CEsupport@MyDentalCE.com
(530) 238-5333

Infection Control OSHA Focus

MaryLou Austin, RDH, MS

Health Science Editor for Current Public Domain Education in Dentistry

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Course Description

This course meets and exceeds the minimum requirements for Infection Control in the clinical dental setting for all US state dental boards. Many state dental licensing boards, including the Dental Board of California, require that licensed and non-licensed dental professionals must meet the minimum requirements of their individual state's laws and regulations in infection control. The goal is for the safety and protection of the public and the dental clinician.

Successful completion of this course will fulfill the mandatory requirement for two (2) units of continuing education in infection control for dental license renewal in all states.

This course includes a historic overview of infection control, a review of important terms, discussion of the chain of infection, typical pathogens, discussion about and application of Standard Precautions, sterilization techniques and monitoring of effectiveness, personal protection equipment (PPE), review of bloodborne pathogens, post-exposure protocols, and a review of infectious diseases relevant in dentistry.

The material in this course is current as per the Centers for Disease Control, 2014-2015 and professional academic resources. This course is suitable for all members of the dental team for license renewal.

Learning Objectives

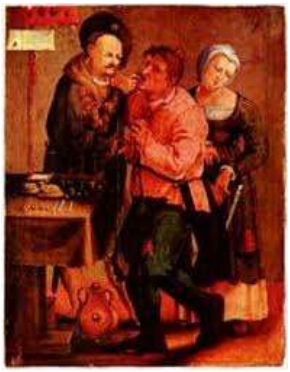
- Review important terms and concepts in infection control.
- Know routes of transmission for disease causing microorganisms.
- Know Standard Precaution measures mandated by state and federal guidelines.
- Identify strategies to prevent occupational exposures to bloodborne pathogens.
- Know post-accidental exposure protocols per OSHA.
- Identify Personal Protection Equipment (PPE) for dental personnel.
- Describe the various sterilization methods for non-critical, semi, and critical instruments and devices.
- Know how to monitor effectiveness of sterilization.
- Understand an office infection control program in a dental office

About the Author

MaryLou Austin, RDH, M.Sc., practiced dental hygiene for over 20 years, and recently completed a hospital rotation on a dental trauma surgical team. Also a long time Health Science and Dental Educator, Ms. Austin has developed learning systems for dental professionals, created rural dental clinic delivery models, and has authored and edited many dental publications. She graduated from the University of Nevada, summa cum laude, and is the current Director of Education for My Dental CE & OSHA Training.

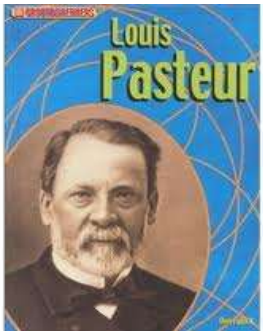
Introduction: The History & Future of Infection Control in Dentistry

For dental healthcare personnel (DHCP), infection and communicable disease can lead to illness, disability, and loss of work time. In addition, patients, family members, and community contacts can become exposed and may become ill or suffer permanent after-effects. A dental office and its team must practice stringent infection control or risk liabilities such as OSHA fines, lawsuits, and unacceptable health risks for patients and dental clinicians. Standard precautions for infection control management make sense because they are based on microbial science and evidence-based medicine concepts.



There were no universal precautions or standards for infection control in Dentistry until the 19th century when Alcock (1827) and Lister (1860's -1870's) advocated disinfection with chemicals—the first being carbolic acid made from creosote. The importance of hand washing as an important infection control measure was first advocated by Ignaz Semmelweis in 1861. Pasteur's new science of microbiology (1860-1880) and Koch's postulates for infectious disease investigation (1870's -1880s) advanced the understanding of pathogenic microbes and the transmission of disease. The most important advances in infection control really occurred in the 20th century.

Joseph Lister



Louis Pasteur

Ignaz Semmelweis

Alexander Fleming

In 1929, Alexander Fleming discovered penicillin, revolutionizing the treatment of simple infections (which were commonly fatal). Since then many antibiotics have been discovered, and death from dental infections today is a rarity.

Sterilization techniques for dental instruments improved during the 20th century and in 1950 Appleton was the first to declare that sterilization by heat is the optimum method for sterilizing dental instruments. The AIDS epidemic has had a major influence on infection control practices in all medical and dental settings. Since 1991 Universal Precautions (now referred to as Standard Precautions), such as the application of latex gloves and improved management of infectious waste and sharps, has advanced both patient and clinician in the modern dental office to a much safer place.

The Future for Dental Professionals

Dental Practice Trends

Major changes have occurred in the number and distribution of dental personnel over the past 60 years. We have moved from a model typically comprised of one dentist and one assistant per practice to one with a much larger and more diverse group of personnel. In 1950, there were approximately 155,000 dental personnel, which included dentists, dental hygienists, dental assistants, and other staff (e.g., receptionists, office managers, bookkeepers, sterilization assistants, laboratory technicians). Just over 50% of these individuals were dentists. By 2015, the total number of dental personnel had risen to almost one million, nearly a six-fold increase.

The US Bureau of Labor Statistics Outlook Handbook 2016-2017, indictated the total number of dental professionals currently in practice in a clinical setting as:

Dentists	151,000
Dental Hygienists	200,500
Dental Assistants	318,800

These statistical numbers tell us that potentially over **670,000** dental professionals and their patients can be exposed to pathogens when in contact with saliva, blood, aerosols, and airborne secretions.

The Center for Disease Control and Prevention (CDC) 2003 *Guideline for Infection Control in the Dental Health-Care Setting* is the foundation upon which standardized application of infection control protocols are used in the US—in all the healthcare professions. This course uses that information in a systematic fashion which specifically addresses the dental healthcare setting per CDC guidelines. The CDC is set to update these Guidelines in 2016.

The CDC material is not regulatory, yet some infection control practices are mandated by federal, state, or local regulations—or by OSHA and the federal Department of Labor. www.cdc.gov/oralhealth/infectioncontrol/guidelines/index.htm.

Standard Precautions

Medical histories and symptomology, whether written or verbal, physical examinations, and laboratory tests may not always reveal the presence of an infectious process, disease, carrier state or pre-symptomatic phases of disease in an individual. Thus, the same infection prevention and control protocols should be used for all patients, regardless of known or suspected infectious status.

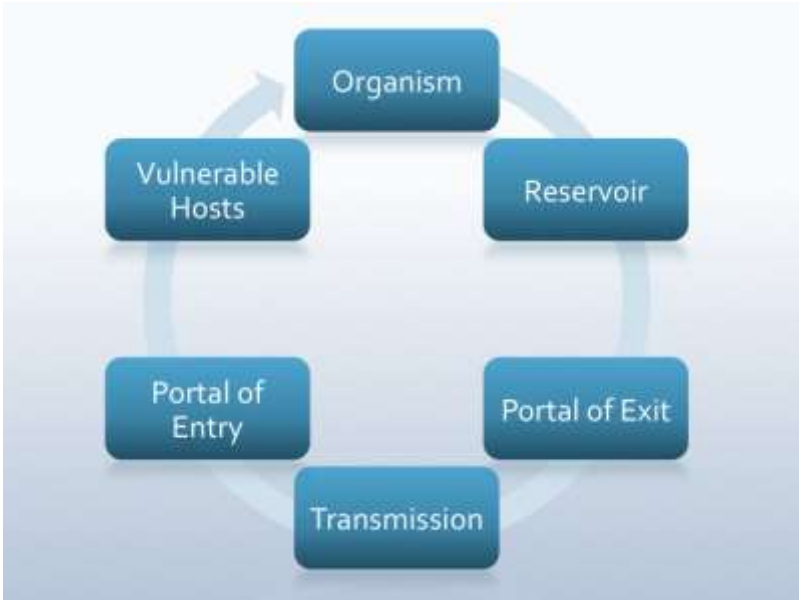
This concept is known as Standard Precautions. Previous infection control recommendations from the US Centers for Disease Control and Prevention (CDC) were focused on the risk of transfer of the blood-borne pathogens like HIV and HBV, and the term **universal precautions** was used. The all-inclusive term is currently **standard precautions**.

Standard precautions applies to contact with:

- Blood
- All body fluids, secretions, and excretions (except sweat), regardless of whether they contain blood
- Non-intact skin
- Mucous membranes

The Infection Process/ Chain of Infection Principles

The definition of the infection process or the chain of infection is the chain of events required for the spread of infection. The six essential links are represented below:



Terms in Chain of Infection

Infectious Agent/Pathogen: The micro-organism that causes infection such as bacteria, viruses, fungi and parasites. There must be an adequate number of pathogens to cause disease.

