co-infections (HBV, HCV, tuberculosis) require special ART.
   d. Increases in viral load while the patient is on ART may indicate drug resistance.

8. **Which of the following is a required element for the transmission of infectious agents in healthcare settings?**
   a. A source of reservoir of infectious agents.
   b. A susceptible host with a portal of entry receptive of the agent.
   c. A mode of transmission for the agent.
   d. All of the above.

9. **Which of the following statements are correct with respect to contact transmission?**
   a. Direct transmission occurs when blood or other potentially infectious material from an infected person directly enters the body of a susceptible person through contact with mucous membrane or break in the skin.
   b. Indirect transmission occurs when the hands of HCWs transmit pathogens after touching an infected body site on one patient, inanimate object, on a contaminated environmental surface and hand hygiene is not performed before touching another patient.
   c. Indirect transmission occurs when patient-care devices, contaminated with blood or OPIM are shared between patients without being adequately cleaned, disinfected, or sterilized.
   d. All of the above.

10. **All of the following statements are correct with respect to droplet transmission except which one?**
   a. Droplets are particles of moisture greater than 5μm, containing potentially infectious organisms.
   b. Droplet transmission is generally limited to distances beyond 3 feet of the source of infectious particles.
   c. Exposure to pathogens in droplets constitutes a form of contact transmission.
   d. Droplet transmission may include contact of a susceptible host with contaminated intermediate objects or environmental surfaces.

11. **Which of the following statements related to patient-to-provider transmission of HIV is correct?**
   a. No cases of occupational HIV transmission to HCWs in the United States have been documented since 1999.
   b. The average risk for HIV infection after percutaneous exposure is estimated to be approximately 0.3% (1 infection associated with 2,885 exposures).
   c. The average risk for HIV infection after mucous membrane (eyes, nose, and mouth) exposure is estimated to be approximately 0.09%.
   d. All of the above.
12. Which of the following statements related to provider-to-patient transmission of HIV is correct?
   a. Since HIV was isolated 25 years ago, only 4 instances of HIV transmission from infected provider to patient have been documented worldwide and no cases have been reported since 2003.
   b. The U.S. cluster involved a dentist, although the precise mechanisms of transmission were never determined and no data were uncovered suggesting intentional transmission.
   c. More than 4 dozen look-back studies have been conducted and none of these studies identified evidence of provider-to-patient transmission.
   d. All of the above.

13. Which of the following statements are relevant with respect to HIV-related precautions in healthcare settings?
   a. In the United States, the proportion of persons who do not know that they are infected with the HIV is estimated to be 20%.
   b. Standard Precautions have been confirmed as effective to prevent exposure to infected blood or OPIM.
   c. Standard Precautions constitutes the primary strategy for the prevention healthcare-associated transmission of HIV.
   d. All of the above.

14. The first step in managing a percutaneous wound to the finger is _______________.
   a. to inject the wound with an antiseptic
   b. to squeeze the wound to express fluid
   c. to flush the wound with water
   d. to wash the wound with soap and water

15. All of the following statements concerning post-exposure prophylaxis (PEP) for healthcare worker potentially exposed to HIV are true except which one?
   a. PEP should be initiated as soon as possible, preferably within 2 hours of exposure.
   b. For HIV exposures that warrant PEP, a basic 4 week, two-drug regimen is recommended.
   c. If PEP is initiated and the source is ultimately determined to be HIV negative, PEP is discontinued.
   d. PEP has been shown to be 100% effective in preventing HIV infection.

16. Methods to monitor for PEP toxicity include:
   a. Renal and liver function tests.
   b. Self-monitoring for adverse reactions.
   c. Complete blood count.
   d. All of the above.

17. In managing a possible occupational HIV exposure, testing of the healthcare worker for HIV seroconversion is indicated _______________.
   a. at baseline, 1 month, 6 months, and 1 year
   b. at baseline, 6 weeks, 6 months, and 1 year
   c. at baseline, 6 weeks, 12 weeks, and 6 months
   d. at baseline, 12 weeks, 6 months, and 1 year

18. Elements of post-exposure counseling and education for a potential HIV exposure include:
   a. Education on potential signs and symptoms of acute HIV infection.
   b. The need to avoid donating blood.
   c. Precautions to prevent secondary spread through sex.
   d. All of the above.
19. Which of the following statements is correct with respect of SHEA guidelines to minimize provider-to-patient transmission of HIV in healthcare settings?
   a. Infected healthcare providers should not be totally prohibited from patient care solely on the basis of an infection with HIV.
   b. Clinical privileges should be graduated according to the likelihood of procedure-related provider-to-patient transmission of these pathogens.
   c. Clinical privileges should be graduated according to the relative viral load of the infected provider.
   d. All of the above.

20. Which of the following statements is correct relative to the responsibilities of an infected healthcare provider?
   a. Routine voluntary, confidential testing of providers is encouraged.
   b. A clinician in private practice who develops HIV infection is ethically bound to report it to the local health department.
   c. Healthcare providers infected with HIV should have their clinical status and laboratory data evaluated by an Expert Review Panel convened in congruence with state and local laws.
   d. All of the above.
References


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