Quality Resource Guide

Infection Control and OSHA Update Part Two

Author Acknowledgements

JOHN A. MOLINARI, PhD

Professor Emeritus
University of Detroit Mercy School of Dentistry
Detroit, Michigan

Director of Infection Control
The Dental Advisor
Ann Arbor, Michigan

Dr. Molinari is a consultant for Hu-Friedy Inc.

Educational Objectives

Following this unit of instruction, the practitioner should be able to:

1. Describe the Hierarchy of Controls for Healthcare.
2. Describe the three common heat sterilization methods.
3. Discuss general instrument sterilization and reprocessing procedures.
4. Describe sterilization monitoring recommendations and elements of a sterility assurance program.
5. Discuss the potential for contaminated environmental surfaces to transmit infectious pathogens.
6. List categories of contaminated environmental surfaces.
7. Explain the necessity for cleaning before subsequent disinfection of environmental surfaces.
8. Describe ideal properties for chemical disinfectants, and government requirements for regulated, available products.
9. Consider the use of single-use disposable items to assist in achieving infection control goals.
10. Discuss the importance and appropriate use of personal protective equipment in dental practice.

MetLife designates this activity for **2.0 continuing education credits** for the review of this Quality Resource Guide and successful completion of the post test.

The following commentary highlights fundamental and commonly accepted practices on the subject matter. The information is intended as a general overview and is for educational purposes only. This information does not constitute legal advice, which can only be provided by an attorney.

Originally published July 2009. Updated and revised October 2012, October 2015 and October 2018, December 2021 and December 2024. Expiration date: December 2027.

The content of this Guide is subject to change as new scientific information becomes available.

ADA C·E·R·P® | Continuing Education Recognition Program

Accepted Program Provider FAGD/MAGD Credit **05/01/21 - 06/31/25.**

MetLife is an ADA CERP Recognized Provider. ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry. Concerns or complaints about a CE provider may be directed to the provider or to ADA CERP at https://ccepr.ada.org/en/ada-cerp-recognition.

Address comments or questions to:
DentalQuality@metlife.com - or -
MetLife Dental Continuing Education
501 US Hwy 22, Area 3D-309B
Bridgewater, NJ 08807

Cancellation/Refund Policy:
Any participant who is not 100% satisfied with this course can request a full refund by contacting us.

MetLife

Navigating life together

Hierarchy of Infection Prevention Controls

The CDC and OSHA, in conjunction with NIOSH, developed a "hierarchy of controls" in 2015 to protect workers and employees from occupational injury and illness.[1] This was modified in 2020 to emphasize effective workplace strategies for **prevention of COVID-19 and other diseases.**[2,3] **Figure 1** presents a graphic of the NIOSH Hierarchy of Controls adapted for dentistry with a representative (not a complete) list of procedural examples.

Sterilization and Instrument Reprocessing

A basic principle for effective infection control is: ***Do not disinfect when you can sterilize.*** Sterilization of contaminated instruments is a fundamental quality control component of any clinical program. An initial distinction must made here between the required antimicrobial outcomes of sterilization and disinfection. **Sterilization** is defined as the destruction of all forms of life, with particular reference to microbial forms. The limiting requirement and basic criterion for the accomplishment of sterilization is the destruction of high numbers of bacterial and mycotic spores, the most heat-resistant microbial forms. In contrast, **disinfection** refers to the inhibition or destruction of pathogens. Spores are not killed during disinfection procedures.

The use of heat has long been recognized as the most efficient, reliable method of sterilization. The historical practice of using liquid chemical disinfectants in dentistry (*e.g.,* "cold sterilization"), including agents such as glutaraldehyde or chlorine dioxide, is no longer necessary or appropriate since most reusable instruments and devices used in dentistry can withstand heat sterilization. If certain devices cannot be sterilized, single-use disposable replacements should be considered. Several methods of heat sterilization are available in dental health-care settings. These are steam under pressure (autoclave), dry heat (including rapid dry heat transfer), and unsaturated chemical vapor (**Table 1**).[4,5]