Reservoir: The place where micro-organisms live, such as in humans, animals, soils, food, plants, air or water. In the dental workplace, the most common reservoirs are humans, water, and dental equipment.

Portal of Exit: Mode of escape from the reservoir. Organisms exit through various body systems, such as the respiratory tract or skin lesions. Escape from the blood stream may be through skin abrasions, hypodermic needles, or dental instruments.

Mode of Transmission:

- Direct contact
- Indirect contact by an intermediate vehicle, like contaminated hands or hypodermic needle
- Airborne

Portal of Entry: Mode of entry of the infectious agent into the new host. Examples are broken skin, respiratory tract, mucous membranes.

Susceptible Host: A host that does not have immunity to the invading infectious agent.

The patient's complete medical and dental record is reviewed to identify specific problems and take necessary precautions.

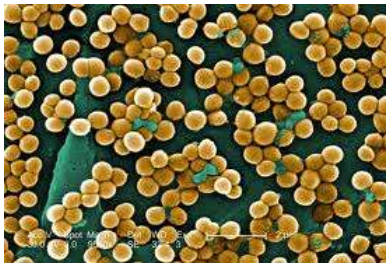
FACTORS THAT ALTER NORMAL DEFENSES	EXAMPLES
Abnormal Physical Conditions	• Defective heart valve
Systemic Diseases	• Diabetes mellitus • Alcoholism • Leukemia • Glomerulonephritis • Acquitted immune deficiency • Various causes of immunosuppression
Drug Therapy (Antibiotics may be required to prevent infection)	• Steroids • Chemotherapeutics
Prostheses & Transplants	• Joint replacement • Cardiac prosthesis • Organ transplant

Airborne Infection

Dust-Borne

Tetanus bacillus

Clostridium tetani (tetanus bacillus), *Staphylococcus aureus*, and enteric bacteria are among the organisms that may travel in the dust from the outside and that moves in and about treatment areas.



Staphylococcus aureus

Airborne organisms can be sources of contamination for dental instruments and the hands of dental personnel. Surface disinfection of all equipment contacted during an appointment contributes to control of dust-borne pathogens.

Aerosol Production

Aerosols

A particle of a true aerosol is less than 50 µm in diameter and nearly all are less that 5 µm. The tiny particles may contain respiratory disease-producing organisms or traces of mercury or amalgam that collect in the lungs because they are not biodegradable.

Spatter

These are heavier and larger particles that may remain airborne for a relatively short time because of their own weight and size. They drop or spatter on people, objects, and the floor. Spatter particles are greater than 50 µm. In contrast to aerosols, spatter may be visible on skin, hair, clothing, or environmental surfaces—gross contamination may result.

Aerosols and spatter are created during breathing, speaking, coughing, or sneezing. They are produced during all intraoral procedures, including examination and scaling. When produced by air spray, air-water spray, handpiece activity, or ultrasonic scaling, the number of aerosols increases to tremendous proportions.

Interruption of Transmission

Use water that meets EPA regulatory standards and run though all water systems that enter the patients' mouth, including handpieces, ultrasonic scalers, and air-water syringes. Clean water should run for at least 2 minutes at the start of each day and 20-30 seconds after each patient during the day. Other considerations include:

- Rubber dams which reduce aerosols containing blood and particles, and

- Air-control methods to supply adequate ventilation.

Microorganisms & Pathogens Transmissible by the Oral Cavity

The microbiological environment of the human oral cavity is very complex. Many of the salivary bacteria come from the dorsum of the tongue, but some are from mucous membranes and gingival / periodontal tissues. And high counts of total microorganisms are found in dental biofilm, periodontal pockets, periapical lesions, and carious lesions.

An advertent transmission to susceptible patients or to a dental clinician may occur as a result of inappropriate work practices, such as careless handwashing, non-hygienic personal habits, or inadequate sterilization and handling of sterile instruments and materials.

Tuberculosis

Rates of tuberculosis (TB) in the U.S. have declined in recent years, although disparities still exist between U.S. and foreign-born people. Additionally, the number of TB outbreaks among health-care personnel and patients has declined since the implementation of the 1994 Centers for Disease Control and Prevention (CDC) guidelines to prevent transmission of Mycobacterium tuberculosis. (USAF, 2009)

Symptoms of active tuberculosis (TB) disease include a productive cough, night sweats, fatigue, malaise, fever, and unexplained weight loss. Although the overall risk of TB transmission in dentistry is likely very low, policies should be in place to help dental team members detect and refer patients with active tuberculosis for immediate medical care.

Refer patients requiring urgent dental treatment to a previously identified facility (such as a hospital) with TB engineering controls and a respiratory protection program.

Tuberculosis

Tuberculosis (TB) is caused by infection with the bacterium Mycobacterium tuberculosis. Infection occurs through inhalation of the bacterium, which then travels to the alveoli of the lungs. In most people who become infected, the body is able to contain the bacteria and prevent it from multiplying. The bacterium can live in the lungs of an infected person for years, even a lifetime, without the person exhibiting any symptoms. This state is called latent TB infection. A person with latent TB is not infectious to others but the infection can develop into active TB disease in the future and usually exhibits a positive reactive tuberculin skin test.

People with latent TB infection

- have no symptoms

- don't feel sick
- can't spread TB to others
- can have a positive tuberculin skin test reaction
- can develop TB disease later in life if they do not receive treatment for latent TB infection.

Most people who have latent TB infection never develop active TB, but if they do not receive treatment for latent TB infection about 10 percent of latent TB infections can develop active disease over a lifetime.

This can happen when the person's immune system is weakened allowing the bacteria to become active and cause TB disease (e.g., individuals with HIV, diabetes, certain hematologic disorders such as leukemias and lymphomas, prolonged corticosteroid use, and other conditions). Only a person with active TB can transmit the disease.

People with active TB disease

- have symptoms (e.g., a productive cough, night sweats, fever, weakness or fatigue, weight loss, pain in the chest);
- feel sick;
- can spread TB to others; and
- can have a positive tuberculin skin test reaction.

The Centers for Disease Control and Prevention (CDC) has developed guidelines for preventing transmission of Mycobacterium tuberculosis in health-care settings.[1]

Routine Medical History

Ask all patients about past history of TB or exposure to TB. Ask about TB signs and symptoms and medical conditions that increase their risk for TB disease when taking their medical history. A diagnosis of respiratory TB should be considered for any patient with symptoms including coughing for more than 3 weeks, loss of appetite, unexplained weight loss, night sweats, bloody sputum or hemoptysis, hoarseness, fever, fatigue or chest pains. The ADA's Health History Form contains these kinds of questions.

Dental Treatment and TB

Because a person with latent TB is not infectious, he or she can be treated in the dental office under standard infection control precautions.

Any patient with symptoms suggestive of active TB disease should be removed from the area of other patients or staff, instructed to wear a surgical or procedure mask, assessed for the urgency of their dental care and promptly referred for medical care. Standard precautions are insufficient to prevent

transmission of the bacterium. Elective dental treatment should be deferred until the patient has been declared non-infectious by a physician. Urgent dental care for a person with suspected or active TB should be provided in a facility that has the capacity for airborne infection isolation and has a respiratory protection program in place. OSHA describes a standard for respiratory protection, which should be consulted if setting up a program (CFR 1910.134 Respiratory Protection). When treating a patient with active TB, dental health care personnel should use respiratory protection (e.g., fitted, disposable N-95 respirators). Standard surgical face masks are not designed to protect against TB transmission.

Risk Assessment

The CDC recommends that dental offices perform an annual risk assessment. Risk assessment involves:

1. Risk Classification—identifying the number of cases of active TB encountered in the office. The CDC classifies a low-risk setting as one where less than 3 patients with active TB are seen each year. An office that saw more than or equal to 3 patients with active TB in the past year is classified as a medium-risk setting. An office where there is evidence of a transmission of TB within the past year or one of the staff has a confirmed diagnosis of active TB is temporarily classified as potential ongoing transmission
2. Community Awareness—being aware of the TB risk level in the surrounding community. Contact the local or state health department to find out the number of TB cases in the community.

Just because a dentist practices in a community with a high number of TB cases does not mean that that dentist's office is medium risk. The likelihood of encountering TB cases in that particular practice determines its risk category.

The level of risk for encountering active TB in the dental office determines the types of administrative, environmental, and respiratory protection controls needed. Annual risk reassessment can also serve as an ongoing evaluation tool of the quality of the office's TB infection control practices and allows identification of any needed improvements in infection control measures.

Training

The CDC recommends that dental office personnel receive training and education on M. tuberculosis and TB disease that emphasizes the increased risks posed by an undiagnosed person with TB disease in a dental-care setting and the specific measures to reduce this risk. Training and education materials are available from the CDC

(http://www.cdc.gov/tb and http://www.findtbresources.org).

