# *Infection Control for Dental Professionals: The California Requirement*

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- Complete the questions at the end of the course.
- Return your completed Answer Sheet to NetCE by mail or fax, or complete online at www.NetCE.com. Your postmark or facsimile date will be used as your completion date.
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***Faculty***

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Dr. Frey retired from the United States Army Dental Corps in 1989 after 22 years of service. Throughout the course of his professional career, he has continuously practiced dentistry, the first 7 years as a general dentist and the past more than 40 as a periodontist. His military experience included the command of a networked Dental Activity consisting of five dental clinics. In his last assignment, he was in charge of a 38-chair facility. Colonel Frey was selected by the Army to serve on two separate occasions as the Chair of the Periodontal Department in Army General Dentistry Residency Training Programs.

Dr. Frey is the founder and president of Perio Plus, a practice management firm specializing in creating individually-designed hygiene and periodontal care programs for general dentists. He is also the creator of the Inspector Gum patient education series.

***Faculty Disclosure***

Contributing faculty, William E. Frey, DDS, MS, FICD, has disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

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The division planner and director have disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

***Audience***

This course is designed for all dentists, dental hygienists, and dental assistants in all practice settings, particularly those practicing in California.

***Accreditations & Approvals***

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This course fulfills the California requirement for 2 hours of infection control education.

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***Course Objective***
The purpose of this course is to familiarize dental professionals with infection control techniques in order to minimize the risks of microbial transmission in the dental healthcare setting.

***Learning Objectives***
*Upon completion of this course, you should be able to:*

1. Outline OSHA and Cal/OSHA regulations that impact the provision of dental care.
2. Analyze potential modes of transmission and pathogens that can result in infection in dental facilities.
3. Discuss potential prevention strategies for infection control, including the use of precautions, hand hygiene, and personal protective equipment.
4. Describe effective environmental control measures that should be applied in dental care.
5. Identify steps that should be taken to protect dental professionals, including vaccination, education, and exposure responses.

## INTRODUCTION

In 2018, there were more than 750,000 jobs in dental occupations in the United States [1]. In California alone there are approximately 91,000 dental healthcare professionals (DHCPs), including dentists, dental hygienists, and dental assistants. Most of these dental workers come in daily contact with a variety of infectious diseases in their workplace and are at risk for both transmitting and contracting these diseases. In California, there are three regulatory agencies involved in infection control in the dental healthcare setting: the Dental Board of California (DBC), which sets the minimum standards, the California Division of Occupational Safety and Health (Cal/OSHA), which publishes the Bloodborne Pathogens Standard, and the California Department of Public Health, which established the Waste Management Act.

To address the issue of infection control and reduce the potential for harm, the DBC established a requirement that dental healthcare licensees in California complete a course on infection control and prevention. DBC regulations also require that licensees comply with and enforce precautions and workplace practices that minimize the transmission of pathogens in dental settings. "Standard Precautions" is the DBC term for infection control measures that encompasses both "Universal Precautions"—a term the Occupational Safety and Health Administration (OSHA) uses—and the Cal/OSHA mandate for bloodborne pathogen transmission. The DBC mandates that Standard Precautions must be practiced in the care of all patients. The same infection control precautions apply to all patients, and all body fluids, except sweat, are considered potentially infectious. Universal Precautions are measures taken when exposed to blood, while Standard Precautions apply to all potentially infectious materials. While most elements of Standard Precautions evolved from Universal Precautions, developed for protection of healthcare personnel, additional elements of Standard Precautions focus on protection of patients. Contact Precautions are used to prevent transmission of an infectious agent associated with environmental contamination (e.g., treating all environmental surfaces as potentially contaminated) that is not interrupted by Standard Precautions alone.

A written protocol should be developed for proper instrument processing, operatory cleanliness, and management of injuries, and a copy of infection control regulations should be conspicuously posted in each dental office [2]. The DBC Standard Precaution guidelines are reviewed annually. Current guidelines may be downloaded at https://govt.westlaw.com/calregs/Document/I3F75D9A0B95D11E0A3CAA6663E6464AA and are found at the conclusion of this course. Significant changes in the 2011 revision include application of the guidelines to all dental healthcare professionals (not just "registered" professionals) and specific steps for disinfection [2]. The goal of these guidelines is to reduce the number of healthcare-associated infections in California dental practice settings.

## OSHA AND CAL/OSHA REGULATIONS

Legal issues first began to impact infection control practices at the beginning of the acquired immunodeficiency syndrome (AIDS) epidemic in the early 1980s. The need to protect healthcare workers from bloodborne exposures resulted in the publication of the Bloodborne Pathogens Standard by OSHA in 1991 [3]. The OSHA Standard requires employers whose employees have exposure to blood or other potentially infectious material to implement safe work practices, education, and barriers to exposure. The Standard was later amended to cover the safe use of sharps.

### BLOODBORNE PATHOGENS STANDARD

The OSHA Bloodborne Pathogens Standard requires that every healthcare worker who may have contact on the job with blood or other bodily fluids (referred to as other potentially infectious material or OPIM) must receive specific annual education, which includes instruction in the basics of infection control and prevention. Training must also cover bloodborne pathogens, modes of transmission, the proper use of needles, and Contact Precautions.

### CALIFORNIA AEROSOL TRANSMISSIBLE DISEASE STANDARD

In 2009, Cal/OSHA adopted the nation's first aerosol transmissible disease (ATD) standard, which remains in effect today. The standard is designed to protect healthcare workers from diseases spread by an airborne or droplet route. The ATD standard requires healthcare employers to develop exposure control procedures and train employees to follow those procedures [4; 5]. Basic exposure precautions, such as source screening, infection control, hand hygiene, and cleaning and decontamination procedures, are a fundamental part of the standard. Employees must be included in the periodic review and assessment of these procedures.

California dental offices whose patients have suspected or confirmed illnesses that require Airborne or Droplet Precautions, such as tuberculosis (TB) or other respiratory illnesses, must comply with the ATD standards [4]. Key points include:

- Dental employees must be trained to screen patients for ATDs.
- The screening process must be described in a written office procedure.
- Screening must be consistently implemented.
- Elective dental treatment should be deferred until the patient is non-infectious for TB or other diseases requiring Airborne or Droplet Precautions.

A simple screening procedure can be done by the first person who comes in contact with a patient. For example, the patient may be asked "How are you feeling today?" or "Do you have any coughs, fever, or flu-like symptoms?" If the patient is not feeling well or gives a positive answer to any part of the second question, the dental treatment should be rescheduled.

Outpatient dental clinics or offices are not required to comply with this standard if they meet all of the following conditions [4; 6; 7]:

- Dental procedures are not performed on patients identified as ATD cases or suspected ATD cases (e.g., persons with TB or other respiratory illnesses).
- The clinic's injury and illness prevention program includes a written procedure for screening patients for ATDs that is consistent with the Centers for Disease Control and Prevention (CDC) guidelines for infection control in dental settings. This procedure must be followed before performing any dental work on a patient.
- Employees have been trained in the screening procedure in accordance with state law.
- Aerosol-generating dental procedures are not performed on a patient identified through the screening procedure as presenting a possible ATD exposure risk unless a licensed physician determines that the patient does not currently have an ATD.