Figure 1

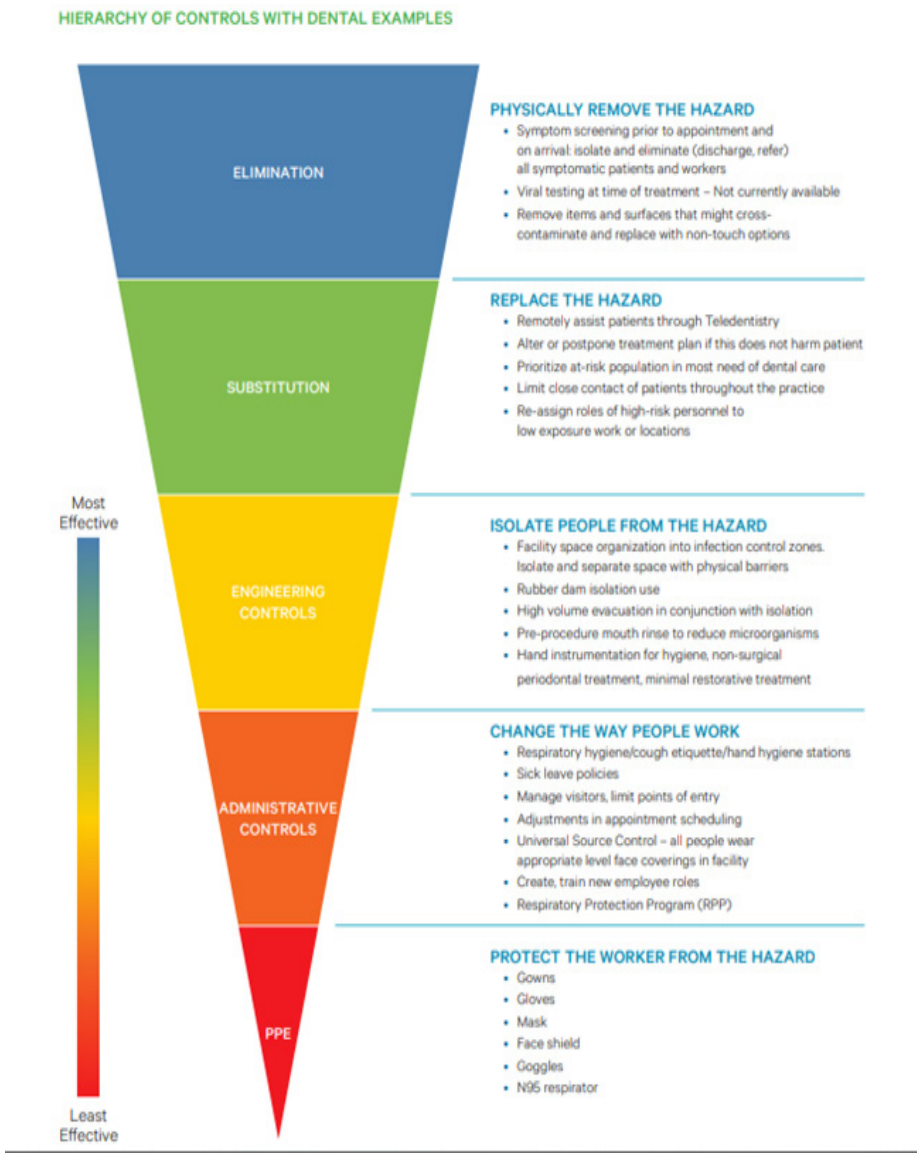


Table 1 - Representative Characteristics of Major Methods of Heat Sterilization

Method	Advantages	Disadvantages
Steam Auto-clave	Rapid turnaround time, low cost per cycle, good penetration, no toxic/ hazardous chemicals, cycle easy to control and monitor	Remove soil and transient micro-organisms
Dry Heat Oven	Does not corrode instruments, no toxic/ hazardous chemicals, low cost per cycle.	Long cycle time, cannot be used with plastics, pa-per products may char, poor penetration compared to steam, not appropriate for handpieces
Rapid Heat Transfer	Short cycle, items are dry after cycle.	Cannot sterilize liquids, may damage plastic and rubber items, door cannot be opened before end of cycle, small capacity per cost, unwrapped items
Unsaturated Chemical Vapor	Good turnaround time, less corrosive to instruments.	Uses toxic/hazardous chemicals, requires fume ventilation, cannot be used with many plastics, instruments must be dry before sterilization

Steam sterilization remains the most widely used modality for wrapped and unwrapped items that are not sensitive to heat and moisture. The evolution of steam sterilization has continued with development of several technological advances. A major innovation utilizes pre- and post-vacuum sterilizers, also called "Class B" sterilizers. In this type of unit, a pump housed within the sterilizer creates a vacuum at the beginning of the cycle to prevent the mixing of air and steam. This ensures rapid and efficient penetration of steam to instrument surfaces. The post-vacuum component at the end of the sterilization interval facilitates more thorough and effective drying, thereby reducing metal corrosion.

Monitoring Sterilization

Sterilization cycles are routinely monitored using a combination of mechanical, chemical, and biological indicators. These can evaluate sterilization conditions and the procedure's effectiveness. Mechanical monitors of sterilization cycles evaluate gauges, displays, or computer printouts for correct temperature, pressure, and exposure time. While incorrect readings serve as a first indication of problems with the cycle, they do not assess conditions within the packages being processed. In contrast, chemical indicators and integrators can use time, temperature and pressure during the cycle, and have varying degrees of sensitivity.[4-6] Their characteristics are summarized in **Table 2**.

The ADA and CDC have published and periodically updated dental infection control recommendations since the beginning of the 1970s[5,7-13] calling for the proper functioning of sterilization cycles to be verified by the periodic use (at least weekly) of biologic indicators (spore tests). Biologic indicators (BI) containing heat-resistant spores provide the best challenge for sterilization cycles. Two species are used, *Geobacillus stearothermophilus* and *Bacillus atrophaeus* (formerly *Bacillus stearothermophilus* and *Bacillus subtilis*). A fundamental feature to note is that a spore vehicle designed for one sterilization method is not necessarily the proper modality for other methods. Calibrated *G. stearothermophilus* spore-impregnated paper strips or glass vials are the appropriate biological monitors for autoclaves and unsaturated chemical vapor sterilizers, while *B. atrophaeus* preparations provide effective challenge for conditions in dry heat sterilizers and ethylene oxide units. The manufacturer's directions provide information for the placement and location of a biological indicator in the sterilizer, as well as appropriate incubation times and temperatures. Proof of destruction of these resistant microbial forms is used to infer that all microorganisms exposed to the same conditions have been destroyed, thereby representing the most sensitive check of sterilizer efficiency. Instrument packs that are sterilized should also be labeled to permit identification in case of a sterilizer failure.

Unfortunately, there are numerous equipment malfunctions and human factors that can adversely affect a sterilizer's performance (**Table 3**).

To investigate possible reasons for sterilization cycle failure, a study of >400 sterilizers in 381 dental offices was undertaken.[16] The study findings indicated that 85-87% of cycle failures were due to human error, not equipment malfunction. It is imperative that sterilizer effectiveness be routinely monitored and verified. Heat-sensitive chemical indicators, such as those that change color after exposure to heat are useful in detecting major unit malfunctions or human errors during sterilization procedures. Yet, they do not ensure the adequacy of the sterilization cycle. More reliable, effective chemical monitors (Type 5 integrators) have become available that can assess the three sterilization parameters - temperature, pressure, and time. It is important to remember that testing with chemical sterilization monitors is not a substitute for spore testing, which remains the "gold standard" for heat sterilization. However, a positive result with this type of monitor can immediately indicate that the sterilization cycle was successful. These chemical process monitors can be used with each load of processed instruments to detect problems between BI test intervals.

Table 2 - Classification of Chemical Indicators/Integrators

Type I (Process Indicators) - tapes or strips used only as external indicators to distinguish processed from unprocessed items (*e.g.*, autoclave tape)

Type II (Bowie-Dick Indicators) – used as quality control indicators for vacuum steam (Class B) sterilizers to assess air removal during cycle

Type III (Temperature Specific Indicators) – indicate attainment of specific minimum temperature within sterilization chamber during a cycle; not sensitive to other parameters (*i.e.*, time)

Type IV (Multi-Parameter Integrators) – provide integrated color change to the temperature, pressure, or time sterilization parameters

Type V (Integrating Indicators) – strips that contain a chemical ink that reacts to all 3 sterilization parameters during the sterilization cycle; the final color change in the card "SAFE" zone provides immediate notification to the user of sterilization cycle success or failure; serve as appropriate adjuncts to biological monitoring of sterilization

Type VI (Cycle Specific Integrators) – strips that react to all critical parameters for specified sterilization cycles

Table 3 - Common Reasons for Sterilization Cycle Failure Using a Heat Sterilizer

1. Inadequate precleaning of instruments
2. Improper equipment maintenance
3. Cycle time too short or temperature too low
4. Overloading or improper loading of sterilizer chamber
5. Incompatible packaging material
6. Interruption of sterilization cycle to add or remove an item

Instrument Reprocessing

Instrument processing and recirculation is a complex process requiring specialized equipment, multiple steps, and trained personnel. Correct cleaning, packaging, sterilizer loading procedures, sterilization methods, and storage practices are essential to ensure that instruments are adequately processed and safe for reuse on patients.[5,14,15] Ideally, a designated, well-controlled area in the office should be used. If possible, a central processing area can be divided into sections for receiving, cleaning, and decontamination; preparation and packaging; sterilization; and storage. A handwashing unit should also be conveniently located in this area. Automatically controlled equipment, such as faucets and soap dispensers, using electronic sensors or foot controls is desirable. The primary goal to remember here is to separate contaminated instruments from areas where clean items are packaged, sterilized, and stored.