Dental Healthcare Workers and TB Skin Test

The CDC's Advisory Committee on Immunization Practices does not recommend routine immunization (Bacille-Calmette- Guérin [BCG]) of U.S. health care workers against TB. However, the CDC does recommend that all persons in the dental office who have the potential for exposure to M. tuberculosis through air space shared with persons with infectious TB disease (which essentially means all personnel) receive a two-step baseline tuberculin skin test (TST) at the beginning of employment in low-risk settings, every 12 months in medium-risk settings and every 8–10 weeks in the event of potential ongoing transmission until no further evidence of ongoing transmission is apparent. By doing so, TST conversions (from a negative to positive result) following an exposure incident can be distinguished from positive TST results resulting from previous exposures. After baseline testing additional TB screening is not necessary in low-risk settings unless an exposure to M. tuberculosis occurs.

Individuals with a positive TST should consult with their physician to determine whether any treatment is required.

1. Centers for Disease Control and Prevention: Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Settings, 2005. MMWR 2005; 54(RR17);1-141

Viral Hepatitis

Of the different types of viral hepatitis, in relation to transmission during dental treatment, Hepatitis B remains to be the greatest threat to the dental team for DHCP who are not immunized. The significance of Hepatitis C for the dental profession is as yet undetermined.

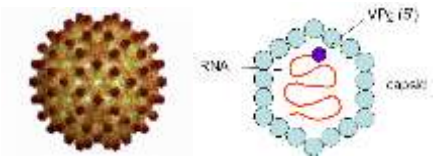
Transmission varies, based on the type of viral hepatitis. Four ways that the disease can be spread include:

1. Infected stool (fecal-oral transmission)
2. Infected blood products
3. Other infected bodily fluids, such as semen, vaginal fluids, or saliva
4. During delivery of a baby

Hepatitis A

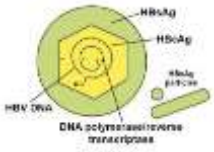
Hepatitis A virus (HAV) is the commonly occurring viral hepatitis, with a worldwide distribution. It is endemic in most countries. Hep A occurs more frequently in children and young adults—and is more severe in adults. The most common transmission is through contact with unsanitary conditions. The unwashed hands of infected persons who cause transmission of Hep A, is called the fecal-oral route.

Hep A is also waterborne and food-borne. Food handlers who are infected can contaminate food before or after cooking. The role of handwashing in prevention of Hep A cannot be overstated.



Hepatitis B

Hepatitis B virus (HBV) is a bloodborne virus of major concern in dental infection control. HBV transmission in a dental health care setting is rare, particularly since standard precautions and routine vaccinations for dental workers were adopted (1985 and 1987, respectively). There have been no reported transmissions from a dental worker to a patient since 1987.



Hepatitis B Vaccination, Screening, and Employees

All dental healthcare providers (DCHP) who are exposed to blood or other potentially infectious materials (OPIM) should receive the Hepatitis B vaccine according to current CDC recommendations and per OSHA regulations. Vaccination (3-dose series) should be followed by assessment of Hepatitis B surface antibody to determine vaccination immunogenicity and, if necessary, revaccination.

Federal OSHA regulations require that all employees who may become exposed to certain chemicals or who interact with patients, either in the front office or any aspect of treatment, must be offered a Hepatitis B vaccination within 10 days of employment. The dentist is required to provide the Hepatitis B vaccination to employees at no charge. If an employee declines to have the vaccination, a form must be signed as proof; if the employee decides later to have the vaccination, the dentist is then required to follow the same guidelines.

Healthcare personnel who have received Hepatitis B vaccine and developed immunity to the virus are at virtually no risk for infection. For a susceptible person, the risks from a single needle stick or cut exposure to HBV-infected blood ranges from 6-30% and depends on the Hepatitis B antigen (HBeAg) status of the source individual.

Hepatitis C

Hepatitis that could not be classified as Hep A or Hep B was classified as Hepatitis C (HCV) —and is now recognized as the most common chronic bloodborne infection, and is the most frequent indication for

liver transplantation. There is no vaccine for Hep C, so behavior modification for risk factors, including strict adherence to standard infection control procedures, is advised.

The transmission is by percutaneous exposure to contaminated blood and plasma derivatives, contaminated needles and syringes, transfusion, or accidental needle stick. HCV has been demonstrated in saliva. Non-percutaneous routes include sexual transmission and perinatal exposure.

Although only 849 cases of confirmed acute Hepatitis C were reported in the United States in 2007, CDC estimates that approximately 17,000 new HCV infections occurred that year, after adjusting for asymptomatic infection and underreporting. Persons newly infected with HCV are usually asymptomatic, so acute Hepatitis C is rarely identified or reported. Approximately 3.2 million persons in the United States have chronic HCV infection. Infection is most prevalent among those born during 1945–1965, the majority of whom were likely infected during the 1970s and 1980s when rates were highest (CDC, 2012).

HIV / AIDS

The human immunodeficiency virus (HIV) is the virus that can lead to AIDS. HIV transmission can occur when blood, semen, pre-seminal fluid, vaginal fluid, or breast milk from an infected person enters the body of an uninfected person.

This highly magnified transmission electron micrographic (TEM) image revealed the presence of mature forms of the human immunodeficiency virus (HIV) in a tissue sample under investigation. Photo courtesy of CDC.

HIV can enter the body through a vein (e.g., injection drug use), the lining of the anus or rectum, the lining of the vagina and/or cervix, the opening to the penis, the mouth, other mucous membranes (e.g., eyes or inside of the nose), or cuts and sores. Intact, healthy skin is an excellent barrier against HIV and other viruses and bacteria.

HIV also can be transmitted through receipt of infected blood or blood clotting factors. However, since 1985 all donated blood in the United States has been tested for HIV. Therefore, the risk of infection through transfusion of blood or blood products is extremely low. The U.S. blood supply is considered to be among the safest in the world.

Despite the tremendous public health education efforts at HIV prevention, the number of people with HIV infection continues to grow, with approximately 56,000 newly diagnosed HIV infections in the US annually (CDC, 2012).

Recommended Immunizations for Dental Personnel

Immunizations substantially reduce both the number of DHCP susceptible to infectious diseases and the potential for disease transmission to other DHCP and patients.

All dental care workers should be adequately immunized against:

- Hepatitis B
- Measles
- Mumps
- Rubella
- Varicella
- Influenza

DHCP Exposure to Bloodborne Pathogens

Reducing bloodborne pathogen exposures helps provide a safe and healthful workplace for dental employers and employees. In addition, reducing exposures can help reduce costs and increase productivity and employee morale.

Clinical Frequencies of Transmission

Percutaneous injuries and blood splashes to the eyes, nose or mouth occur frequently during dental treatment. A study of practicing Canadian dentists reports an average of 3 percutaneous injuries and 1.5 mucous-membrane exposures per year. The highest frequencies of percutaneous injuries were reported by orthodontists (4.9 per year) and the highest frequencies of blood splashes to the eyes, nose or mouth were reported by oral surgeons (1.8 per year). In a one-year period, 0.5% of dentists in Canada reported exposure to HIV and an additional 14% were uncertain if the source patient was HIV zero-positive; similarly, 0.8% reported exposure to HBV (15% uncertain) and 1.9% reported exposure to

the blood of a high-risk patient (17% uncertain). These frequencies of known exposure to HIV and HBV are likely to be underestimates as a result of uncertainty related to the zero-status of the patient and non-reporting bias (Canadian Dental Association, 2008).

Summary of risks of transmission of HBV, HCV and HIV with a contaminated needle are approximately:

30%	**(HBV when the source is e-antigen positive) – Hepatitis B Virus**
3.0%	**(HCV) – Hepatitis C Virus**
0.3%	**(HIV) – Human Immunodeficiency Virus**

Infection Control: Regulations and Guidelines

Occupational Safety and Health Administration (OSHA)

The Occupational Safety and Health Administration (OSHA) regulate workplace safety in the United States either through federal regulation or state-sponsored OSHA programs. In dentistry, one of the areas covered by the Bloodborne Pathogens Rule 1 is the use of personal protective equipment (PPE). There are no specific requirements regarding the types of materials for PPE. Rather, the regulations require that the employer assess the potential for exposure based on the nature of procedures typically done in a particular practice and select the appropriate protective attire.