## MODES OF TRANSMISSION

Almost all pathogens are transmitted by being carried from one place to another. The mode or means of transmission is the weakest link in the chain of infection, and it is the only link that can be eliminated entirely. Most infection control efforts are aimed at preventing transmission of pathogens from a reservoir to a susceptible host. Both Standard and Contact Precautions are designed to interrupt the mode of transmission.

| COMMON MODES OF INFECTION TRANSMISSION | |
|---|---|
| **Category** | **Definition** |
| Direct | Person-to-person transmission of pathogens |
| Indirect | An intermediate person or item (e.g., an instrument) acts as a transport between the portal of exit in one person and the portal of entry to the next person (e.g., unwashed hands) |
| Fomites | Contact with soiled objects, such as used gloves, pens, used tissues, and soiled laundry |

*Source: Compiled by Author* *Table 1*

The most common modes of transmission in the healthcare setting are the hands of healthcare workers and items that move from patient to patient, both of which are examples of indirect transmission (***Table 1***). Items moving between patients should be cleaned and sterilized after each use to avoid indirect transmission of pathogens. Because it addresses the weakest link in the chain of transmission, hand hygiene is still the single most important procedure for preventing the spread of infection.

## AEROSOLS, DROPLETS, AND SPLATTER

Aerosols, droplets (produced by the respiratory tract), and splatter contaminated with blood and bacteria are produced during many dental procedures [8]. Devices such as dental handpieces, ultrasonic and sonic scalers, air polishers, air-water syringes, and air abrasion units produce visible aerosol clouds and possible airborne contamination. Splatter generated by dental procedures such as drilling is a primary risk for transmission of bloodborne pathogens. In general, because of their smaller size, aerosols pose the greatest risk for airborne infection.

Several studies have shown that aerosol or droplet nuclei may extend up to 6 feet away from the source and can remain airborne for up to 30 minutes after a procedure. TB is of special concern because it is a large particle that can remain airborne or can dry on a surface and become airborne again as part of a dust particle.

The American Dental Association recommends that in addition to using standard barriers, such as masks, gloves, and eye protection, the proper sterilization of instruments and treatment of dental unit waterlines is necessary to reduce or eliminate this source of potentially contaminated dental aerosols. Preprocedural rinsing with an antimicrobial mouthwash such as chlorhexidine is also recommended, although it is only effective for oral bacteria found in saliva and those adhering to mucous membranes. It does not penetrate subgingivally and likely has no effect on bacteria in the nasopharynx [9].

Diseases known to spread by aerosols or droplet include:

- TB
- Pneumonic *Yersinia pestis* infection (plague)
- Influenza
- Legionellosis (Legionnaires disease)
- Severe acute respiratory syndrome (SARS)

Procedures or equipment aimed at eliminating the means of transmission include [9]:

- Universal preprocedural rinses
- Dental dams for certain procedures
- High-volume evacuator (HVE) at the treatment site (An HVE can only remove airborne contamination if it removes a large volume of air. A saliva ejector does not remove enough air to be classified as an HVE.)
- High-efficiency particulate arresting and ultraviolet filters in the ventilation system

- Gloves to minimize contamination of hands, discarded after each patient
- Cleaning, disinfection, and sterilization of equipment used by more than one patient
- Environmental cleaning and disinfection, especially of high-touch surfaces

### FOMITE TRANSMISSION

Devices can transmit pathogens if they are contaminated with blood or bodily fluids or are shared without cleaning, disinfecting, and sterilizing between patients; these are classified as fomites. Surgical instruments that are inadequately cleaned between patients or that have manufacturing defects that interfere with the effectiveness of reprocessing may transmit bacterial, fungal, and viral pathogens. Clothing, uniforms, laboratory coats, or gowns used as personal protective equipment (PPE) may become contaminated with potential pathogens after care of a patient colonized or infected with an infectious agent [10].

Contaminated clothing and laboratory coats can potentially transmit infectious agents to successive patients. A 2007 study in a Maryland teaching hospital revealed that 27% of the white coats worn by 109 physicians and other healthcare professionals were colonized with *Staphylococcus aureus* and 6% were colonized with methicillin-resistant *S. aureus* (MRSA). In a follow-up questionnaire, 65% of the healthcare workers reported they had last washed their white coat more than a week ago and nearly 16% had last washed their coat more than 30 days ago [11]. A study presented at the American Society of Microbiology Conference in 2012 identified clothing and household linens (e.g., cotton towels) as a significant transmission source of infectious pathogens [12]. However, evidence linking clothing to hospital infection rates is lacking, and additional research is necessary to determine the actual extent of this risk [13].

Dental equipment and dental unit waterlines are both potential sources of transmission and potential reservoirs. Routine cleaning and sterilization and adherence to the American Dental Association's recommended procedures for treating dental unit waterlines have been shown to be effective in eliminating transmission of infectious organisms via these devices. If a surgical procedure involves soft tissue or bone, California regulations require the use of sterile coolants or irrigants, delivered using a sterile delivery system. In addition, a new infection control standard that took effect on January 1, 2019, requires that water or other methods for irrigation must be sterile or contain recognized disinfecting or antibacterial properties when performing procedures on exposed dental pulp. This requirement is in response to a 2016 outbreak of mycobacterial infection from a Southern California dental clinic that led to the hospitalization of more than 60 children. The cause was determined to be bacteria introduced through water during pulpotomies [14].

## BLOODBORNE PATHOGENS

Healthcare employees can be exposed to blood through needlestick and other sharps injuries, damaged mucous membranes, and broken skin exposures. The pathogens of primary concern to dental professions are human immunodeficiency virus (HIV), hepatitis B virus, and hepatitis C virus.

### HEPATITIS B VIRUS

Healthcare personnel who have received the hepatitis B vaccine and developed immunity to the virus are at virtually no risk for infection. For a susceptible person, the risk from a single needlestick or cut exposure to hepatitis B-infected blood ranges from 6% to 30%, depending on the hepatitis B antigen status of the source individual [8; 15]. While there is a risk for hepatitis B infection from exposures of mucous membranes or nonintact skin, there is no known risk for infection from exposure to intact skin [16].

### HEPATITIS C VIRUS

Hepatitis C is transmitted primarily through percutaneous exposure to infected blood. The average risk for infection after a needlestick or cut exposure to hepatitis C virus-infected blood is approximately 1.8% [17]. The risk following a blood exposure to the eye, nose, or mouth is unknown but is believed to be very small; however, hepatitis C virus infection from blood splashes to the eye has been reported [17]. There also has been a report of hepatitis C virus transmission that may have resulted from exposure to nonintact skin, but there is no known risk from exposure to intact skin [8]. Documented transmission of hepatitis C or hepatitis B virus has resulted from using the same syringe or vial to administer medication to more than one patient, even if the needle was changed.

The prevalence of hepatitis C virus infection among dentists and surgeons is similar to that among the general population, approximately 1% to 2% [15]. No studies of transmission from hepatitis C virus-infected dental healthcare personnel to patients have been reported, and the risk for such transmission appears limited [6].

### HIV/AIDS

The average risk of HIV infection after a needlestick or cut exposure to HIV-infected blood is 0.3%; 99.7% of needlestick or cut exposures do not lead to infection [8; 17]. The risk after exposure of the eye, nose, or mouth to HIV-infected blood is estimated to be 0.1%. There have been no documented cases of HIV transmission due to an exposure involving a small amount of blood on intact skin (i.e., a few drops of blood on skin for a short period of time) [8; 17].