Contaminated instruments should be handled as little as possible to prevent exposure to sharp instruments that can cause percutaneous injury. Also of concern is exposure to microorganisms on contaminated instruments and devices through contact with nonintact skin on the hands or contact with mucous membranes of the eyes, nose, or mouth. Thus, contaminated instruments and devices should be handled carefully with heavy-duty utility gloves serving as major PPE, in addition to protective clothing, eyewear, and a mask. Examination gloves do not provide adequate protection against sharps injuries. In order to minimize the potential for accidents, instruments can also be placed in a covered puncture-resistant container during transport to the instrument processing area.

Cleaning contaminated instruments prior to sterilization is a fundamental initial step. If organic or inorganic bioburden or debris is not removed it can interfere with microbial inactivation and compromise the sterilization process. Therefore, cleaning should precede all sterilization processes. If cleaning cannot be performed immediately, placing instruments in a puncture-resistant container or an ultrasonic cleaner and soaking them with detergent, a disinfectant/detergent, or an enzymatic cleaner will prevent drying of blood, saliva, and dental materials, thereby making subsequent cleaning easier and less time-consuming. This is often referred to as "presoaking." Using a liquid chemical sterilant/high-level disinfectant (*e.g.,* glutaraldehyde) as a presoaking or holding solution is NOT recommended.

Virtually all dental facilities use ultrasonic cleaning units as a primary method for cleaning contaminated instruments prior to heat sterilization. The historical snapshot of dental personnel routinely cleaning instruments using a scrub brush is just that, past history, thanks to the development and demonstrated effectiveness of mechanical instrument cleaners. The use of automated cleaning equipment such as ultrasonic cleaners or instrument washers does not require presoaking or scrubbing of instruments. These units are also safer and more efficient than manually cleaning contaminated instruments. In most dental offices, instruments are cleaned in an ultrasonic cleaner for a designated time period. The unit removes soil in a process using electrical energy to generate sound waves. When the sound waves travel through the liquid, millions of tiny bubbles form and burst continuously. This process, termed "cavitation," disrupts chemical bonds, which allow contaminants to adhere to solid surfaces. Specially formulated solutions are designed and tested for instrument cleaning in ultrasonic units and instrument washers. The ultrasonic solution must completely cover the items for cleaning to occur, and cleaning solutions should be changed at least daily or sooner if visibly contaminated. A perforated basket, tray, or rack should be used to keep instruments at the proper distance from the bottom of the tank, as this can reduce the amount of ultrasonic waves produced and may damage the unit. Ultrasonic units are also covered when in operation to decrease aerosols and avoid splashing of solution. When the cleaning is complete, the instruments should be rinsed under running water, inspected for residual blood or debris, and dried thoroughly.

Drying Instruments Prior to Packaging and Sterilization

Dental personnel responsible for instrument processing frequently ask whether cleaned instruments, cassettes, and other items need to be dried before sterilization. The most common thought for not drying instruments before placing them in pouches or wraps is that the instruments are going to get wet during exposure to steam, which is 100% water vapor, during the cycle. There are problems with this line of thinking. The drying components of autoclave cycles are designed, manufactured, and calibrated to remove only the same amount of water vapor that is placed into the chamber during the cycle. Instruments that are still very wet when placed in packaging materials present an additional water burden for the sterilizer to remove. This can result in formation of wet packs. When packages come out wet, the paper on the pouch can funnel moisture or bacteria from a staff member's hands through the paper, compromising the integrity of the packaging. This is referred to as "wicking." Wet packaging is also much more susceptible to tearing and leakage than dry packaging. Lastly, wetness can cause certain instruments to corrode.

Loading Sterilizers

Manufacturers provide specific instructions for loading sterilizers, and correct loading of the chamber is essential for the success of the sterilization cycle. Heat sterilizers require free circulation of the sterilizing agent (*e.g.,* steam, dry heat, unsaturated chemical vapor) throughout the cycle. Unfortunately, during instrument reprocessing, the staff member may fill a sterilizer chamber with as many sealed pouches and wrapped packs as possible to get as much done in a single cycle. Why do manufacturers caution against this? In addition to increasing the warm-up time needed to achieve sterilization conditions, overloading the chamber can delay or even prevent thorough contact of the sterilizing agent with all items in the unit. Also, the chance of a failed biological monitoring test increases when a sterilizer is overloaded.

Storage of Sterilized Instruments

Wrapped or packaged sterile instruments should be stored in covered or closed cabinets whenever possible. They should not be stored under sinks or where they might become wet. Storage practices can be either date- or event-related. For date-related shelf-life practices, sterilized packages are expiration-dated and used on a "first in, first out" basis. Event-related shelf-life practices recognize that the product should remain sterile indefinitely unless an event causes it to become contaminated (such as torn or wet packaging). Sterilized packages should be inspected before opening and use to ensure the material has not been compromised (wet, torn, or punctured) during storage. If a package has been compromised, the contents should be reprocessed - that is, cleaned, packaged, and heat-sterilized again - before patient use.[5,14,15]

In summary, instrument sterilization and processing include multiple steps. Correct cleaning, packaging, sterilizer loading procedures, sterilization methods, and storage practices are essential to ensure that an instrument is adequately processed and safe for reuse on patients. It is important for the office staff to be familiar with each procedure. Office infection-control plans and training programs should include comprehensive information about this process.

Environmental Surface Cleaning and Disinfection

Treatment areas typically become contaminated with blood, saliva, and other body fluids during patient care. Certain bacteria, viruses, and fungi can survive on environmental surfaces for extended periods. Many can persist outside a host, remain infectious for prolonged intervals, and may also require more extensive disinfection procedures.[17,18] An unfortunate reminder of the ability of certain pathogens to remain viable outside of a host was published in May 2007. It involved patient-to-patient transmission of hepatitis B virus (HBV) in an oral surgery practice. The CDC was unable to determine the mechanism of viral cross-infection and could only speculate in the absence of definitive evidence.[19] HBV is a hardy hydrophilic virus and can persist in dried blood for seven days on inanimate surfaces. Infectious virions can remain on surfaces even in the absence of visible blood. One possibility for HBV transmission proposed by the CDC was that cross-infection occurred from environmental surfaces contaminated with blood from the source patient. HBV and certain other viruses tend to remain recoverable because of their minimal metabolic activity and relatively resistant structural components. For example, hepatitis C virus (HCV) has been shown to survive on dialysis unit environmental surfaces for up to 16 weeks. Resultant infections in patients in such a unit were traced back to inanimate surfaces.[20] Influenza viruses and rhinoviruses can also survive for hours or even days after cross-contamination from nasal secretions onto items such as light handles, pens, doorknobs, and countertops.