The intention of PPE in dentistry is to prevent workers' skin, eyes, nose, mouth, and other mucous membranes from coming into contact with a patient's blood or other potentially infectious materials (OPIM), including saliva. Other requirements include providing PPE in appropriate sizes, replacing when necessary, and maintaining and laundering items as needed. All responsibility for providing and maintaining PPE and ensuring its use lies with the employer. The dentist / employer may not allow an employee to decline the use of PPE when there is a potential for exposure. For instance, the employer may not allow an assistant or hygienist to skip wearing a mask during procedures where there will be spray or spatter because they find it uncomfortable.

Centers for Disease Control and Prevention (CDC)

The Centers for Disease Control and Prevention issues guidelines and recommendations on numerous topics, including infection control. The *Guidelines for Infection Control in Dental Health-Care Settings*—2003 explain the various types of PPE and provide guidance in the use and selection of gloves, gowns, masks, and eyewear. In addition, the guidelines address such issues as jewelry, fingernails, and the storing and dispensing of hand care products. Although the CDC is not a

regulatory agency, the guidelines from the CDC often serve as the basis for regulations by federal and state agencies.

Infection Exposure Control in the Clinical Setting

Blood Exposure: Clinical Considerations

The CDC guidelines for infection control in dentistry emphasize the importance of Standard Precautions**. Standard Precautions include not only blood and body fluids suspected of containing blood, but all body fluids, excretions, and secretions with the exception of sweat.** The infection control precautions taken by the office team should be consistent for all patients and not based on the infectious status of the patient.

Dental Healthcare Personnel (DHCP)

Exposure to blood through percutaneous injury, or by contact with mucous membranes of the eye, nose or mouth, or by contact with non-intact skin is the primary method DHCP are exposed to blood-borne pathogens, such as HBV, HCV, and HIV, in dental health-care settings. Percutaneous exposures involve the greatest risk for transmission, and would include needle-sticks or cuts with contaminated sharp objects. Non-intact skin includes all exposed skin that is chapped, abraded or has dermatitis.

The majority of exposures in a dental health-care setting are preventable by using:

Personal Protection Equipment (PPE)

PPE is a major component of Standard Precautions. Exposure control refers to all procedures during clinical care necessary to provide top-level protection from exposure to infectious agents for members of the dental team and their patients.

Engineering Controls

Engineering controls are technology-based safer designs for equipment, and devices intended to reduce percutaneous exposures. Examples: needle guards, self-sheathing anesthetic needles, dental units designed to shield burs on hand pieces.

Work-Practice Controls

Work-practice controls are those practices established to avoid handling, using, assembling or cleaning contaminated sharp instruments, equipment or appliances, and the use of sharps containers. Sharps would include all needles, scalers, laboratory knives, burs, explorers and endodontic files and reamers.





Personal Protection Equipment (PPE) for the Dental Team

PPE is designed to protect the skin and the mucous membranes of the eyes, nose, and mouth of dental health-care personnel from exposure to blood or other potentially infectious material. OSHA mandates that dental health care workers wear gloves, surgical masks, protective eyewear, and protective clothing in specified circumstances to reduce the risk of exposures to bloodborne pathogens.

Clinical Attire

The wearing of apparel by clinicians and their assistants is vulnerable to contamination from splash, spatter, aerosols, and patient contact. The recommended uniform is designed and cared for in a manner that minimized cross-contamination.

Various types of protective clothing (e.g., gowns, jackets) are worn to prevent contamination of street clothing and to protect the skin of personnel from exposure to blood and body fluids. When the gown is worn as personal protective equipment (i.e., when spatter and spray of blood, saliva, or other potentially infectious material is anticipated), the sleeves should be long enough to protect the forearms. Protective clothing should be changed daily or sooner if visibly soiled. Personnel should remove protective clothing before leaving the work area.

Gown or Uniform

Gowns or uniforms are expected to be clean and maintained as free as possible from contamination. Clinical clothing over street clothes is not recommended because of exposure to infectious material while seeing clinical patients.

- Solid Closed Front
- Length
- No Pockets

Commercial laundering services are preferred for gowns or uniforms. If laundering at home, separate the office laundry from home clothing. Wash with hot water and bleach. Exercise great diligence.

Use of Face Mask and Respiratory Protection

Basic personal protection is composed of face mask, protective eyewear, and gloves. The face mask is placed first. Protective eyewear is placed second. Then hands are washed prior to gloving.

Dental health-care personnel should wear a surgical mask that covers both their nose and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood or body fluids. When a surgical mask is used, it should be changed between patients or during patient treatment if it becomes wet.

The ideal mask:

- Has no contact with nostrils or lips
- Has a high bacterial filtration efficiency rate
- Fits snugly around the entire edges of the mask
- Does not fog eyewear
- Is convenient to put on and remove
- Is made of non-irritating, non-allergic material
- Does not collapse during wear
- Is easily disinfected

Protective Eyewear

Eye protection for DHCP and patients is necessary to prevent physical injuries and infections of the eye. Protective eyewear is worn for all procedures. Protective eyewear for patients is also strongly recommended.

Hand Hygiene

Hand hygiene is a general term that applies to routine hand washing, antiseptic hand wash, antiseptic hand rub, or surgical hand antisepsis.

Hand Washing Principles

Hand hygiene substantially reduces potential pathogens on the hands and is considered a primary measure for reducing the risk of transmitting organisms to patients and dental health care personnel. Indications for hand hygiene include the following:

- Before and after treating each patient (e.g., before glove placement and after glove removal).
- After barehanded touching of inanimate objects likely to be contaminated by blood, saliva, or respiratory secretions.
- Before leaving the dental operatory.
- When hands are visibly soiled.
- Before re-gloving, after removing gloves that are torn, cut, or punctured.

For oral surgical procedures, perform surgical hand antisepsis before donning sterile surgical gloves.

Methods of Hand Washing

Methods	Agent	Area	Minimum Duration
Routine Hand Wash 	Water and non-antimicrobial soap (i.e., plain soap)	All surfaces of the hands and fingers	15 seconds
Antiseptic Hand Wash 	Water and antimicrobial soap (e.g., chlorhexidine, iodine and iodophors, chloroxylenol [PCMX], triclosan)	All surfaces of the hands and fingers	15 seconds
Antiseptic Hand Rub 	Alcohol-based hand rub	All surfaces of the hands and fingers	Until the hands are dry
Surgical Antisepsis 	Water and antimicrobial soap (e.g., chlorhexidine, iodine and iodophors, chloroxylenol [PCMX], triclosan)	Hands and forearms	2 – 6 minutes

Gloves and Gloving

Dental health care personnel wear gloves to prevent contamination of their hands when touching mucous membranes, blood, saliva, or other potentially infectious materials and to reduce the likelihood that microorganisms on their hands will be transmitted to patients during dental patient-care procedures.

Wearing gloves does not replace the need for hand washing. Personnel should wash their hands immediately before donning gloves. If the integrity of a glove is compromised (e.g., if the glove is punctured), the glove should be changed as soon as possible.

Exposure to glutaraldehyde, hydrogen peroxide, and alcohol preparations may weaken latex, vinyl, nitrile, and other synthetic glove materials. Other chemicals associated with dental materials that may weaken gloves include acrylic monomer, chloroform, orange solvent, eugenol, cavity varnish, acid etch, and dimethacrylates. Because of the diverse selection of dental materials on the market, glove users should consult glove manufacturer about the compatibility of glove material with various chemicals.

Glove Types and Indications

Glove Type	Indications	Comments	Common Glove Materials
Patient Examination Gloves 	Examinations and other nonsurgical procedures involving contact with mucous membranes; laboratory procedures	Medical device regulated by the FDA. Non-sterile and sterile, single-use disposable. Use for one patient and discard appropriately.	Natural rubber latex (NRL) Nitrile Polyvinyl chloride (vinyl) and other synthetics Polyethylene (plastic)
Surgeon's Gloves 	Surgical procedures	Medical device regulated by the FDA. Sterile and single-use disposable. Use for one patient and discard appropriately.	Natural rubber latex (NRL) Nitrile Combinations of latex and/or synthetics
Non-Medical Gloves 	Housekeeping procedures (e.g., cleaning and disinfection) Handling contaminated sharps or chemicals Not for use during patient care	Not a medical device regulated by the FDA. General purpose utility gloves that are puncture or chemical resistant. Sanitize after use	NRL and nitrile or chloroprene blends Neoprene Nitrile Butyl Rubber

Contact Dermatitis & Latex Hypersensitivity

Occupationally related contact dermatitis can develop from frequent and repeated use of hand hygiene products, exposure to chemicals, and glove use. Contact dermatitis is classified as either irritant or allergic. Irritant contact dermatitis is common, non-allergic, and develops as dry, itchy, irritated areas on the skin around the area of contact.