In the United States, the risk of HIV transmission in dental settings is extremely low. According to surveillance data from 1981 to 2010, a total of 57 cases of HIV seroconversion had been documented among healthcare personnel after occupational exposure to a known HIV-infected source, but none were among dental care personnel [18]. Transmission of HIV to 6 patients of a single dentist with AIDS has been reported, but the mode of transmission could not be determined [19].

Certain factors affect the risk of HIV transmission after an occupational exposure. Laboratory studies have determined if needles that pass through latex gloves are solid rather than hollow-bore or are of small gauge (e.g., anesthetic needles), less blood is transferred. In a retrospective, case-control study of healthcare personnel, an increased risk for HIV infection was associated with exposure to a relatively large volume of blood, as with a deep injury with a device that was visibly contaminated with the patient's blood or a procedure that involved a needle placed in a vein or artery [20]. The risk was also increased if the exposure was to blood from patients with terminal illnesses, possibly reflecting the higher titer of HIV in late-stage AIDS patients.

## PREVENTION STRATEGIES

In 1986, California became the first state to pass a comprehensive bloodborne pathogen standard [9]. The California standard provided a model for federal legislation, and in 1991, OSHA published its Bloodborne Pathogens Standard. Since then, regulatory and legislative activity has focused on implementing a hierarchy of prevention and control measures to improve infection control in healthcare settings. Respiratory hygiene, safe injection practices, aseptic technique, hand hygiene, and the use of PPE are now accepted as essential components of an effective infection prevention strategy. The Cal/OSHA ATD standard passed into law in 2009 was expected to be a blueprint for federal standards addressing aerosol transmissible diseases [5; 9]. Although permanent federal standards have not come to fruition, in June 2021, OSHA issued an emergency temporary standard addressing occupational exposure to severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), commonly referred to as COVID-19, including patient screening and management, use of Standard and Transmission-Based Precautions, PPE, and controls for aerosol-generating procedures [21].

## STANDARD PRECAUTIONS

The gradual acceptance of various infection prevention standards has changed the way we work in the provision of dental care. The use of Standard Precautions reduces the risk of infection to staff and patients and ensures that the right precautions are used with both known and unknown carriers of diseases due to bloodborne pathogens. Standard Precautions apply to contact with:

- Blood
- All bodily fluids, secretions, and excretions (except sweat), regardless of whether they contain blood
- Intact or nonintact skin
- Mucous membranes

A central tenet of Standard Precautions is to consider all patients to be potentially infected with a bloodborne pathogen. Saliva has always been considered a potentially infectious material in dental infection control; thus, no operational difference exists in clinical dental practice between Universal Precautions and Standard Precautions. For organisms other than bloodborne pathogens, early identification and prompt isolation are critical.

When adhering to Standard Precautions, always:

- Use good hand hygiene.
- Use gloves for contact with blood, bodily fluids, nonintact skin (including rashes), mucous membranes, used equipment, linens, and trash.
- Use a gown any time your clothing is soiled and if a patient has uncontained bodily fluids (e.g., blood, saliva).
- Use a mask and eye protection if you may be splashed or be exposed to droplets; glasses do not adequately protect you.
- Change gloves if they become heavily soiled when working on a patient or if you must go from a potentially more infective area to a lesser one.

In addition, never:

- Wear artificial fingernails.
- Touch a second patient with the same pair of gloves used on the first patient.
- Reuse gowns, even for repeated contacts with the same patient.
- Contaminate the environment with dirty gloves.
- Wear gloves outside the treatment area unless you can say why you are wearing them.

## RESPIRATORY HYGIENE

If dental clinics and offices comply with state regulations for screening of patients with ATDs, they are not required to comply with the new standards for prevention of transmission of ATDs [4]. However, because no screening process is universally effective, dental professionals should be aware of the potential dangers associated with transmission of pathogens via the airborne and droplet routes.

Respiratory droplets can transmit infection when they travel directly from the respiratory tract of the infected individual to the mucosal surfaces of the recipient, generally over short distances (i.e., 6 feet or less). Airborne transmission occurs with only a few organisms that can survive the drying of respiratory droplets. When the droplets evaporate, they leave behind droplet nuclei, which are so small they remain suspended in the air and can travel over longer distances. Respiratory droplets and droplet nuclei are generated when an infected person coughs, sneezes, or talks during procedures. Facial masks or shields generally provide direct protection from droplet transmission. Some pathogens transmitted via the airborne route (e.g., TB) require the use of an N95 respirator or better (e.g., N99, N100) due to the small particle size.

## ASEPTIC TECHNIQUE

Aseptic technique involves the handling, preparation, and storage of medications in a manner that prevents microbial contamination. It also applies to the handling of all supplies used for injections and infusions. To avoid contamination, medications should be drawn in a clean medication preparation area. Any item that may have come in contact with blood or other potentially infectious material should be kept separate from medications.

## SAFE INJECTION PRACTICES

In 2000, the Federal Needlestick Safety and Prevention Act authorized OSHA to revise its Bloodborne Pathogens Standard to require the use of safety-engineered sharp devices in healthcare settings [22]. Guidelines on the design, implementation, and evaluation of a sharps injury prevention program have been developed by the CDC.

Safe injection practices are designed to prevent disease transmission within the healthcare setting. The absence of visible blood or other signs of contamination in a used syringe does not mean the item is free from potentially infectious agents. Bacteria and other microbes can be present without any visible evidence of contamination. All used injection supplies and materials should be considered potentially contaminated and should be discarded.

To ensure safe injection practices, use aseptic technique throughout all aspects of injection preparation and administration. A new, sterile syringe and needle should be used to draw up medications while preventing contact between the injection materials and the nonsterile environment. Practice proper hand hygiene before handling medications, and discard medication vials upon expiration or any time there are concerns regarding the sterility of the medication.

Never leave a needle or other device inserted into a vial or bottle for multiple uses. This provides a direct route for micro-organisms to enter the vial and contaminate the fluid. Medications should never be administered from the same syringe to more than one patient, even if the needle is changed.

Dental professionals should follow proper technique when using and handling needles, cannulae, and syringes. Whenever possible, use sharps with engineered sharps injury protections (e.g., non-needle or needle devices with built-in safety features or mechanisms that effectively reduce the risk of an exposure incident). Do not disable or circumvent the safety feature on devices.

Cases of bloodborne pathogen transmission as a result of improper injection practices have common themes [22]. Often, aseptic technique and Standard Precautions were not carefully followed. Infection control programs may be lacking or responsibilities unclear. In several instances, failure to recognize an infection control breach has led to prolonged transmission and a growing number of infected patients. In all cases, investigations were time-consuming and costly and required the notification, testing, and counseling of hundreds and sometimes thousands of patients.

## HAND HYGIENE

Despite the simplicity and effectiveness of hand hygiene in preventing the spread of infectious disease, adherence to hand hygiene practice remains unacceptably low [23]. Adherence varies among professional categories of healthcare workers but is usually estimated as less than 50%, a rate that has not changed in more than a decade [23; 24; 25]. Healthcare providers might need to clean their hands as many as 100 times in a 12-hour shift, depending on the number of patients and intensity of care [25]. For dental healthcare workers, strict adherence to hand hygiene protects both the patient and the worker. Hand hygiene should be done when you first come to work, before you touch your first patient or clean equipment, and before and after every patient contact—including after touching intact skin. In addition, perform hand hygiene:

- After contact with any bodily fluids, including your own
- Before any non-invasive or invasive procedure
- Each time you remove your gloves
- When your hands feel or look dirty

- After contact with contaminated things or environments, such as charts
- After handling used equipment or linen
- After using the bathroom
- Before contact with any portal of entry, your patient's or your own
- Before and after eating

A number of conditions restrict dental healthcare professionals from participating in direct patient care. These include weeping dermatitis, exudative lesions, or any hand conditions that increase the risk of disease transmission.