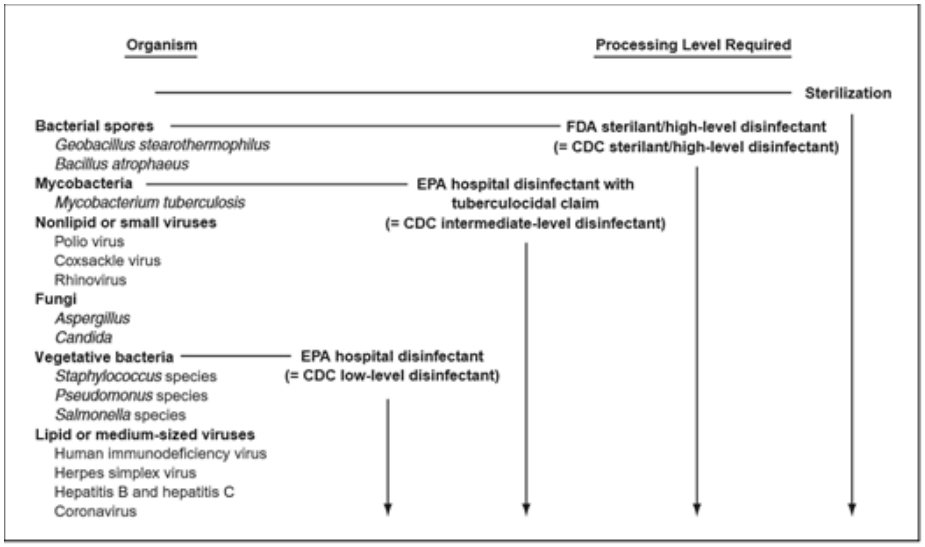
As with other infection control issues, much of the evidence addressing cross-infection from environmental surfaces has come from medical outbreaks and look-back investigations. Included are numerous instances of hospital-acquired infections involving bacterial pathogens.[18] A major emerging environmental problem is associated with methicillin-resistant *Staphylococcus aureus* (MRSA). *S. aureus* is among the most adaptable microorganisms and can remain viable in dried blood and exudate on environmental surfaces for weeks. Cross-infection usually occurs person-to-person via colonized or contaminated hands, but most staphylococcal strains have been shown to survive for weeks to months on contaminated inanimate surfaces. The presence of many of the virulent strains has also been confirmed during disease outbreaks in hospitals and other clinical settings. Another gram-positive coccus, *Enterobacter faecium*, is another common, serious microbial contaminant of medical equipment and environmental surfaces.[18] These bacteria are relatively hardy in the environment and can be detected for up to seven days on multiple surfaces.

Classification of Contaminated Patient-Care Items and Environmental Surfaces

Chemical disinfectants and sterilizing chemicals are classified by the CDC into three categories:[5]

1. Low-level: an EPA-registered disinfectant without a tuberculocidal claim. These are chemicals with the narrowest antimicrobial range and are also termed hospital-level disinfectants. They may kill a variety of viruses and bacteria, but do not kill tubercle bacteria, more resistant viruses, and many fungi.

Figure 2



Source: Adapted from Bond WW, Ott BJ, Franke K, McCracken JE. Effective use of liquid chemical germicides on medical devices; instrument design problems. In: Block SS, ed. Disinfection, sterilization and preservation. 4th ed. Philadelphia, PA: Lea & Gebiger, 1991:1100.

2. Intermediate-level: an EPA-registered disinfectant with a tuberculocidal claim. Although they do not inactivate bacterial endospores, intermediate-level disinfectants kill many other microbial forms, including tubercle bacteria (*i.e., Mycobacterium tuberculosis*). *M. tuberculosis* presents a severe challenge to disinfectants. This acid-fast, wax, and lipid-coated bacterium is routinely used as a test organism because of its resistance to many chemical agents. Documented tuberculocidal activity assures the user that the product is an intermediate- or high-level disinfectant and that it will kill microorganisms currently known to be potential pathogens in healthcare settings.

3. High-level: FDA-approved chemical agents capable of sterilizing items, but only after prolonged immersion intervals (*i.e.*, glutaraldehydes, hydrogen peroxide, peracetic acid). Disinfection of contaminated environmental surfaces does not require the use of chemical sterilants or high-level disinfection. Major distinctions between categories are shown in **Figure 2**.[5]

Selecting a Surface Disinfectant

The perfect surface disinfectant product has not yet been developed. However, advances in the chemistry of recent generations of formulations have resulted in numerous effective products. Many may be able to meet several of the ideal properties and offer expanded anti-microbial actions (**Table 4**).[17,21-23]

Environmental surfaces in the dental operatory are surfaces or equipment that do not directly contact the patient. As mentioned above, these surfaces frequently become contaminated during patient care and can serve as reservoirs for microbial cross-contamination. Environmental surfaces are classified as non-critical items and can be divided into **clinical contact** and **housekeeping** surfaces (**Table 5**).[24] Implicit in the definition of housekeeping environmental surfaces is the suggestion of a very small potential for cross-infection during treatment. The lack of evidence suggesting a risk to dental care providers or their patients represents the basis for recommendations in this area. Thus, the 2003 CDC infection control guidelines for dentistry recommended that most housekeeping environmental surfaces need only be cleaned with soap and water or an EPA-registered detergent/low-level disinfectant. The nature and type of surface and extent of contamination are determining factors for the level of chemical exposure. The use of impermeable disposable barriers for those clinical surfaces that cannot withstand exposure to chemical disinfectants should be accomplished between patients. For clinical surfaces that are not visibly contaminated with blood, saliva, or other body fluids and can tolerate chemical disinfection, an alternative recommendation is to clean and subsequently disinfect them using either an EPA-registered low-level disinfectant with an HBV and HIV inactivation claim, or an intermediate-level (*i.e.,* tuberculocidal) hospital disinfectant. If visibly contaminated with blood, clinical surfaces must be disinfected with an EPA-registered, intermediate-level disinfectant. This designation indicates that a disinfectant can kill *Mycobacterium tuberculosis, Staphylococcus aureus, Pseudomonas aeruginosa, Salmonella typhimurium, Escherichia coli*, representative fungi, hydrophilic viruses, and lipophilic viruses.

Surface Barriers

There are two effective approaches to reduce the potential for cross-contamination and cross-infection from dental environmental surfaces.

Table 4 - Properties of an Ideal Disinfectant

1. Broad-spectrum of antimicrobial activity: should have kill claims for the most prevalent healthcare pathogens; effective as intermediate-level disinfectants.
2. Fast acting: should have a rapidly lethal action on all forms of targeted microorganisms.
3. Good cleaning properties; should not be affected by physical factors, such as blood, saliva, and exudate.
4. Nontoxic to users and patients.
5. Surface compatibility: should not compromise the integrity of fabrics, dental equipment, metallic surfaces.
6. Residual antimicrobial effect on treated surfaces.
7. Easy to use: should be available in multiple forms, such as sprays and wipes. Disinfectant wipes should also be made of a durable substrate that will not tear or dry out quickly.
8. Acceptable odor to users and patients.
9. Eco-friendly: should not be able to form chemical residues that can potentially harm natural environmental systems.
10. Economical: cost should not be prohibitively high Germicides manufactured for environmental surface disinfection are regulated and registered by the Environmental Protection Agency (EPA), in contrast to products marketed as antiseptics, which are formulated for use on living tissues are regulated by the Food and Drug Administration (FDA).