Latex allergy (type I hypersensitivity to latex proteins) can be a more serious systemic allergic reaction. It usually begins within minutes of exposure but can sometimes occur hours later. It produces varied symptoms, which commonly include runny nose, sneezing, itchy eyes, scratchy throat, hives, and itchy burning sensations. However, it can involve more severe symptoms including asthma marked by difficult breathing, coughing spells, and wheezing; cardiovascular and gastrointestinal ailments; and in rare cases, anaphylaxis and death.

Categories of Glove-Associated Skin Reactions

	Irritant Contact Dermatitis	Allergic Contact Dermatitis (Type IV [delayed] Hypersensitivity)	Latex Allergy (Type I [immediate] Hypersensitivity or NRL_protein allergy)
Causative Agents	Toxic chemicals (e.g., biocides, detergents); excessive perspiration; irritating chemicals used in hand products and in glove manufacture	Accelerators and other chemicals used in glove manufacture; sterilants and disinfectants (e.g. glutaraldehyde); bonding agents (e.g. methracrylates); local anesthetics	Latex proteins from Hevea brasiliensis (rubber tree)
Reactions	Skin reactions usually confined to the area of contact	Skin reactions usually confined to the area of contact	Skin and systemic reactions can occur as soon as 2–3 minutes, or as long as several hours after skin or mucous membrane contact with the protein allergens
	Acute: Red, dry, itchy irritated areas	**Acute:** Red, dry, itchy irritated areas	**Acute:** Hives, swelling, runny nose, nausea, abdominal cramps, dizziness, low blood pressure, bronchospasm, anaphylaxis (shock)
	Chronic: Dry, thickened skin, crusting, deep painful cracking, scabbing sores, peeling	**Chronic:** Dry thickened skin, crusting, scabbing sores, vesicles, peeling (appears 4–96 hours after exposure)	**Chronic:** As above, increased potential for extensive, more severe reaction

Patients with a latex allergy should not have direct contact with latex-containing materials and should be treated in a "latex safe" environment. Such patients also may be allergic to the chemicals used in manufacturing natural rubber latex gloves, as well as to metals, plastics, or other materials used to provide dental care.

Treatment Room Features

Notable features for a treatment room which is ideally planned for infection control are included in this section. The design of many treatment rooms may not be conducive to ideal planning for infection control, understanding that when renovations are anticipated, the plans and design can reflect the most advanced knowledge available relative to safety and disease control.

The objective is to have materials, shapes, and surface textures that facilitate effective use of infection control measures:

- Design for easy cleaning and disinfection; smooth and uncluttered surfaces.
- Removable hoses that can be cleaned and disinfected.
- Syringes with autoclavable tips or fitted for single use, disposable tips.
- No carpeting.
- All foot-operated controls for chairs, lights, and dental unit.
- Avoid upholstery.
- Sink should be smooth material like stainless steel.
- Water faucets and soap dispensers should be automatic.
- All supplies sterilizable or disposable.
- Sharps and biohazard disposal.

Barrier Protection

Clinical contact surfaces and equipment can be protected from contamination using barrier protection. Barrier protection is particularly effective for those clinical contact surfaces that are difficult to clean and disinfect due to surface topography or material chemical incompatibilities. Barrier protection materials include:

- Clear plastic wrap
- Plastic bags
- Plastic sheets
- Plastic tubing
- Plastic-backed paper
- Other materials impervious to moisture

Barriers become contaminated during patient care. Barriers should be removed and discarded between patients using gloves. Following removal of the barrier, the clinical contact surface should be examined to ensure it did not become inadvertently contaminated. The surface should be cleaned and disinfected if contaminated.

Following removal of the barrier, gloves should be removed, hand hygiene should be performed and clean barriers should be placed prior to the next patient treatment.

Sharps

Contaminated sharps must be placed immediately (or as soon as possible after use) in sharps disposal containers. Sharps containers must be labeled and easily accessible to employees. They must be located as close as feasible to the immediate area where the sharps are used or can be reasonably anticipated to be found (e.g., dental operatory).

Sharps containers must be:

- rigid
- closeable and sealable
- puncture resistant
- leak proof
- portable
- kept in an upright position
- closed immediately prior to their removal or replacement
- placed in a secondary container if leakage is possible
- replaced as needed to prevent overfilling

Instrument Processing

All instrument cleaning, disinfecting, and sterilizing should occur in a designated central processing area in order to more easily control quality and ensure safety.

Precise terminology in the dental environment:

- An item is clean if all visible soil (organic and inorganic) debris and OPIM are removed by manually or mechanically using water with detergents or enzymatic products.
- True sterilization involves killing all microorganisms including hardy bacterial spores on a surface or instrument.
- Disinfection lies somewhere in between these two. Disinfection may kill all kinds of disease producing microorganisms but cannot kill bacterial spores.

The instrument processing area should be physically divided into sections:

- Receiving
- Cleaning
- Decontamination
- Preparation and packaging
- Sterilization
- Storage

Cleaning Procedures

Cleaning should precede all disinfection and sterilization processes. Cleaning involves the removal of debris (organic or inorganic) from an instrument or device. If visible debris is not removed, it will interfere with microbial inactivation and can compromise the disinfection or sterilization process.

Dental instruments are classified into three categories depending on the risk of transmitting infection.

1. **Critical instruments:** used to penetrate soft tissue or bone, or enter into or contact the bloodstream or other normally sterile tissue. They should be sterilized after each use. Sterilization is achieved by steam under pressure (autoclaving), dry heat, or heat/chemical vapor. Critical instruments include forceps, scalpels, bone chisels, scalers and surgical burs.
2. **Semi-critical instruments:** do not penetrate soft tissues or bone but contact mucous membranes or non-intact skin, such as mirrors, reusable impression trays and amalgam condensers. These devices also should be sterilized after each use. In some cases, however, sterilization is not feasible and, therefore, high-level disinfection is appropriate.
3. **Non-critical instruments:** come into contact only with intact skin such as external components of x-ray heads, blood pressure cuffs and pulse oximeters. Such devices have a relatively low risk of transmitting infection; therefore, may be reprocessed between patients by intermediate-level or low-level disinfection.

Exposure Prevention and Personnel Safety per CDC & OSHA

The **Centers for Disease Control and Prevention** (CDC) states that*, "Contaminated instruments should be handled carefully to prevent exposure to sharp instruments that can cause percutaneous injury. Instruments should be placed in an appropriate container at the point of use to prevent percutaneous injuries during transport to the instrument processing area."*

In addition, the **Occupational Safety and Health Administration (OSHA**) says, *"The person handling the instruments through removal, cleaning, packaging and sterilization needs to use heavy-duty gloves to help prevent injury with sharp contaminated instruments."*

Manual Cleaning / Pre-Soaking

If manual cleaning is not performed immediately, instruments should be placed into a container and soaked with a detergent, a disinfectant/detergent, or an enzymatic cleaner to prevent drying of patient material and make manual cleaning easier and less time consuming.

Using mechanical means of instrument cleaning rather than hand scrubbing should minimize handling of instruments. If hand scrubbing is necessary, heavy-duty (utility) gloves, mask, eyewear and gown

should always be worn while cleaning. Minimize the risk of puncture injury by scrubbing only one instrument at a time while holding it low in the sink.

Use of a system utilizing locked cassettes eliminates the need to sort, handle and hand scrub individual instruments.

Mechanical Cleaning Devices

Ultrasonic cleaner

Ultrasonic cleaners employ sound waves in a chamber of liquid to create cavitation. When the cavitation comes into contact with the instruments, it dislodges debris. Although more study is needed, there is some evidence that ultrasonic cleaners may be more effective in cleaning small items with complex shapes, such as endodontic files, than are washer/disinfectors.

Instrument washers

Instrument washers use high-velocity hot water and a detergent to clean instruments. Widely used for decades in hospitals and large facilities as a part of the central sterilization process, these devices have recently become available for the dental office.

Instrument examination and care

Cleaning instruments, provides a good opportunity to examine, replace or remove damaged instruments; lubricate items such as hand pieces; and otherwise prepare instruments for sterilization. Instruments must be dry before packaging - if drying was not part of the cleaning process, time must be taken to dry the instruments completely. High-quality metal dental cassettes specially designed to withstand high temperatures are preferred for use with steam and chemical vapor sterilizers. Most sterilizers on the market today offer a cassette rack, which helps to prevent over-loading in the sterilizer, thereby reducing the risk of ineffective sterilization and ultimately of infection and cross-infection.

Packaging

Packaging materials (wrapped or container systems) allow penetration of the sterilization agent and maintain sterility of the processed item after sterilization. Materials for maintaining sterility of instruments during transport and storage include wrapped perforated instrument cassettes, peel pouches of plastic or paper, and sterilization wraps (which can be either woven or unwoven). A chemical indicator / integrator should be placed among the instruments, inside the package, as well as on the outside of each package.