Good handwashing is difficult to practice, is rarely known or taught, and is one of the single most effective ways to prevent transmission of many diseases, including influenza. Everyone knows to wash their hands before eating and after using the restroom. However, few do little more than remove obvious dirt. Good handwashing involves removing the skin oils where organisms can remain even when the hands look clean. A quick pass under the water faucet and fast dry with a towel may remove visible dirt, but the oils and organisms remain.

To effectively remove the oils and organisms, the process should take at least 20 seconds, or the amount of time it takes to sing "Twinkle, Twinkle Little Star." The hands should be soaped and rubbed vigorously for 15 seconds to create a good lather and to assure that all parts of each hand are soaped and rubbed well. Then, the hands should be rinsed thoroughly and dried, preferably with a paper towel. The towel should be used to turn off the water faucet and then properly thrown away. Such handwashing removes the oils that harbor the organisms. However, 20 seconds is a long time in the busy life of a healthcare provider, and this 20 seconds has been identified as a major barrier to handwashing, particularly among those who consider themselves "too busy" to wash their hands [23]. If there is no visible dirt or contamination, a waterless hand sanitizer with at least 60% alcohol can be used between patients. However, nothing is as good as washing well with soap and water. Some mistakenly think that hot water must be used to kill the organisms. Water hot enough to kill organisms would be too hot to touch. Warm water softens oils but mainly adds to comfort and encourages better washing technique (i.e., longer duration). Careful attention to handwashing and cleansing may result in chapped skin, so the dental professional must find effective lotions to care for his/her hands.

Certain soaps contain stronger antiseptic compounds, such as chlorhexidine, and these soaps may be considered in cases in which exposure to potentially infectious material is likely. Antiseptic soaps or surgical preparation liquids have been found more effective than plain soap in removing bacteria from healthcare workers hands both pre- and postprocedure [26; 27]. In addition, antiseptics may be added to alcohol-based handrubs in order to achieve persistent germicidal activity [6]. Possible side effects associated with frequent use of antiseptic hand scrubs include skin irritation, dermatitis, allergic reactions, and potential development of microbial resistances. Chlorhexidine products are considered safe for regular use in dental practice; however, if associated side effects are bothersome, they may result in decreased hand hygiene compliance.

In summary, start and end each work day using an antibacterial soap. Gloves provide a breeding ground for microbial growth, and washing before and after use is encouraged. If hands are not visibly soiled, a waterless hand sanitizer (at least 60% alcohol) may be used. For surgical procedures, wash hands with antimicrobial soap prior to gowning and gloving.

## PERSONAL PROTECTIVE EQUIPMENT

PPE is defined as special coverings designed to protect healthcare personnel from exposure to or contact with infectious agents [28]. Cal/OSHA regulations require use of PPE in dental care settings to protect personnel from exposure to bloodborne pathogens. Under OSHA's General Duty Clause, PPE is also required for any potential infectious disease exposure. Employers must provide their

employees with appropriate PPE and ensure its proper disposal. If reusable, it must be properly cleaned or laundered, repaired, and stored after use [29]. PPE must fit the individual user, and it is up to the employer to ensure that PPE is available in sizes appropriate for all their workers. Employees are prohibited from taking PPE home to launder.

In addition to the familiar gloves and gowns, PPE includes a variety of barriers and respirators used alone or in combination to protect skin, mucous membranes, and airways from contact with infectious agents. The selection of PPE is based on the nature of the patient/provider interaction and the likely mode of transmission. Primary PPE used in oral healthcare settings includes gloves, surgical masks, protective eyewear, face shields, and protective clothing.

Procedures that generate splashes or sprays of blood, bodily fluids, secretions, excretions, or chemical agents require either a face shield (disposable or reusable) or mask and goggles. The wearing of masks, eye protection, and face shields in specified circumstances (when blood or other potentially infectious material exposures are likely to occur) is mandated by the OSHA Bloodborne Pathogens Standard. Sterile barriers for invasive procedures and masks or respirators for the prevention of droplet contamination are also required.

The use of PPE is not a substitute for safe work practices. Avoid contaminating yourself by keeping your hands away from your face and not touching or adjusting equipment. PPE is a potential means of transmission if not changed between patients. All PPE should be removed when leaving patient care areas.

**Gloves**

Dental personnel should wear gloves to prevent contamination of their hands when touching mucous membranes, blood, saliva, or other potentially infectious material. Gloves reduce the likelihood that micro-organisms present on the hands will be transmitted to patients during surgical or other patient-care procedures. Gloves used in the healthcare setting are subject to U.S. Food and Drug Administration (FDA) evaluation and clearance. Nonsterile, disposable medical gloves made of latex or nitrile should be available for routine patient care. Dental professionals should always use gloves when [28; 30]:

- Anticipating direct contact with blood or bodily fluids, mucous membranes, nonintact skin, and other potentially infectious material
- Engaging in direct contact with patients who are colonized or infected with pathogens transmitted by the contact route, such as vancomycin-resistant enterococci or MRSA
- Handling or touching visibly or potentially contaminated patient care equipment and environmental surfaces

Studies have repeatedly shown that vinyl gloves have higher failure rates than latex or nitrile gloves. For this reason, either latex or nitrile gloves are preferable for clinical procedures that require manual dexterity or those involving more than brief patient contact. Heavier, reusable utility gloves should be used for non-patient-care activities, such as handling or cleaning contaminated equipment or surfaces, handling chemicals, or disinfecting contaminated tools [28; 30].

During dental procedures, patient examination gloves commonly contact multiple types of chemicals and materials, such as disinfectants and antiseptics, composite resins, and bonding agents, and these materials can compromise the integrity of latex, nitrile, and other synthetic glove materials. In addition, latex gloves can interfere with the setting of vinyl polysiloxane impression materials. Given the diverse selection of dental materials on the market, dental practitioners should consult glove manufacturers regarding the chemical compatibility of glove materials [6].

Wearing sterile surgeon's gloves during surgical procedures has a strong theoretical rationale. Sterile gloves minimize transmission of micro-organisms from the hands of surgical personnel to patients and prevent contamination of the hands of surgical personnel with the patient's blood and bodily

fluids. In addition, sterile surgeon's gloves are more rigorously regulated by the FDA and may provide an increased level of protection for the provider if exposure to blood is likely [6].

Gloves should be removed and replaced if torn or punctured and discarded between patients to prevent transmission of infectious material. They should never be washed and reused, as micro-organisms cannot be removed reliably from glove surfaces. Glove reuse has been associated with transmission of MRSA and gram-negative bacilli [28; 30].

When gloves are worn in combination with other PPE, they should be put on last. Gloves that fit snugly around the wrist are preferred for use with a gown because they will cover the gown cuff and provide a more reliable continuous barrier for the arms, wrists, and hands. Removing gloves properly also prevents hand contamination. Hand hygiene following glove removal ensures that the hands will not carry potentially infectious material that might have penetrated through unrecognized tears or contaminated the hands during glove removal [28; 30]. When processing contaminated sharp instruments, needles, and devices, heavy utility gloves should be used to prevent puncture injuries.