Table 5 - Categories of Environmental Surfaces in Dental Settings

Type of Surface	Definition	Examples
Clinical Contact	Surfaces that are frequently touched or that become contaminated and subsequently contact instruments, devices, hands or gloves.	Light handles, switches, dental x-ray equipment, chairside computers, drawer handles, faucet handles, countertops, pen, telephone handle, doorknob
Housekeeping	Surfaces that do not come into contact with patients or devices used in dental procedures	Floors, walls, sinks

These involve either the use of surface barrier covers to prevent the surface or item from becoming contaminated or cleaning and disinfecting the surface after contamination occurs. Surface barriers include a variety of single-use disposable covers which are impervious to moisture. Using barriers to protect surfaces and equipment is useful, especially if the surfaces are: 1) touched frequently by gloved hands during patient care; 2) likely to be contaminated with blood or other potentially infectious materials; or 3) difficult to clean (*e.g.,* chair control panels, air/water syringe buttons, light handles).[5,25] Adoption of certain surface covers depends on evaluation of potential advantages and disadvantages for their inclusion in an overall infection control program (**Table 6**).

A long-standing infection control recommendation in this area states that disposable barriers should be removed and discarded between patients while dental personnel are still wearing gloves, because these items can become contaminated during patient care. In addition, it is not necessary to clean and disinfect a properly covered surface between patients unless the barrier fails, or the surface becomes accidentally contaminated during treatment.

Personal Protective Equipment (PPE)

The routine use of PPE is important to prevent tissue contact with potentially infectious pathogens and materials between HCW and their patients. Prior to the COVID-19 pandemic, infection control regulations and recommendations stated that HCW must wear protective attire including disposable gloves, eyewear and protective clothing when: 1) performing treatment procedures which generate splash, spatter, contact with body fluids or mucous membranes or 2) touching items or surfaces that may be contaminated with body fluids (**Table 7**). However, COVID-19 forced healthcare workers to face a new standard regarding airborne SARS-CoV-2 viruses. Previous PPE recommendations had to be revised to include strategies addressing respiratory precautions.

Gloves

Properly fitting gloves protect HCW from direct exposure through visually undetected cuts and abrasions on the hands. Gloves used during patient care are single-use items and must not be used when providing care for another patient or be washed for reuse. The American Dental Association (ADA) initially approached the issue of practitioners wearing disposable gloves in an important 1976 publication aimed at protecting dental clinicians from occupational HBV infection.[26] This recommendation was reinforced and expanded in a later ADA publication.[27] In today's healthcare environment the routine use of disposable gloves is the single most important application of PPE use.

Traditionally, the most common type of glove worn during patient treatment has been comprised of latex. This material can be manufactured in multiple sizes and specifications (ambidextrous, right or left hand, low powder, powder-free, low protein), affords a comfortable fit and tactility for most users, and provides an effective barrier during the time interval needed to provide most dental procedures. Unfortunately, clinical manifestations of latex allergies in HCWs and the population at large caused a large percentage of HCWs to now

Table 6 - Factors to Consider for Use of Surface Disposable Covers

Advantages	Disadvantages
1. Prevent cross-contamination 2. Protect difficult-to-clean surfaces 3. Less time consuming than cleaning and disinfection 4. Reduces use of potentially harmful chemicals 5. Clinical Contact	1. Need a variety of sizes and types of covers 2. Many plastic items are non-biodegradable 3. Undesirable aesthetic appearance 4. Additional costs over chemical sprays and wipes

Table 7 - Personal Protective Equipment before COVID-19

Face Mask	Protective Clothing	Protective Eyewear
1. It must fit the face well to minimize open spaces on the side of the face. 2. It should be able to prevent penetration of particles generated during the procedure for which the mask is worn. 3. It should not rest against the mouth, as the wearer's breath can condense and wet the fabric.	1. The outer occupational garment should be fluid resistant, not fluid proof. 2. Appropriate garment material should not permit blood or other potentially infectious fluids to pass through or reach the health-care worker's clothes or epithelial/mucosal tissues. 3. For routine dental procedures, cotton or cotton/polyester laboratory coats or clinic jackets with cuffs are satisfactory. 4. Protective garments must be changed at least when visibly soiled. 5. Protective garments must be removed before leaving the workplace.	1. It should have solid sideshields to afford peripheral protection. 2. It must meet the American National Standards Institute Occupational and Educational Eye and Face Protection Standard for impact resistance. 3. It should be able to withstand cleaning and disinfection between patient procedures. 4. It should not distort the operator's vision. 5. A faceshield worn with a mask can be worn when greater protection is desired.

wear nitrile gloves. Other types of disposable gloves include chloroprene, medical vinyl, and neoprene. Sterile latex or similar treatment glove materials is indicated when surgical procedures are performed. Sterile gloves are available as right- and left-handed fitted items and offer clinicians excellent tactility, comfort and dexterity.

Puncture and chemical resistant reusable utility gloves are a type of non-treatment glove routinely worn when dental personnel handle and clean contaminated instruments, clean the operatory area, or complete surface cleaning and disinfection procedures. These gloves are puncture-resistant, resistant to chemical toxicity, and able to withstand multiple cleaning and disinfection exposures. They are usually comprised of nitrile or neoprene. Some types can withstand repeated heat sterilization in an autoclave. A summary of considerations for the selection of gloves is provided in **Table 8**.

Face Masks and Respirators

Dental HCWs are routinely exposed to variable concentrations of aerosols, sprays, spatter, and/or splashes during various treatment procedures. Examples include the use of a dental handpiece, ultrasonic scaler, ultrasonic scaling devices, and air/water syringes; while grinding items contaminated with oral secretions; or when cleaning contaminated instruments. In addition to the SARS-CoV-2 virus, airborne microorganisms that can be infectious via this route of exposure include *staphylococci, streptococci, tubercle bacilli, rubeola* (measles) viruses, herpesviruses, cold viruses, and influenza viruses.[28]

Based on the documented transmission of the SARS-CoV-2 virus via an airborne modality, dental professionals had to adopt additional respiratory equipment and practices protocols protect against occupational exposure. This included development of a respiratory protection plan, use of N95 respirators for aerosol-generating procedures, additional PPE, and suggested approaches for improving air quality in treatment areas.[29,30] Earlier guidelines consistently recommended the use of high-volume evacuation (HVE) and a rubber dam whenever possible. Application of these devices can substantially decrease the potential for contamination from saliva or blood.[28]