Types and Use of Sterilization Packaging Materials

Sterilization Method	Packaging Material Requirements	Acceptable Materials
Steam Autoclave	• Should allow steam to penetrate	• Paper • Plastic • Cloth • Paper peel packages • Wrapped perforated cassettes
Dry Heat	• Should not insulate items from heat. • Should not be destroyed by temperature used.	• Paper bags • Polyfilm plastic tubing • Wrapped perforated cassettes
Unsaturated Chemical Vapor	• Vapors should be allowed to precipitate on contents. • Vapors should not react with packaging material. • Plastics should not contact sides of sterilizer.	• Wrapped perforated cassettes • Paper • Paper peel pouches

Sterilization

Parameters such as time, pressure and temperature vary according to the type of sterilizer, materials being sterilized and individual models within sterilizer brands. Sterilizers are medical devices, requiring clearance by the Food and Drug Administration before manufacturers may offer them for sale. The FDA requires rigorous testing to ensure an adequate margin of safety in each cycle type described in the instructions.

Moist Heat: Steam under Pressure / Steam Autoclave

Steam autoclaves are the most commonly used type of heat sterilizer in dental practices. Two types of processes employ steam under pressure. The difference between the two is the manner in which the machine evacuates the air from the sterilization chamber and then introduces the steam.

A typical cycle for wrapped instruments includes heat-up and pressurization time, followed by a 15-to-30-minute cycle during which sterilization is taking place (121°C at 15 psi). The sterilization cycle time decreases as the temperature is increased. It is important to use cycle times and temperatures

described in the owner's manual, and never to interrupt the sterilization cycle to remove or add items, or for any other reason. Interruption of the cycle will result in instruments that are not sterile and therefore not safe for use on patients. The unit must only be opened after completion of the drying cycle. Upon removal from the sterilizer, sterile packs must be stored in a clean, dry area. Packs that become wet, torn, contaminated, or otherwise compromised require re-sterilization.

Dry Heat: Convection and Static Air

Dry-heat sterilization employs high temperatures for extended periods to achieve sterilization of instruments. The method of heat circulation in dry-heat sterilizers is usually convection, which helps to ensure that the heat circulates throughout the sterilization chamber during the process. Mechanical convection is more effective; the sterilizer contains a fan or blower that continually circulates the heated air to maintain a uniform temperature throughout the chamber. Most commercially available dry-heat sterilizers on the market today are of this type.

The higher temperature of a dry-heat sterilizer means that paper will scorch and plastic will melt. Specialized packaging material is available for dry-heat sterilizers. Most hand pieces will not tolerate the higher temperatures of a dry-heat sterilizer.

Chemical Vapor Sterilizer

Unsaturated chemical vapor sterilization relies upon the use of a proprietary chemical that contains formaldehyde, alcohol and other inert ingredients, instead of water, to produce a vapor to promote the sterilization. Use of this proprietary chemical also results in the vapor having less humidity and therefore being less corrosive to sensitive instruments than if water were used.

Sterility Assurance

All the efforts that go into the preparation of instruments are futile if the sterilization process itself is not successful. An indicator such as autoclave tape may change color when exposed to heat, but there is a possibility that the heat was not present for the proper length of time or that there was inadequate pressure. Indicators that go on the outside of the packs are useful for identifying processed and unprocessed packs. Failure of sterilization can occur due to mechanical malfunction of the sterilizer or due to operator error. There are several methods to provide assurance of sterility.

Operator Error

Most sterilizers have a system to notify the operator of mechanical malfunction, but sterilizers cannot notify the operator whether the contents of the instrument packs or cassettes are sterile or not. Operator error in loading the sterilizer could result in failure to sterilize

all the packs in spite of the proper time, temperature and/or pressure. It is important to avoid overloading the sterilizer or loading packs and cassettes on top of one another; use of a cassette system helps to reduce operator error due to overloading.

Chemical Indicators

Chemical indicators indicate the presence of certain conditions during the sterilization cycle, such as the presence of heat and steam. There are five classifications of indicators recognized by the FDA, and it is important to note that it is now recommended that all packs or cassettes include internal and external indicators.


Class 1


Class 2


Class 3


Class 4


Class 5

Class 1 - Process Indicators

These are placed on the outside of packs and are useful in determining which packs have been properly processed versus those that have not. Class 1 process indicators include autoclave tape and the color change indicators embedded on the outside of sterilization packaging materials.

Class 2 - Bowie-Dick Indicators

These show the pass/fail in pre-vacuum sterilizers. This test is conducted daily with the chamber empty, during the first cycle of the sterilizer, and is available as a kit from commercial sterilization monitoring companies.

Class 3 - Temperature-Specific Indicators

These react to one of the critical parameters of sterilization and indicate exposure to a specific value such as temperature or psi.

Class 4 - Multi-Parameter Indicators

These react to two or more of the critical parameters in the same manner as Class 3 indicators.

Class 5 - Integrating indicators

These are designed to react to all critical parameters of sterilization cycles. When used properly, integrating indicators may serve as the basis for the release of processed items, excluding implants. It is important to follow the manufacturer's specific instructions for use regarding a test challenge pack.

Biological Monitoring

The use of biological monitors (spore tests) is the most reliable method to validate that the sterilizer is functioning and that the sterilization of instruments is effective. These monitors consist of paper strips or vials impregnated with bacterial spores that are specifically resistant to the sterilization process. New spore tests have been developed that enable completion of biological monitoring in-office and yield results in as little as 24 hours. These tests allow quick remediation and validate proper infection control procedures without a long lag time during which the sterilization procedure may have become ineffective but is not known. It is recommended that biological monitoring be conducted at least weekly and with every load that includes an implantable device.

Care of Sterile Instruments

Sterile items and disposable (single-use) items should be stored in an enclosed storage area (e.g., cabinet or drawer). Dental supplies and instruments should not be stored under sinks or in other locations where they might become wet. Sterilized items should remain wrapped until they are needed for use.

Unwrapped items are susceptible to contamination. Avoid storing items loose in drawers or cabinets because unwrapped items cannot be kept sterile. Items stored in this manner are subject to contamination from dust, aerosols generated during treatment, and the hands of personnel who must handle them.

Sterilized instruments should be stored in a manner that preserves the integrity of the packaging material. Storage practices can be either date- or event-related. Although some facilities continue to date every sterilized package and use shelf-life practices (first in, first out), other facilities have switched to event-related practices. This approach recognizes that the product should remain sterile until some event causes the item to become contaminated (e.g., a package becomes torn or wet). The quality of the packaging material, the conditions under which items are stored and transported, and the amount that they are handled all affect the chances that the package and its contents will remain sterile. All packages containing sterile items should be inspected before use to verify barrier integrity and dryness. Any package that is wet, torn, dropped on the floor, or damaged in any way should not be used. The instruments should be re-cleaned, packaged in new wrap, and sterilized again.

****My Dental CE does not have any commercial interest, nor do we accept payment from commercial suppliers, for any dental product used in the sterilization process. Photos used with permission and are included for illustrative purposes only and does not constitute a product endorsement.****

Chemical Disinfectants

Chemical disinfectants are used on clinical contact surfaces are directly touched by contaminated instruments, devices, hands, or gloves. Examples of clinical contact surfaces include light handles, switches, reusable containers of dental materials, countertops, and telephone handles. Use barriers to protect these surfaces from contamination during treatment, or clean and disinfect them between patients.

Safe Use of Chemical Disinfectants

1. Read and follow label instructions
2. Read and maintain copy of Material Safety Data Sheet (MSDS)
3. Don appropriate Personal Protective Equipment (PPE), usually heavy duty gloves, face mask and protective apparel

Material Safety Data Sheets

All chemical products should have a **Material Safety Data Sheet (MSDS)** that details the types of hazardous exposures associated with the product (e.g. damage to eyes, ingestion hazard, skin irritation, etc.), and the appropriate protective measures. Many materials used in the manufacture of medical gloves will not protect against chemical exposures.

Overview of Chemical Disinfectants Used in Dentistry (CDC, 2008)

Alcohol

In the healthcare setting, “alcohol” refers to two water-soluble chemical compounds: ethyl alcohol and isopropyl alcohol—that have generally underrated germicidal characteristics. FDA has not cleared any liquid chemical sterilant or high-level disinfectant with alcohol as the main active ingredient. These alcohols are rapidly bactericidal rather than bacteriostatic against vegetative forms of bacteria; they also are tuberculocidal, fungicidal, and virucidal but do not destroy bacterial spores.