**Cover Garb**

Gowns are intended to protect the arms and exposed body areas and prevent contamination of clothing with blood, bodily fluids, and other potentially infectious material. The type of gown selected is based on the nature of the patient/provider interaction, including the anticipated degree of contact with infectious material and potential for blood and bodily fluid penetration of the barrier. Laboratory coats or jackets worn over personal clothing for comfort or purposes of identity are not considered PPE [28; 30].

California regulations require that dental personnel wear reusable or disposable protective attire when their clothing or skin is likely to be soiled with blood or other potentially infectious material. Gowns must be changed daily or between patients if they become moist or visibly soiled. Protective attire must be removed when leaving laboratories or areas of patient care activities. Reusable gowns should be laundered in accordance with Cal/OSHA Bloodborne Pathogens Standards [2].

**Masks, Protective Eyewear, and Face Shields**

In California, dental professionals are required to wear surgical masks that cover both the nose and mouth, in combination with either chin-length plastic face shields or protective eyewear when there is potential for splashing or spattering of blood or other potentially infectious material. After each patient and during patient treatment (if applicable), masks must be changed if moist or contaminated. After each patient, face shields and protective eyewear shall be cleaned and disinfected, if contaminated [2].

Masks should fit snuggly and fully cover the nose and mouth to prevent fluid penetration. For this reason, masks that have a flexible nose piece and can be secured to the head with string ties or elastic are preferable. Surgical masks protect against micro-organisms generated by the wearer and also protect dental personnel from large-particle droplet spatter that might contain bloodborne pathogens or other potentially infectious material. If the mask becomes wet or contaminated, it should be changed between patients or even during patient treatment. For employees at increased risk of exposure to ATDs, such as those working in endemic areas (e.g., Southeast Asia) or in areas designated for isolation or quarantine, the employer must provide a respirator at least as effective as an N95 respirator.

Most surgical masks are not National Institute for Occupational Safety and Health (NIOSH)-certified as respirators, do not protect the user adequately from exposure to TB, and do not satisfy OSHA requirements for respiratory protection. However, certain surgical masks (i.e., N95 respirators) do meet the requirements and are certified by NIOSH. The level of protection a respirator provides is determined by the efficiency of the filter material for incoming air (e.g., 95% for N95) and how well the face piece fits or seals to the face. N95 respirators are required to be labeled as such on the device.

Respirators are used when treating patients with diseases requiring Airborne Precautions and should be used in the context of a complete respiratory protection program. This program should include training and fit testing to ensure an adequate seal between the edges of the respirator and the wearer's face.

Goggles with side shields provide barrier protection for the eyes and should fit snuggly over and around the eyes or personal prescription lenses. Personal prescription lenses do not provide optimal eye protection and should not be used as a substitute for goggles. If goggles or face shields are reusable, they must be placed in a designated receptacle for subsequent reprocessing. If they are not reusable, they may be discarded in a designated waste receptacle.

Face shields extending from chin to crown provide better face and eye protection from splashes and sprays than goggles. Shields that wrap around the sides may reduce splashes around the edge. Removal of a face shield, goggles, and mask can be performed safely after gloves have been removed and hand hygiene performed. The ties, ear pieces, or headband used to secure the equipment to the head are considered clean and therefore safe to touch with bare hands. The front of the face shield is considered contaminated [30].

## ENVIRONMENTAL CONTROL MEASURES

As discussed, contaminated surfaces and objects can serve as the means of transmission for potential pathogens. The transfer of a micro-organism from an environmental surface to a patient is largely via hand contact with the surface. Although hand hygiene is important to minimize the impact of this transfer, cleaning and disinfecting environmental surfaces is fundamental in reducing their potential contribution to the incidence of infections [31].

### ENVIRONMENTAL CLEANING

All work areas, including contact surfaces and barriers, must be maintained in a clean and sanitary condition. Employers are required to determine and implement a written schedule for cleaning and disinfection based on the location, type of surface to be cleaned, type of soil present, and tasks or procedures being performed. All equipment and environmental and working surfaces must be properly cleaned and disinfected after contact with blood or other potentially infectious material.

If items or surfaces likely to be contaminated are difficult to clean and disinfect, they must be protected with disposable impervious barriers. Clean and disinfect all clinical contact surfaces that are not protected by impervious barriers using a California Environmental Protection Agency (Cal/EPA)-registered, hospital grade low- to intermediate-level disinfectant after each patient. The low-level disinfectants used must be labeled effective against hepatitis B virus and HIV. Use disinfectants in accordance with the manufacturer's instructions. Clean all housekeeping surfaces (e.g., floors, walls, sinks) with a detergent and water or a Cal/EPA-registered, hospital-grade disinfectant. Chemical-resistant utility gloves should be worn when handling hazardous chemicals [31].

### MEDICAL WASTE MANAGEMENT

Federal, state, and local guidelines and regulations specify the categories of medical waste subject to regulation and outline the requirements associated with treatment and disposal. Regulated medical waste is defined as [6; 31]:

- Liquid or semi-liquid blood or other potentially infectious materials
- Contaminated items that would release blood or other potentially infectious material in a liquid or semi-liquid state if compressed
- Items that are caked with dried blood or other potentially infectious material capable of releasing these materials during handling

- Contaminated sharps (e.g., needles, burs, scalpel blades, endodontic files)
- Pathologic and microbiologic wastes containing blood or other potentially infectious material

Regulated medical waste accounts for only 9% to 15% of total waste in hospitals and 1% to 2% of total waste in dental offices [6]. Examples of regulated waste found in dental practice settings are solid waste soaked or saturated with blood or saliva (e.g., gauze saturated with blood after surgery), extracted teeth, surgically removed hard and soft tissues, and contaminated sharp items such as needles, scalpel blades, and wires [6].

Medical waste requires careful disposal and containment before collection and consolidation for treatment. A single, leak-resistant biohazard bag is usually adequate for containment of regulated medical wastes, provided the bag is sturdy and the waste can be discarded without contaminating the bag's exterior. Contamination or puncturing of the bag requires placement into a second biohazard bag. All bags should be securely closed for disposal.

Medical waste requiring storage should be kept in labeled, leak-proof, puncture-resistant containers under conditions that minimize or prevent foul odors. The storage area should be well-ventilated and inaccessible to pests. Any facility that generates regulated medical waste should have a regulated medical waste management plan to ensure health and environmental safety in accordance with federal, state, and local regulations [31].

## DENTAL UNIT WATERLINES, BIOFILM, AND WATER QUALITY

*The following information is taken from the Centers for Disease Control and Prevention publication Guidelines for Infection Control in Dental Health-Care Settings* [6].

Studies have shown that dental unit waterlines, such as narrow-bore plastic tubing that carries water to high-speed handpieces, air/water syringes, and ultrasonic scalers, can become colonized with micro-organisms, including bacteria, fungi, and protozoa. Protected by a polysaccharide layer known as a glycocalyx, these micro-organisms colonize and replicate on the interior surfaces of the tubing and form a biofilm. This biofilm serves as a reservoir that can increase the number of micro-organisms in the water used during dental treatment.

In 1993, the CDC recommended that dental waterlines be flushed at the beginning of the clinic day to reduce the microbial load. Dental unit water that remains untreated or unfiltered is unlikely to meet drinking water standards.