Table 8 - Considerations for Selection of Gloves

Considerations	Examples
Material	• latex, vinyl, nitrile, chloroprene, neoprene
Skin Sensitivity	• allergies to latex or nitrile • hand perspiration
Size	• proper size, lightweight and pliable • snug fit without hand constriction • appropriate finger length • fits palm without compression
Tactile Sensation	• grip • glove thickness • slipperiness of glove material when wet
Function	• non-sterile gloves • sterile gloves surgical procedures • utility gloves for instrument reprocessing and clean-up procedures

Reprinted with permission of THE DENTAL ADVISOR

Table 9

	ASTM Level 1	ASTM Level 2	ASTM Level 3
FLUID RESISTANCE, mmHg	80	120	160
BFE	≥95%	≥98%	≥98%
PFE, @ 0.1 micron	≥95%	≥98%	≥98%
DELTA P, mm H_2O/cm^2	<4.0	<5.0	<5.0
FLAME SPREAD	Class 1	Class 1	Class 1

FLUID RESISTANCE:
- represents mask's resistance to penetration by synthetic blood under pressure (mmHg)
- measures ability of mask's construction to minimize fluids from traveling through the material and potentially coming into contact with the wearer
- higher the fluid resistance (filtration), the better the protection

BFE (Bacterial Filtration Efficiency):
- represents percentage of bacteria filtered out at pore size of 1 – 5 microns
- the measure of efficiency of the mask filtering bacteria through it

PFE (Particulate Filtration Efficiency):
- represents percentage of particles filtered out at a pore size of 0.1 – 1.0 microns
- the measure of the efficiency of the mask in filtering particles passing through it
- the size of the particles filtered is critical

DELTA P (Differential Pressure):
- represents the pressure drop across the mask or resistance to air flow in mmH_2O/cm^2
- determines breathing resistance
- higher the Delta P, the less breathability, but the better the filtration

FLAME SPREAD:
- measures flame spread of the mask material

Face Masks

Masks that cover the mouth and nose can effectively reduce the inhalation of potentially infectious airborne particles. They also protect mucous membranes of the mouth and nose from direct contamination via spatter, splashes, or sprays of blood or OPIM. Their importance requires that clinicians understand the properties of an ideal face mask when selecting one for their own use. These properties include: 1) does not contactthe nostrils or lips; 2) has a high bacterial filtration efficiency (BFE) rate; 3) fits snuggly around its entire periphery; 4) does not cause fogging of eyewear; 5) is easy to put on and remove; 6) is made of a fabric that does not irritate skin or induce allergic reactions; and 7) is made of a fabric that does not collapse during wear or when wet.

An FDA-approved mask will protect against microbe-laden sprays, splashes, and droplets. During routine use a facemask should be carefully adjusted to mold to the face. It should be changed between patients and more frequently when exposed to heavy spatter and/or droplets or if it becomes moist or wet.

The American Society of Testing and Materials (ASTM) developed testing methods to determine performance specifications of materials in face masks used in healthcare facilities. These are summarized in **Table 9**.

Filtration of airborne particles is a basic mask function and it is determined by the size of the pores in the mask material (in microns) and the filtration efficacy (*i.e.,* percentage of particles filtered out by the mask).

N95 Respirators

An N95 respirator is a respiratory protective device designed to achieve a very close facial fit and effectively filter small airborne particles (*i.e.,* aerosols). The edges of this respirator are designed to form a close seal around the nose and mouth. Wearers must be initially fit-tested with an N95 respirator before use in patient care settings where aerosol-generating procedures are being performed. N95 respirators include standard and surgical N95 respirators. All N95 respirators used in healthcare and other occupational settings must be approved by the National Institute of Occupational Safety and Health (NIOSH). In contrast to surgical masks, these devices and other NIOSH-approved respirators can filter airborne contaminants with a minimum size of 0.3 microns. In contrast, surgical facemasks protect against sprays, splashes, and large droplets. A comparison of major features of N95 respirators and face masks is presented in **Table 10.**

When choosing respiratory PPE for patient treatment, dental HCWs should use their clinical judgment to determine the appropriate level of barrier and respiratory protection based on the length of the procedure, the amount of fluid or aerosol generated, and standard precautions (**Table 11**).

Protective Eyewear

During dental procedures, large particles of debris and saliva can be ejected toward the oral health care provider's face. These particles can contain large concentrations of bacteria and can physically

Table 10

Understanding the Difference

	Surgical Mask	N95 Respirator
Testing and Approval	Cleared by the U.S. Food and Drug Administration (**FDA**)	Evaluated, tested, and approved by **NIOSH** as per the requirements in *42 CFR Part 84*
Intended Use and Purpose	Fluid resistant and provides the wearer protection against large droplets, splashes, or sprays of bodily or other hazardous fluids. Protects the patient from the wearer's respiratory emissions.	Reduces wearer's exposure to particles including small particle aerosols and large droplets (**only non-oil aerosols**).
Face Seal Fit	Loose-fitting	Tight-fitting
Fit Testing Requirement	No	Yes
User Seal Check Requirement	No	Yes. Required each time the respirator is donned (put on)
Filtration	Does NOT provide the wearer with a reliable level of protection from inhaling smaller airborne particles and is not considered respiratory protection	Filters out at least 95% of airborne particles including large and small particles
Leakage	Leakage occurs around the edge of the mask when user inhales	When properly fitted and donned, minimal leakage occurs around edges of the respirator when user inhales
Use Limitations	Disposable. Discard after each patient encounter.	Ideally should be discarded after each patient encounter and after aerosol-generating procedures. It should also be discarded when it becomes damaged or deformed; no longer forms an effective seal to the face; becomes wet or visibly dirty; breathing becomes difficult; or if it becomes contaminated with blood, respiratory or nasal secretions, or other bodily fluids from patients.

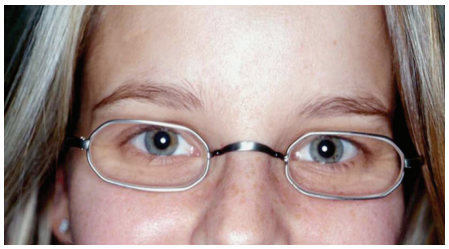
This information provides clarification regarding respirator and mask use in workplaces in which employees are exposed to respiratory hazards, it is not specific for the COVID-19 pandemic.