Chlorine & Chlorine Compounds

Hypochlorites, the most widely used of the chlorine disinfectants, are available as liquid (calcium hypochlorite). The most prevalent chlorine products in the United States are aqueous solutions of 5.25%–6.15% sodium hypochlorite, usually called household bleach. They have a broad spectrum of antimicrobial activity, do not leave toxic residues, are unaffected by water hardness, are inexpensive and fast acting, remove dried or fixed organisms and biofilms from surfaces and have a low incidence of serious toxicity. Disadvantages include corrosiveness to metals in high concentrations (>500 ppm), inactivation by organic matter, discoloring or “bleaching” of fabrics, release of toxic chlorine gas when mixed with ammonia or acid.

Formaldehyde

Formaldehyde is used as a disinfectant and sterilant in both its liquid and gaseous states. Formaldehyde is sold and used principally as a water-based solution called formalin, which is 37% formaldehyde by weight. The aqueous solution is a bactericide, tuberculocide, fungicide, virucide and sporicide. OSHA indicated that formaldehyde should be handled in the workplace as a potential carcinogen and set an employee exposure standard for formaldehyde that limits an 8-hour time-weighted average exposure concentration of 0.75 ppm.

Glutaraldehyde

Glutaraldehyde is a saturated dialdehyde that has gained wide acceptance as a high-level disinfectant and chemical sterilant. Aqueous solutions of glutaraldehyde are acidic and generally in this state are not sporicidal. Only when the solution is "activated" (made alkaline) by use of alkalinating agents to pH 7.5–8.5 does the solution become sporicidal. Once activated, these solutions have a shelf-life of minimally 14 days because of the polymerization of the glutaraldehyde molecules at alkaline pH levels.

Iodophors

Iodine solutions or tinctures long have been used by health professionals primarily as antiseptics on skin or tissue. Iodophors, on the other hand, have been used both as antiseptics and disinfectants. FDA has not cleared any liquid chemical sterilant or high-level disinfectants with iodophors as the main active ingredient.

Quaternary Ammonium Compounds

The quaternary ammonium compounds are widely used as disinfectants. EPA-registered quaternary ammonium compounds are appropriate to use for disinfecting medical equipment that contacts intact skin (e.g., blood pressure cuffs). The quaternaries commonly are used in ordinary environmental sanitation of noncritical surfaces, such as floors, furniture, and walls.

Properties of an Ideal Chemical Disinfectant

- Broad spectrum
- Fast acting
- Not affected by environmental factors; active in the presence of organic matter.
- Non-toxic
- Surface compatibility; non-corrosive
- Residual anti-microbial effects
- Odorless
- Economical

- Soluble in water
- Good cleaning properties
- Environmentally friendly

Dental Unit Waterlines

Dental unit waterlines (DUW) (i.e., narrow-bore plastic tubing that carries water to hand pieces, air/water syringe and ultrasonic scaler) can become heavily colonized with waterborne microorganisms, including bacteria, fungi, and protozoa. This bacterial aggregation is called **biofilm**. However, DUW are not a conducive environment for bacterial floral commonly found in the oral cavity.

High numbers of these opportunistic microorganisms are not necessarily dangerous to the general population, unless the DHCP or patient is a susceptible host. Susceptible hosts would include DHCP or patients that are immune-compromised (those living with HIV and people undergoing oncology treatment or organ transplantation procedures), those with cystic fibrosis, chronic bronchitis and bronchiectasis.

Biofilm found in water lines

The potential risk of infection from DUW microorganisms can be effectively reduced to counts to potable water standards (i.e., less than 500 cfu/ml) by following regular waterline maintenance procedures. These procedures are as follows:

- Waterline heaters should not be used in a dental unit or in dental equipment, as these heaters encourage waterline microorganism growth.
- All waterlines should be purged at the beginning of each workday by flushing the lines thoroughly with water for at least 2-3 minutes. This purging should be done with hand pieces, air/water syringe tips and ultrasonic tips not attached to the waterlines.
- Hand pieces utilizing water coolant should be run for 20-30 seconds after patient care, in order to purge all potentially contaminated air and water.
- Sterile water or sterile saline should be used when irrigating open vascular sites and whenever bone is cut during invasive surgical procedures.

Several dental devices contact mucous membranes and expel air and water into the patient's mouth and potentially into open wounds. These devices are attached to the air or waterlines of the dental unit, and include:

- High- and low-speed hand pieces, including low-speed motors
- Prophylaxis angles
- Ultrasonic and sonic scaling tips
- Ultrasonic and sonic endodontic devices
- Air abrasion devices
- Air and water syringe tips

Occupational Accidental Exposure Management

Percutaneous Injury

Exposure to blood or saliva by percutaneous injury is the greatest risk for acquiring a blood-borne pathogen in the dental health-care setting. Every effort should be made by all DHCP to avoid percutaneous injury.

- Significant exposures should be dealt with immediately. A significant exposure exists whenever any of the following events occurs:
- Percutaneous injury, where the skin of the DHCP is punctured.
- Blood, saliva or other body fluid is splashed onto non-intact skin (dermatitis, cuts or abrasions).
- Blood, saliva or other body fluid is splashed onto mucosa of the eyes, the mouth or the nose.

The steps in managing a significant exposure are:

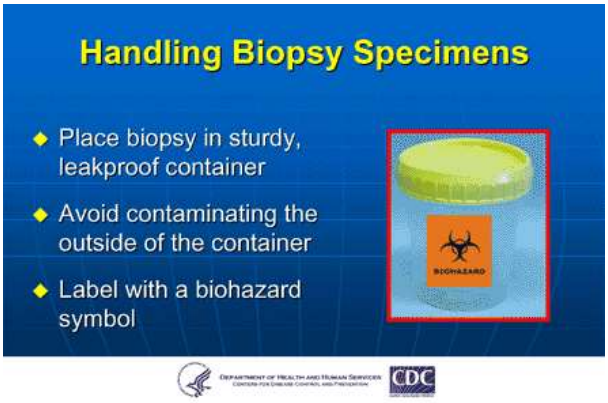
1. Remove gloves or immediate clothing, if necessary, to assess the extent of the injury.
2. First-aid should be administered, if necessary, for percutaneous exposures.
    a. Immediately wash the area, including the puncture or wound using antimicrobial soap and water. Exposed eye, mouth or nose mucosa should be flushed with copious amounts of water. The application of caustic agents such as bleach, or the injection of antiseptic agents into the wound is not advisable.
3. Report the injury to the Office Infection Prevention and Control Officer.

Biohazardous Material

Biopsy Specimens

Biopsy specimens should be placed in a sturdy, leak-proof container with a secure lid for transportation. The DHCP should take care when collecting the specimen to avoid contaminating the outside of the container. If the outside of the container becomes or is suspected to be contaminated, it should be cleaned and disinfected or placed in an impervious bag prior to transportation.

Local state regulations may require a biopsy container to be labeled with the biohazard symbol during storage, transport, shipment and disposal.



Extracted Teeth

Extracted teeth may be returned to a patient without any special considerations for infection prevention and control.

Extracted teeth that are being discarded should be handled carefully and disposed in general waste. Extracted teeth sent to a dental laboratory for shade or size comparisons should be cleaned and surface-disinfected with a hospital-grade tuberculocidal intermediate-level disinfectant. Extracted teeth containing dental amalgam should not be placed in waste containers that are subsequently incinerated. (CDA, 2008)

Medical waste of concern requires special storage, handling, neutralization and disposal, according to state regulations. Such waste includes:

- Solid waste soaked or saturated with blood or saliva
- Surgically removed hard or soft tissue (not including extracted teeth)
- Contaminated sharp items (e.g., needles, scalpel blades, wires)

All containers with blood or saliva (e.g., suctioned fluids) may be safely poured into a utility sink, drain or toilet, which drains into a sanitary sewer system or septic tank. DHCP should wear appropriate PPE during this task.

Dental Prostheses and the Dental Laboratory

Dental prostheses, appliances or impressions brought into the laboratory may be contaminated with microorganisms. Dental prostheses, impressions, orthodontic appliances and other prosthodontic materials (e.g., occlusal rims, temporary prostheses, face bow forks or bite registrations) should be thoroughly cleaned of all debris, disinfected with a hospital-grade tuberculocidal intermediate-level disinfectant and thoroughly rinsed before being handled in the in-office laboratory or sent to an off-site laboratory. Cleaning and disinfection should be done as soon as possible after removal from the patient's mouth and before drying of blood or other organic debris occurs. “Wet” impressions or appliances should be placed in an impervious bag prior to transportation to an off-site laboratory.

Dental laboratory staff should wear appropriate PPE (mask, gloves and protective eyewear) until cleaning and disinfection is completed.