Commercial devices and procedures shown to improve the quality of water used in dental treatment include self-contained water systems with chemical treatment, in-line microfilters, and combinations of these treatments. Simply using tap, distilled, or sterile water will not eliminate bacterial contamination in treatment water if biofilms in the system are not controlled. Removal or inactivation of dental waterline biofilms requires use of chemical germicides. California law defines "germicide" as a chemical agent that can be used to disinfect items and surfaces based on the level of contamination [2].

Patient material, such as oral micro-organisms, blood, and saliva, can enter the dental water system during treatment. Devices connected to the dental water system that enter the patient's mouth should be flushed to discharge water and air for a minimum of 20 to 30 seconds after each patient to remove patient material that might have entered the turbine, air, or waterlines.

Manufactured dental units are now engineered to prevent retraction of oral fluids, but some older units are equipped with antiretraction valves that require periodic maintenance. Users should consult the owner's manual or contact the manufacturer to determine whether testing or maintenance of antiretraction valves or other devices is required. Even with antiretraction valves, flushing devices for a minimum of 20 to 30 seconds after each patient is recommended. The DBC standards require that, at the beginning of each work day, dental lines and devices must be purged with air or flushed with water for at least two minutes prior to attaching handpieces, scales, air/water syringe tips, or other devices [2].

## ENGINEERING AND WORK PRACTICE CONTROLS

*The following information is taken from the OSHA Bloodborne Pathogens Standard, 1910.1030.*

Engineering controls such as sharps disposal containers, self-sheathing needles, and safer medical devices (e.g., sharps with engineered sharps injury protections and needleless systems) isolate or remove the bloodborne pathogens hazard from the workplace. On the other hand, work practice controls reduce the likelihood of exposure by specifying the manner in which a task is performed (e.g., prohibiting recapping of needles by a two-handed technique).

Engineering and work practice controls are intended to work synergistically to eliminate or minimize employee exposure. These controls must be examined and maintained or replaced on a regular basis to ensure their effectiveness. To maintain a safe workplace, employers must provide handwashing facilities that are readily accessible to employees.

Contaminated needles and other contaminated sharps should not be bent, recapped, or removed unless the employer can demonstrate that there is no alternative or that such action is required by a specific procedure. Necessary bending, recapping, or needle removal must be accomplished through the use of a mechanical device or a one-handed scoop technique. Shearing or breaking of contaminated needles is prohibited. Immediately, or as soon as possible after use, contaminated reusable sharps (e.g., scalpels, dental knives) must be placed in appropriate containers until properly reprocessed. These containers must be:

- Puncture resistant
- Labeled or color-coded
- Leak-proof on the sides and bottom
- Maintained in accordance with OSHA requirements for reusable sharps
- Designed so personnel are not required to reach by hand into the container
- Located as close as possible to the point of use

Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure. Food and drink should not be kept in refrigerators, freezers, shelves, or cabinets or on countertops where blood or other potentially infectious material is present.

All procedures involving blood or other potentially infectious material must be performed in such a manner as to minimize splashing, spraying, spattering, and generation of droplets of these substances. Splatter shields should be used on medical equipment associated with risk-prone procedures.

Equipment that may become contaminated with blood or other potentially infectious material must be examined before servicing or shipping and should be decontaminated as necessary, unless the employer can demonstrate that decontamination of such equipment or portions of such equipment is not feasible. A readily observable label should be attached to the equipment stating which portions remain contaminated. The employer must ensure that this information is conveyed to all affected employees, the servicing representative, and the manufacturer before handling, servicing, or shipping, so appropriate precautions may be taken.

## CLEANING, DISINFECTION, AND STERILIZATION

Application of accepted infection control principles helps maintain a safe environment for both patients and dental care workers. This includes proper use of Standard Precautions and application of approved techniques for cleaning, disinfection, sterilization, and reprocessing of dental equipment. Healthcare policies must identify—primarily on the basis of an item's intended use—whether cleaning and disinfection or sterilization is indicated (***Table 2***) [7].

Cleaning is defined as the removal of visible soil (organic and inorganic material) from objects and surfaces; normally, it is accomplished manually or mechanically using water with detergents or enzymatic products. Decontamination reduces the number of pathogenic micro-organisms on objects, usually with a 0.5% chlorine solution [7]. Thorough cleaning and decontamination are essential before high-level disinfection and sterilization because inorganic and organic materials that remain on the surfaces of instruments interfere with the effectiveness of these processes.

Disinfection is a process that eliminates many or all pathogenic micro-organisms, except bacterial spores, on inanimate objects. In healthcare settings, objects are usually disinfected using liquid chemicals or wet pasteurization (i.e., the use of hot water to destroy micro-organisms). There are three levels of disinfection:

- High-level disinfection: Used to disinfect patient-care equipment that touches mucous membranes or blood.
- Intermediate-level disinfection: Used mainly to disinfect items that have contact with intact skin, but is appropriate for certain semicritical items (e.g., chair arms).
- Low-level disinfection: Used to disinfect the healthcare environment or items that touch intact skin.

Surface disinfection is an important part of environmental cleaning. Most bacteria and mycobacteria (e.g., TB) survive for months on dry surfaces [32]. Respiratory viruses, such as coxsackie or influenza, can persist on surfaces for a few days. Hepatitis viruses and HIV can persist for more than one week, and herpes viruses have been shown to persist from only a few hours up to seven days [32]. All surfaces in patient care areas should be cleaned then disinfected according to the manufacturer's instructions and allowed to dry completely.

Sterilization is a process that destroys or eliminates all forms of microbial life and is carried out in healthcare facilities by physical or chemical methods. Sterile and nonsterile are absolute concepts. If a sterile item is touched by anything nonsterile, the formerly sterile item is contaminated.

The sterilization area should be separate from any patient care or staff break areas. The sterilization section of the processing area should include the sterilizers and related supplies, with adequate space for loading, unloading, and cool down [6]. The area can also include incubators for analyzing spore tests and enclosed storage for sterile items and single-use items. Manufacturer and local building code specifications will determine placement and room ventilation requirements.

**METHODS FOR STERILIZING AND DISINFECTING PATIENT-CARE ITEMS AND ENVIRONMENTAL SURFACES**

| Process | Result | Method | Examples | Patient Care Items | Environmental Surfaces |
|---|---|---|---|---|---|
| Sterilization | Destroys all micro-organisms, including bacterial spores. | Heat-automated, high temperature | Steam, dry heat, unsaturated chemical vapor | Heat-tolerant critical and semicritical | NA |
| | | Heat-automated, low temperature | Ethylene oxide gas, plasma sterilization | Heat-sensitive critical and semicritical | |
| | | Liquid immersion[a] | Glutaraldehyde, glutaraldehydes with phenols, hydrogen peroxide, hydrogen peroxide with peracetic acid, peracetic acid | | |
| High-level disinfection | Destroys all micro-organisms, but not necessarily high numbers of bacterial spores. | Heat-automated | Washer disinfector | Heat-sensitive semicritical | NA |
| | | Liquid immersion[a] | Glutaraldehyde, glutaraldehydes with phenols, hydrogen peroxide, hydrogen peroxide with peracetic acid, ortho-phthalaldehyde | | |
| Intermediate-level disinfection | Destroys vegetative bacteria and most fungi and viruses. Inactivates *Mycobacterium bovis*[b]. Not necessarily capable of killing bacterial spores. | Liquid contact | EPA-registered hospital disinfectant with label claim of tuberculocidal activity (e.g., chlorine-containing products, quaternary ammonium compounds with alcohol, phenolics, bromides, iodophors, EPA-registered chlorine-based product) | Noncritical with visible blood | Clinical contact surfaces, blood spills on housekeeping surfaces |
| Low-level disinfection | Destroys most vegetative bacteria and certain fungi and viruses. Does not inactivate *Mycobacterium bovis*. | Liquid contact | EPA-registered hospital disinfectant with no label claim regarding tuberculocidal activity. OSHA also requires label claim of HIV and HBV potency for use of low-level disinfectant for use on clinical contact surfaces (e.g., quaternary ammonium compounds, some phenolics, some iodophors) | Noncritical without visible blood | Clinical contact surfaces, housekeeping surfaces |

[a]Contact time is the single critical variable distinguishing the sterilization process from high-level disinfection with FDA-cleared liquid chemical sterilants. High-level disinfection uses shorter submersion times.
[b]Inactivation of the more resistant *Mycobacterium bovis* is used as a benchmark to measure germicidal potency.