Table 11 - Representative Applications of Respiratory PPE in Dentistry

ASTM Level Masks			NIOSH
Level 1	**Level 2**	**Level 3**	**N95 Respirator**
• Patient exams • Operatory cleaning/maintenance • Impressions • Lab trimming, finishing and polishing • Orthodontics	• Limited oral surgery • Endodontics • Prophylaxis • Restoratives/composites • Sealants • Scaling and root planing	• Complex oral surgery • Crown preparation • Implant placement • Periodontal surgery • Use of ultrasonic scalers (Magnetostrictive and Piezo) • Laser based applications	• Indicated for use when treating patients with airborne diseases such as TB, measles, COVID-19 • When smoke, mists/gases/vapors/ sprays are present

damage the eyes. Protective eyewear is necessary to prevent both physical injury and infection from aerosolized oral microbes. Of particular concern are the herpes simplex viruses and *Staphylococcus aureus*; however, the normal oral flora must also be considered opportunistic ocular pathogens. Eyewear that provides the best protection has side shields and is large enough to adequately cover and protect the wearer's eyes from injury. Some models are made to fit over the regular corrective glasses. Personal eyeglasses are not considered PPE (**Figure 3**), as they may be too small to protect the eyes from airborne debris and macroscopic or microscopic particles. Using protective eyewear with solid side shields and a surgical mask is adequate for procedures where small amounts of spatter or splashes are likely. Adding a clear plastic disposable or non-disposable face shield may be helpful when more protection is desired. When wearing a face shield DHCP must also wear a mask. Face shields can extend from the chin to the crown, and some even wrap around the sides of the head offering side protection. The patient should wear protective eyeglasses to prevent injury from accidentally dropped instruments, chemical splashes, and other foreign objects. Contaminated reusable protective eyewear should be washed thoroughly with soap and water, rinsed well, and if visibly soiled, disinfected between patients, according to the manufacturer's instructions.[5]

Figure 3



Eyewear that is not sized or designed for use during dental treatment does not provide sufficient protection from airborne macroscopic or microscopic trauma to the eyes.

Protective Clothing

The 1991 OSHA Bloodborne Pathogens Standard mandated employers to address employee protective clothing:

"Gowns, Aprons, and Other Protective Body Clothing: Appropriate protective clothing such as, but not limited to, gowns, aprons, lab coats, clinic jackets, or similar garments shall be worn in occupational exposure situations. The type and characteristics will depend upon the task and degree of exposure anticipated."[31]

For routine dental procedures, cotton or cotton/polyester high-neck, long-sleeved laboratory coats or clinic jackets with elastic or stocking net cuffs are satisfactory. The end of the sleeves should be fashioned so that gloves can be cuffed up over them to protect the forearm. Prior to COVID-19, infection control recommendations included guidelines for protective clothing being changed at least daily, or when visibly soiled.

Summary

The oral healthcare professional must protect their patients and staff from the hazards associated with dental procedures. This article builds upon the information presented in QRG, *Infection Control and OSHA Update Part One 6th Edition*. A discussion of the essential elements of effective instrument processing and sterilization, surface disinfection, sharps injury prevention, and personal protective equipment selection and use is presented. Each practice must have a written infection control plan that embodies the principles of infection control and occupational health; reflects current science; and adheres to relevant federal, state, and local regulations and statutes.

References

1. OSHA, NIOSH. Identifying hazard control options: the hierarchy of controls. Available at: https://www.bing.com/search?q=OSHA%2C+NIOSH.+Identifying+hazard+control+options%3A+the+hierarchy+of+controls&form=ANNTH1&refig=c833aa85747346e38e47ed1960a4ce73&pc=DCTS. Accessed December 29, 20204.
2. OSHA. Guidance on preparing workplaces for COVID-19. (March 2020) Available at: https://www.osha.gov/Publications/OSHA3990.pdf. Accessed December 29, 2024.
3. OSHA. Protecting workers guidance on mitigating and preventing the spread of COVID-19 in the workplace (January 29, 2021) Available at: https://www.osha.gov/coronavirus/safework. Accessed December 29, 2024.
4. Harte JA, Molinari JA. Sterilization procedures and monitoring. In: Molinari JA, Harte JA, eds. Cottone's Practical Infection Control in Dentistry. 3rd ed. Philadelphia, PA: Wolters Kluwer/ Lippincott Williams & Wilkins;2010:148-170.
5. CDC. Guidelines for infection control in dental health-care settings. MMWR 2003;52(No. RR-17)1-66.
6. Molinari JA. Instrument recirculation: maximizing the process. Dent Econ. (2016).
7. ADA Council on Dental Therapeutics. Type B (serum)hepatitis and dental practice. 1976;92(1):153-9. doi: 10.14219/jada.archive.1976.0303.
8. ADA Council on Dental Materials and Devices, Council on Dental Therapeutics. Infection control in the dental office. J Am Dent Assoc. 1978;97:673-677.
9. CDC. Recommended infection control practices for dentistry. MMWR 1986;35:237-242.
10. CDC. Recommended infection control practices for dentistry. MMWR 1993;41(RR-8):1-12
11. ADA Infection control recommendations for the dental office and the dental laboratory. Council on Dental Materials, Instruments, and Equipment. Council on Dental Practice. Council on Dental Therapeutics. J Am Dent Assoc J Am Dent Assoc. 1988 Feb;116(2):241-8. doi: 10.14219/jada.archive.1988.0341.
12. ADA. Infection control recommendations for the dental office and the dental laboratory. J Am Dent Assoc. 1992;123:1-8.
13. ADA Councils on Scientific Affairs and Dental and the Dental Practice. Infection control recommendations for the dental office and the dental laboratory. J Am Dent Assoc. 1996; 127:672-680
14. CDC. Summary of Infection Prevention Practices in Dental Settings: Basic Expectations for Safe Care. Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services; October 2016.
15. CDC. Best practices for sterilization in dental settings. (May15, 2024) Available at: https://www.cdc.gov/dental-infection-control/hcp/dental-ipc-faqs/dental-sterilization.html. Accessed December 29, 2024.
16. Hastreiter RJ, Molinari JA, Falken MC, et al. Effectiveness of Dental Office Instrument Sterilization Procedures. J Am Dent Assoc. 1991;122(10):51-6. doi: 10.14219/jada.archive.1991.0291.
17. Assar SK, Block SS. Survival of microorganisms in the environment. In: Block SS, ed. Disinfection, Sterilization and Preservation. 5th edition. Philadelphia, PA: Lippincott Williams & Wilkins;2001:1221-1242.
18. Otter JA, Yezli S, French GL. The role played by contaminated surfaces in the transmission of nosocomial pathogens. Infect Control Hosp Epidemiol. 2011;32(7):687-99. doi: 10.1086/660363.
19. Redd JT, Baumbach J, Kohn W, et al. Patient-to-patient transmission of hepatitis B virus associated with oral surgery. J Infect Dis. 2007;195(9):1311-4. doi: 10.1086/513435. Epub 2007 Mar 21.
20. Paintsil E, Binka M, Patel A, et al. Hepatitis C virus maintains infectivity for weeks after drying on inanimate surfaces at room temperature: implications of risks of transmission. J Infect Dis. 2014;209(8):1205-11. doi: 10.1093/infdis/jit648. Epub 2013 Nov 23.
21. Molinari JA, Harte JA. Environmental surface disinfection control: disposable barriers and chemical disinfection. In: Molinari JA, Harte JA, eds. Cottone's Practical Infection Control in Dentistry. 3rd ed. Philadelphia, PA: Wolters Kluwer Lippincott Williams & Wilkins;2010: 171-184.
22. Rutala WA, Weber DJ. Selection of the ideal disinfectant. Infect Control Hosp Epidemiol. 2014;35(7):855-65. doi: 10.1086/676877.
23. Molinari JA. Environmental surface asepsis: principles, applications, and issues. Inside Dent. March 2009;62-63
24. Schneiderman MT, Cartee DL. Surface Disinfection. In: Depaola LG, Grant LE, eds. Infection Control in the Dental Office. Springer Nature; 2019:169-191.
25. Molinari JA. Environmental surface barriers. Educational article sponsored by Palmero Healthcare (2023)
26. American Dental Association. Type B (serum) hepatitis and dental practice. Council on Dental Therapeutics. 1976;92(1):153-9. doi: 10.14219/jada.archive.1976.0303.
27. American Dental Association. Infection control in the dental office. Council on Dental Materials and Devices Council on Dental Therapeutics. J Am Dent Assoc. 1978; 97:673–677.
28. Harrel SK, Molinari JA. Aerosols and splatter in dentistry. a brief review of the literature and infection control implications. J Am Dent Assoc. 2004;135(4):429-37. doi: 10.14219/jada.archive.2004.0207.
29. CDC. Guidance for dental settings: Interim infection prevention and control guidance for dental settings during the COVID-19 response (May 19,2020) Available at: https://stacks.cdc.gov/view/cdc/88256. Accessed December 29, 2024.
30. CDC. Infection control guidance for healthcare professionals about coronavirus (COVID-19). (June 3, 2020) Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control.html. Accessed December 29, 2024.
31. OSHA. Final Rule on Occupational Exposure to Bloodborne Pathogens. (December 6, 1991) Available at: osha.gov/laws-regs/federalregister/1991-12-06. Accessed December 29, 2024.

POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the "Online Exam." We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(2.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **A recommended infection control precaution for dentistry is:**
   a. Routine use of sterile gloves during provision of dental treatment.
   b. Sterilization of contaminated environmental surfaces
   c. Use of short-sleeve clinic jackets during patient care.
   d. Cleaning of contaminated instruments before sterilization

2. **Which of the following chemical monitors can be used to check the effectiveness of an autoclave sterilization cycle?**
   a. Autoclave tape
   b. External and internal pouch indicators
   c. Type V integrators
   d. All of the above

3. **Considerations for the use of Personal Protective Equipmentby treatment providers include:**
   a. the use of ambidextrous non-sterile gloves when surgical procedures are performed.
   b. use of puncture-resistant utility gloves when handling and cleaning contaminated instruments.
   c. use of ASTM Level 2 masks when treating a known infectious tuberculosis patient.
   d. use of protective eyewear that is large enough and has side shields to protect the eyes from airborne debris.
   e. Both b and d only

4. **It is recommended that face masks be changed:**
   a. only when they become wet.
   b. between patients.
   c. daily
   d. twice per day.

5. **With regard to instrument re-processing and sterilization procedures:**
   a. Proof of sterilization is achieved when the indicators on heat-processed pouches change color.
   b. CDC guidelines for re-processing procedures primarily recommend cleaning instruments by manual scrubbing.
   c. Destruction of heat-resistant bacterial spores is considered the main validation of a sterilization process.
   d. Manual hand scrubbing of contaminated instruments is as efficient as ultrasonic cleaning.

6. **The visual demonstration of dark stripes on autoclave tape from a recently heat sterilized package of instruments package indicates:**
   a. that the contents are sterile
   b. that the processed items have gone through an autoclave cycle
   c. the sterilizer passes the biological monitoring recommendation
   d. None of the above

7. **The appropriate test microorganism to use for monitoring autoclaves and unsaturated chemical vapor sterilizers is:**
   a. *Bacillus subtilis.*
   b. *Geobacillus stearothermophilus.*
   c. *Mycobacterium tuberculosis.*
   d. Hepatitis B virus.

8. **Disinfection of visibly soiled clinic contact surfaces is best accomplished with the application of a/an:**
   a. Low level disinfectant
   b. Intermediate level disinfectant
   c. Soap and water preparation

9. **According to OSHA and the CDC, a Level 1 surgical mask can be safely used during aerosol-generating procedures.**
   a. True
   b. False

10. **Which of the following statements concerning instrument reprocessing is correct?**
    a. N95 respirators
    b. surgical face masks
    c. reusable face shields
    d. none of the above

Registration/Certification Information (Necessary for proper certification)

Name (Last, First, Middle Initial): _____

PLEASE PRINT CLEARLY

Street Address: _____ Suite/Apt. Number _____

City: _____ State: _____ Zip: _____

Telephone: _____ Email: _____

State(s) of Licensure: _____ License Number(s): _____

Preferred Dentist Program ID Number: _____ ☐ Check Box If Not A PDP Member

AGD Mastership: ☐ Yes ☐ No

AGD Fellowship: ☐ Yes ☐ No Date: _____

Please Check One: ☐ General Practitioner ☐ Specialist ☐ Dental Hygienist ☐ Other

FOR OFFICE USE ONLY

Evaluation - Infection Control and OSHA Update Part Two 6th Edition

Providing dentists with the opportunity for continuing dental education is an essential part of MetLife's commitment to helping dentists improve the oral health of their patients through education. You can help in this effort by providing feedback regarding the continuing education offering you have just completed.

Please respond to the statements below by checking the appropriate box, using the scale on the right.

	1 = POOR 1	2	3	4	5 = Excellent 5	
1. How well did this course meet its stated educational objectives?	☐	☐	☐	☐	☐	
2. How would you rate the quality of the content?	☐	☐	☐	☐	☐	
3. Please rate the effectiveness of the author.	☐	☐	☐	☐	☐	
4. Please rate the written materials and visual aids used.	☐	☐	☐	☐	☐	
5. The use of evidence-based dentistry on the topic when applicable.	☐	☐	☐	☐	☐	☐ N/A
6. How relevant was the course material to your practice?	☐	☐	☐	☐	☐	
7. The extent to which the course enhanced your current knowledge or skill?	☐	☐	☐	☐	☐	
8. The level to which your personal objectives were satisfied.	☐	☐	☐	☐	☐	
9. Please rate the administrative arrangements for this course.	☐	☐	☐	☐	☐	

10. How likely are you to recommend MetLife's CE program to a friend or colleague? *(please circle one number below:)*

10 **9** **8** **7** **6** **5** **4** **3** **2** **1** **0**

extremely likely — neutral — not likely at all

What is the primary reason for your 0-10 recommendation rating above?

11. Please identify future topics that you would like to see:

Thank you for your time and feedback.

MetLife

To complete the program traditionally, please mail your post test and registration/evaluation form to:
MetLife Dental Quality Initiatives Program | 501 US Highway 22 | Bridgewater, NJ 08807