Lasers and Thermal Tissue Changes

The thermal destruction of tissue, during procedures that use a laser or electrosurgical unit, creates a smoke by-product, which may contain viable microorganisms.

Lasers transfer electromagnetic energy into tissues, resulting in the release of a heated plume that includes particles, gases (e.g., hydrogen cyanide, benzene, and formaldehyde), tissue debris, viruses and offensive odors.

DHCP should use work practice and engineering controls to avoid inhaling or otherwise coming in contact with laser and electrosurgical plumes and surgical smoke. These practices include using:

- Standard Precautions (e.g., high-filtration surgical masks and possibly full face shields)
- Central room suction units with in-line filters to collect particulate matter from minimal plumes
- Dedicated mechanical smoke exhaust systems with a high-efficiency filter to remove substantial amounts of laser plume particles

Summary of Infection Control Program Principles

The goal of a dental infection-control program is to provide a safe treatment environment for the patient and a safe working environment for the DHCP. This is accomplished by reducing the risk of health-care associated (nosocomial) infections in patients and occupational exposures in DHCP. Errors in infection prevention and control practices are caused by faulty systems, processes and conditions that lead DHCP to make mistakes or fail to prevent errors being made by others.

Effective program evaluation is a systematic way to ensure procedures are useful, feasible, ethical and accurate. Program evaluation is an essential organizational practice.

A successful infection prevention and control program depends on developing standard operating procedures, evaluating practices, routinely documenting adverse outcomes (e.g., occupational exposures to blood) and work-related illnesses in DHCP and monitoring health- care associated infections in patients. Strategies and tools to evaluate the infection-control program can include:

- Periodic observational assessments
- Checklists to document procedures
- Routine review of occupational exposures to blood-borne pathogens

FAQs | CDC Information Links

Bead Sterilizer

Bloodborne Pathogens and Aerosols

Bloodborne Pathogens — Occupational Exposure

- What is an occupational exposure
- Infectious body fluids
- Risk of infection
- Steps following exposure
- Medical follow-up and management
- Measures to reduce the risk of exposure
- Safety devices

Bone Allografts

Carpeting/Cloth Furnishings

Contact Dermatitis and Latex Allergy

- Contact dermatitis

- Latex allergy
- Glove-associated skin reactions
- Dental healthcare personnel with latex allergy
- Powder-free gloves
- Patients with latex allergy

Extracted Teeth

- Disposing of teeth
- Giving teeth to patients
- Extracted teeth in educational settings

Fluoride Mouth Rinse Program

- Need for standard precautions
- Procedures for handling waste

Hand Hygiene

- What is hand hygiene
- Indications for hand hygiene
- Types of hand hygiene
- Storing hand care products
- Do lotions affect gloves

IV Solution Reuse

Personal Protective Equipment (PPE)

- Purpose of PPE
- Surgical masks
- Protective eyewear
- Clothing Gloves
- Handwashing
- Washing gloves
- Glove exposure
- Types of gloves

Preprocedural Mouth Rinse

- Contamination from aerosols and spatter
- Procedure-induced bacteremias
- Recommendations

Saliva Ejector and Backflow
Sterilization — Cleaning

- Central instrument processing area
- Pre-sterilization cleaning
- Cleaning methods (automated and manual)
- Performing manual cleaning
- Personal protective equipment (PPE)

Sterilization — Monitoring

- Monitoring methods
- Frequency of monitoring
- Sterilization of implants
- Procedures for positive spore test
- Factors influencing effectiveness

Sterilization — Packaging and Storage

- Types and use of packaging materials
- Cassettes Storage Shelf-life of instruments (date-related versus event-related)

Appendices – Resources for Staff

Guidelines for Infection Control in Dental Health-Care Settings, 2003. *MMWR*, December 19, 2003:52(RR-17). View PDF file [PDF- 1.2M] *Updated version due late 2016

- **Appendix A:** Regulatory Framework for Disinfectants and Sterilants;
  includes Figure: Decreasing Order of Resistance of Micro-organisms to Germicidal Chemicals
- **Appendix B:** Immunizations Strongly Recommended for Health-Care Personnel (HCP)
- **Appendix C:** Methods for Sterilizing and Disinfecting Patient-Care Items and Environmental Surfaces

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All photographs and images without a source reference are in the public domain. All other photographs are properly credited as to their source.

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Exam – Infection Control in Clinical Dentistry

1. The term “Standard Precautions” replaces an older term, “Universal Precautions”.
   a. True
   b. False

2. An example of a mode of transmission is:
   a. Direct contact
   b. Indirect contact
   c. Airborne
   d. All of the above

3. Spatters are heavier and larger particles that may remain airborne for a relatively short time because of their own weight and size.
   a. True
   b. False

4. Hepatitis B is an airborne and foodborne virus.
   a. True
   b. False

5. All DHCP who are exposed to blood or other potentially infectious materials should receive the Hepatitis B vaccine according to the current CDC recommendations.
   a. True
   b. False

6. Of the various hepatitis viruses, the one of most concern in dentistry is:
   a. Hepatitis A
   b. Hepatitis B
   c. Hepatitis C
   d. A & B

7. All of the following are examples of PPE (Personal Protection Equipment), EXCEPT:
   a. Needle guards
   b. Face Shields
   c. Clinical gowns
   d. Latex or nitrile gloves

8. Face masks continue to be effective even if wet.
   a. True
   b. False

9. Hand hygiene is considered the most effective measure for reducing the risk of transmitting organisms to patients and DHCP.
   a. True
   b. False

10. A latex allergy may include the following symptoms, EXCEPT:
    a. hives
    b. dilated pupils
    c. itchy eyes
    d. coughing spells

11. Contaminated sharps are considered biohazardous waste.
    a. True
    b. False

12. Packaging precedes all disinfection and sterilization processes.
    a. True
    b. False

13. Dental instruments are classified into three categories depending on the risk of transmission. Those categories include all EXCEPT:
    a. critical
    b. temperature critical
    c. semi-critical
    d. non-critical

14. Ultrasonic cleaners use sound waves in a chamber of liquid to create cavitation.
    a. True
    b. False

15. The sterilization cycle time increases as the temperature is increased.
    a. True
    b. False

16. The number of chemical indicator classes recognized by the FDA and used in dentistry to indicate the presence of conditions in the sterilization process, is:
    a. 3
    b. 4
    c. 5
    d. None of the above

17. Biological monitors or “spore tests” should be used:
    a. Daily
    b. Weekly
    c. Monthly
    d. Semi-annually

18. The properties of an ideal chemical disinfectant include:
    a. Broad spectrum
    b. Fast acting
    c. Odorless
    d. Soluble
    e. All of the above

19. The colonies which grow in dental unit water lines are known as:
    a. Protozoans
    b. Oral pathogens
    c. Biofilm
    d. Generally harmless

20. Exposure to blood or saliva by percutaneous injury is the greatest risk for acquiring a blood-borne pathogen in the dental health-care setting. Every effort should be made by all DHCP to avoid percutaneous injury.
    a. True
    b. False

21. Tuberculosis is an airborne caused disease. Most exposed persons do not become infected.
    a. True
    b. False

22. It is against the law to give extracted teeth back to patients.
    a. True
    b. False

23. Dental prostheses, appliances or impressions brought into the laboratory may be contaminated with microorganisms.
    a. True
    b. False

24. The thermal destruction of tissue, during procedures that use a laser or electrosurgical unit, creates a smoke by-product that does not contain viable microorganisms.
    a. True
    b. False

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Fax Answer Sheet – Infection Control OSHA Focus

(888) 727-0013

Please complete and **fax this form only** to (888) 727-0013. Please print your answers clearly.

Name: _____ **Profession:** _____

License State: _____ **License #:** _____ **Exp. Date:** ___/___

mm *yy*

Address 1: _____

Address 2: _____

City: _____ **State:** _____ **Zip Code:** _____

Phone: _____ **Fax:** _____ **Email:** _____

Please print the corresponding letter for each answer below:

1.	_____	**6.**	_____	**11.**	_____	**16.**	_____	**21.**	_____
2.	_____	**7.**	_____	**12.**	_____	**17.**	_____	**22.**	_____
3.	_____	**8.**	_____	**13.**	_____	**18.**	_____	**23.**	_____
4.	_____	**9.**	_____	**14.**	_____	**19.**	_____	**24.**	_____
5.	_____	**10.**	_____	**15.**	_____	**20.**	_____		

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	Excellent	Good	Fair	Poor
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Overall satisfaction of ordering process.	❒	❒	❒	❒
Overall satisfaction of course content and exam.	❒	❒	❒	❒
Overall satisfaction with website.	❒	❒	❒	❒

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