*Source: [6]* *Table 2*

According to the CDC guideline, heat-tolerant dental instruments usually are sterilized by steam under pressure (autoclaving), dry heat, or unsaturated chemical vapor [6]. All sterilization should be performed by using medical sterilization equipment cleared by the FDA. The sterilization times, temperatures, and other operating parameters recommended by the manufacturer of the equipment used, as well as instructions for correct use of containers, wraps, and chemical or biological indicators, should always be followed [6]. Sterilization most often fails due to overloading.

Devices being sterilized should first be cleaned, as debris interferes with the sterilization process. If an ultrasonic unit is utilized, it should be covered while actively in use. Instruments should be fully dry prior to packaging and storage.

Storage practices for wrapped sterilized instruments can be either date- or event-related. Packages containing sterile supplies should be inspected before use to verify barrier integrity and dryness. Although some facilities continue to date every sterilized package and use shelf-life practices, other facilities have switched to event-related practices [6]. This approach recognizes that the product should remain sterile indefinitely, unless an event causes it to become contaminated (e.g., torn or wet packaging). Even for event-related packaging, the date of sterilization should be placed on the package, and if multiple sterilizers are used in the facility, the sterilizer used should be indicated on the outside of the packaging material to facilitate the retrieval of processed items in the event of a sterilization failure [6; 7]. If packaging is compromised, the instruments should be re-cleaned, sterilized again, and packaged in new wrap [7].

**Categorizing Patient-Care Items**

Patient-care items (e.g., dental instruments, devices, and equipment) are categorized using the Spaulding classification system as critical, semicritical, or noncritical, depending on the potential risk for infection associated with their intended use. Critical items are those items that enter sterile spaces, such as soft tissue or bone. These items pose the greatest risk of transmitting infection and require sterilization.

Semicritical items touch intact mucous membranes and have a lower risk of transmission. Because the majority of semicritical items in dentistry are heat-tolerant, they should be sterilized using heat. If a semicritical item is heat-sensitive, it should, at a minimum, be processed with high-level disinfection, which kills all microbial life except spores [6; 7].

Noncritical items pose the least risk of transmission of infection, contacting only intact skin, an effective barrier to most micro-organisms. In the majority of cases, cleaning and disinfection with an EPA-registered hospital disinfectant is adequate. When the item is visibly contaminated with blood or other potentially infectious material, an EPA-registered hospital disinfectant with a tuberculocidal claim (i.e., intermediate-level disinfectant) should be used [6; 7].

High-speed dental hand pieces, low-speed hand piece components used intraorally, and other dental unit attachments (e.g., reusable air or water syringe tips and ultrasonic scaler tips) must be heat-sterilized between patients. Single-use disposable instruments such as prophylaxis angles, cups, brushes, tips for high-speed evacuators, saliva ejectors, and air and water syringe tips must be used for one patient only and discarded. Proper functioning of the sterilization cycle must be verified at least weekly through the use of a biologic indicator (such as a spore test). Test results should be maintained for 12 months [2]. Studies have demonstrated variability among dental practices in meeting sterilization standards. In one study, 49%

of respondents did not challenge autoclaves with biological indicators. Other studies using biologic indicators found a high proportion (15% to 65%) of positive spore tests after assessing the efficacy of sterilizers used in dental offices [7].

Dental unit water lines must be anti-retractive. At the beginning of each workday, dental unit lines should be purged with air or flushed with water for at least two minutes prior to attaching handpieces, scalers, and other devices. The dental unit line must be flushed between each patient for a minimum of 20 seconds [2]. Single-use barriers may be used on those environmental surfaces that are difficult to clean and disinfect.

**Laboratory Areas**

According to California regulations, splash shields and equipment guards must be used on dental laboratory lathes. Fresh pumice and a disinfected, sterilized, or new ragwheel should be used for each patient. Devices used to polish, trim, or adjust contaminated intraoral devices must be disinfected or sterilized [2].

Intraoral items, such as impressions, bite registrations, and prosthetic or orthodontic appliances, must be cleaned and disinfected with an intermediate-level disinfectant before manipulation in the laboratory and before placement in the patient's mouth. Such items should be thoroughly rinsed prior to placement in the patient's mouth [2].

**Reprocessing Reusable Medical Equipment**

Reusable instruments, medical devices, and equipment should be managed and reprocessed according to recommended and appropriate methods. Industry guidelines as well as equipment and chemical manufacturer recommendations should be used to develop and update reprocessing policies and procedures. Written instructions should be available for each instrument, medical device, and equipment reprocessed. The FDA has issued guidance on ensuring the safety of reusable medical devices [33].

**Single-Use Devices**

A single-use device is a device that is intended for use on a single patient during a single procedure. An unused single-use device is referred to as an original device. A reprocessed single-use device is an original device that has previously been used on a patient and has been subjected to additional processing and manufacturing for the purpose of an additional single use on a patient [34].

## PROTECTING DENTAL HEALTHCARE WORKERS

Protecting dental professionals is an integral part of every dental organization's general program for infection prevention and control. The objectives usually include [35; 36]:

- Educating personnel about the principles of infection control and emphasizing individual responsibility
- Providing care to personnel for work-related illnesses or exposures
- Identifying work-related infection risks and implementing appropriate preventive measures
- Containing costs by preventing infectious diseases that result in absenteeism and disability

### OCCUPATIONAL EXPOSURES

An occupational exposure is defined as a percutaneous injury or contact of mucous membrane or nonintact skin with blood, tissue, or other potentially infectious material, most commonly a needlestick injury. The risk of infection depends on several factors, including:

- Whether the exposure was from a hollow-bore needle or other sharp instrument
- Whether the exposure was to nonintact skin or mucous membranes
- The amount of blood involved
- The amount of contagion present in the source person's blood

If a sharps injury occurs, wash the exposed area with soap and water. Do not "milk" or squeeze the wound. There is no evidence that using antiseptics will reduce the risk of transmission for any bloodborne pathogens; however, the use of antiseptics is not contraindicated. In the event that the wound needs suturing, emergency treatment should be obtained. The risk of contracting HIV from this type of exposure is extremely rare. Only 58 cases of confirmed occupational HIV transmission to healthcare personnel have been reported in the United States, with an additional 150 possible transmissions reported to the CDC [37]. There are no documented cases of a dental healthcare professional contracting HIV from an occupational exposure.

OSHA's final rule for occupational exposure to bloodborne pathogens requires dental employers to arrange a confidential medical evaluation and follow-up for any employee reporting an exposure incident [3]. An exposure incident is any eye, mouth, mucous membrane, nonintact skin, or other parenteral contact with blood or other potentially infectious material. Saliva in dental procedures is treated as potentially infectious material.

Following an exposure, the dental employer must refer the exposed employee to a licensed healthcare professional who can provide information and counseling and discuss how to prevent further spread of a potential infection. The exposed employee is entitled to appropriate follow-up and evaluation of any reported illness to determine if the symptoms may be related to HIV or hepatitis B infection.

Prompt response is necessary whenever an occupational exposure occurs. If possible, the patient should be interviewed to determine if any risk factors or bloodborne pathogens not previously disclosed are present. The patient may be tested along with the employee, if he or she agrees, in order to obtain the most information possible. Testing and postexposure prophylaxis may be conducted at an occupational injury clinic. All events leading up to and after the exposure should be documented in a written report.

### Postexposure Prophylaxis

Postexposure prophylaxis (PEP) involves the provision of medications to someone who has had a substantial exposure, usually to blood, in order to reduce the likelihood of infection. PEP is available for HIV and hepatitis B virus. Although there is no PEP recommended for hepatitis C virus, limited data indicate that antiviral therapy might be beneficial when started early in the course of infection [38]. For employees who have not received the hepatitis B vaccine series, the vaccine (and in some circumstances hepatitis B immunoglobulin) should be offered as soon as possible (within seven days) after the exposure incident. The effectiveness of hepatitis B immunoglobulin administered more than seven days after exposure is unknown. PEP has been the standard of care for healthcare providers with substantial occupational exposures since 1996 and must be provided in accordance with the recommendations of the U.S. Public Health Service [38].

## TUBERCULOSIS PREVENTION

California has one of the highest incidence rates of TB in the country, primarily because of its large immigrant and other high-risk populations (e.g., homeless persons) [39]. The TB infection rate is 14 times higher among foreign-born individuals than among those born in the United States. The rates among Asian and Black individuals born outside the United States were 50 and 51 times higher, respectively, than that of U.S.-born White persons [39]. To prevent the transmission of *Mycobacterium tuberculosis* in dental care settings, infection-control policies should be developed based on the community TB risk assessment and reviewed annually. The policies should include appropriate screening for latent or active TB disease in dental care providers, education about the risk for TB transmission, and provisions for detection and management of patients who have suspected or confirmed TB disease.

The CDC recommends that all dental care providers be screened for TB upon hire, using either a tuberculin skin test or blood test [40]. In addition, the California Department of Public Health requires that healthcare facilities in California perform initial and annual TB screening of employees [41].

Patients with symptoms of TB should be identified by screening; dental treatment should be deferred until active TB has been ruled out or the patient is no longer infectious following treatment. The potentially active TB patient should be promptly referred to an appropriate medical setting for evaluation of possible infectiousness and should be kept in the dental care setting only long enough to arrange for referral. Standard Precautions are not sufficient to prevent transmission of active TB.

A diagnosis of active respiratory TB should be considered for any patient with the following symptoms:

- Coughing for more than three weeks
- Loss of appetite
- Unexplained weight loss
- Night sweats
- Bloody sputum or hemoptysis
- Hoarseness
- Fever
- Fatigue
- Chest pain

A person with latent TB (positive skin test and no symptoms) can be treated in a dental office using standard infection control precautions [42]. This person has no symptoms and cannot transmit TB to others as there are no spores in his or her sputum.

The American Dental Association recommends that all patients be asked about any history of TB or exposure to TB, including signs and symptoms and medical conditions that increase their risk for TB disease. The Health History Form, developed by the U.S. Department of Health and Human Services, can be used to ask these questions.

If a patient with suspected or confirmed infectious TB disease requires urgent dental care, that care should be provided in a setting that meets the requirements for California ATD standards and airborne infection isolation. Respiratory protection (with a fitted N95 disposable respirator) should be used while performing procedures on such patients. Standard surgical masks are not designed to protect against TB transmission [42].

## VACCINATION

### Hepatitis B

Cal/OSHA guidelines require that healthcare workers who perform tasks that may involve exposure to blood or bodily fluids must have hepatitis B vaccination made available to them within 10 working days of initial assignment. The employee must also be given free information about the efficacy, safety, and benefits of vaccination [43].

The hepatitis B vaccine is given in a series of three injections at 0, 1, and 6 months. If one of the injections is missed, the series does not need to be restarted. The CDC recommends if the series is interrupted, the second or third dose should be administered as soon as possible; the second and third doses should be separated by an interval of at least eight weeks [44]. No booster is necessary. Follow-up serologic testing two months after vaccination (to ensure efficacy) is recommended. The provision of employer-supplied hepatitis B vaccination may be delayed until after probable exposure for employees whose sole exposure risk is the provision of first aid.

The high risk of hepatitis B virus exposure among healthcare personnel makes it imperative that clinical dental personnel be vaccinated. Vaccination can protect both workers and patients from hepatitis B virus infection and, whenever possible, should be completed when dentists or other dental care personnel are in training [6].

**Influenza**

Influenza is primarily transmitted from person to person via large, virus-laden droplets generated when infected persons cough or sneeze. These large droplets can settle on the mucosal surfaces of the upper respiratory tracts of susceptible persons who are within 3 feet of infected persons. Transmission may also occur through direct contact or indirect contact with respiratory secretions, such as when touching surfaces contaminated with influenza virus and then touching the eyes, nose, or mouth. The CDC strongly recommends that all healthcare personnel, especially those who have contact with patients at high risk, who have high-risk medical conditions, or who are older than 50 years of age, receive an annual (seasonal) influenza vaccination [45].

## TRAINING AND EDUCATION

Dental professionals should also fulfill all federal and state requirements for infection control training. New employees, or employees being transferred into jobs involving tasks or activities with potential exposure to blood or other potentially infectious material, must receive bloodborne pathogen training before assignment to tasks in which an occupational exposure may occur. Retraining is required annually or when changes in procedures or tasks affecting occupational exposure occur. Employees should be provided access to a qualified trainer to answer questions during the training session.

## CONCLUSION

Effective infection control techniques are critical to reducing the incidence of infections in dental facilities. Antiseptic techniques and antibiotics will kill micro-organisms, while proper hand hygiene will block their transmission. Gloves, gowns, and masks remove dental professionals from the transmission cycle by protecting them from contact with micro-organisms. Contact Precautions and isolation techniques help patients avoid being vectors of transmission. Engineering controls help to make the workplace safer, while administrative controls ensure that written protocols are in place and followed. Lastly, ensuring that dental professionals are immune or vaccinated can help decrease the availability of potential hosts.

## DENTAL BOARD OF CALIFORNIA GENERAL PROVISIONS: SECTION 1005. MINIMUM STANDARDS FOR INFECTION CONTROL

The Dental Board of California General Provisions: Section 1005. Minimum Standards for Infection Control is available online at https://govt.westlaw.com/calregs/Document/I3F75D9A0B95D11E0A3CAA6663E6464AA.

## CAL/OSHA COVID-19 STANDARD

In light of the ongoing COVID-19 pandemic, Cal/OSHA has developed an Emergency Temporary Standard to help protect healthcare providers and patients. The Standard must be re-authorized (and revised, if necessary) every six months. It may be accessed online at https://www.dir.ca.gov/oshsb/documents/Dec162021-COVID-19-Prevention-Emergency-txtcourtesy-2nd-Readoption.pdf.

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