Quality Resource Guide

Infection Control and OSHA Update - Part One

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Educational Objectives

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

1. Understand the rationale for effective infection control precautions.
2. Distinguish between OSHA Bloodborne Pathogens regulations and recommended isolation (*i.e.,* transmission-based), universal and standard precautions.
3. Comprehend recommended transmission-based precautions associated with controlling aerosols and airborne pathogens.
4. Discuss the most current health-care professional vaccination recommendations for hepatitis B and SARS-CoV-2 infection (COVID-19).
5. Describe biofilm accumulation and infection control challenges in dental devices that use water.
6. Utilize strategies that can minimize dental water contamination and reduce potential risks.

MetLife designates this activity for **1.0 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.

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

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Introduction

Infectious Diseases and the Health Care Worker

The history of infection control in healthcare settings, aimed at controlling transmission of a variety of infectious diseases, has been marked by steady progress highlighted with extraordinary individual achievements. Implementation of an extensive array of appropriate practices, devices, and procedures, initially required recognition of infectious disease risks as well as determined cooperation by numerous professional groups. This approach led to the development and refinement of new principles, procedures, and products to meet the increasingly complex demands of patient care. This direction has created a safer environment for both the patient and the healthcare worker (HCW). Routine application of effective infection control strategies continues to require a major commitment by medical and dental care providers, along with a willingness to respond to emerging biomedical information.

Infection control practices were initially developed in the early 1960s[1] to limit the potential transmission of bloodborne pathogens in clinical settings. The primary target of those precautions was hepatitis B virus (HBV). This viral pathogen remains the most infectious bloodborne microbial organism for the HCW. The use of standard infection control precautions is necessary to prevent its transmission. Even though HBV was documented as the major occupational microbial challenge, widespread implementation of infection control principles and procedures did not become integrated into many dental practices until after the emergence and recognition of the acquired immunodeficiency syndrome (AIDS) pandemic in the early 1980's. The same recommended protocols and procedures for minimizing HBV infection were subsequently applied to both human immunodeficiency virus (HIV), the etiologic agent of AIDS, and more recently, hepatitis C virus (HCV). The American Dental Association's (ADA) initial infection control recommendations were published in 1978,[2] however, it was the impact of HBV and HIV infections in the 1980's that forever changed the way dentistry is practiced.

The recognition that many persons infected with HIV, HBV and other microbial pathogens showed neither symptoms for extended periods, nor gave positive histories of prior infection, led the Centers for Disease Control and Prevention (CDC) to recommend the practice of treating all patients as though they are infected with HBV or HIV. This approach to patient care was termed "universal precautions". This terminology has been modified in recent years to "standard precautions".

It is important to understand that while the rationale for infection control remains the same, the information contained in infection control practices and protocols is not static, and must be modified in response to challenges presented by new microbial diseases. In 2020, the world was forever changed and required to face a new normal with the deadly emergence of SARS-CoV-2 virus and the COVID-19 pandemic. Delivery of health care has also been significantly impacted. The following discussion will provide an update of recently instituted infection prevention precautions for dentistry, as well as consideration of long standing, representative components of a practical dental infection control program.

Guidelines and Regulations

It is important to realize that the Occupational Safety and Health Administration (OSHA) and the Center for Disease Control (CDC) are two completely different governmental agencies with different mandates (**Table 1**). The CDC develops guidelines designed to protect both the patient and the HCW, while OSHA regulations apply only to the latter. Guidelines published by the CDC or other advisory agencies do not carry the weight of law possessed by a regulatory agency such as OSHA. OSHA has the authority to require and enforce compliance with recommended infection control practices and procedures. OSHA relies upon appropriate authorities, including the CDC, to provide background information when they formulate their standards. It is important that dental providers be aware of updates or changes to recommended infection control practices to provide the safest environment possible for their patients and employees, as well as to remain in compliance with OSHA regulations.

Governmental regulations from federal agencies such as the OSHA, and state and local health departments, require the HCW to be trained in appropriate infection control practices and other safety precautions. They also require application of these measures during patient care to reduce

Table 1 - OSHA Regulations vs. CDC Recommendations

OSHA • Regulatory agency • Set and enforce standards • Investigates and inspects • Blood-borne Pathogen Standard 29 CFR 1910.1030 and CPL 2-2.69 • Employee protection
CDC • Non-regulatory agency • Science- and Evidence-based Guidelines/Recommendations • Morbidity and Mortality Weekly Report Recommendations and Reports • Often enforced by state

potential risks of disease transmission to the patient and the HCW. The development of a specific set of OSHA regulations to protect the HCW from occupational risks associated with bloodborne disease transmission began in the 1980's when unions representing HCWs petitioned OSHA to require employers to have a workplace free from recognized harm. More specifically, unions wanted employers to protect employees from occupational HBV infection. After a series of public hearings, OSHA published the Bloodborne Pathogens Standard on December 6, 1991.[3] These regulations were based on CDC universal precautions recommendations and went into effect in early 1992.[4] The OSHA standard imposed obligations on employers to provide safe and healthful work environments for all HCWs. Requirements included work practice controls, engineering controls, personal protective equipment, and administrative controls.

In the dental setting these controls can be described as:

1. work practice controls relating to the manner in which a task is performed and advising the use of safer work practices designed to minimize the risk of disease transmission;
2. engineering controls that are technology-based (refer to items or instruments that isolate a hazard, such as a sharp's disposal container);
3. personal protective equipment including the use of gloves, masks, protective eyewear, and protective clothing to prevent contamination of the HCW during the delivery of dental care.
4. administrative controls (the policies, procedures and practices within a dental office that reduce risks associated with bloodborne disease transmission).

Revisions to the Bloodborne Pathogens Standard were mandated in 2001.[5] These revisions clarified the need for employers to consider safer needle devices as they become available and to involve employees directly responsible for patient care (*e.g.*, dentists, hygienists, and dental assistants) in identifying and choosing such devices. Engineering controls are available which can be used as the primary method to reduce exposures to bloodborne pathogens. The controls include sharps containers, self-sheathing needles, safety scalpels with retractable blades or covers, as well as safer medical devices, such as sharps with engineered sharps injury protection and needleless systems. Dental anesthetic syringes and needles that incorporate safety features have been developed for dental procedures, and their implementation and routine use in dental facilities is increasing. In 2015 OSHA also published revisions to previous regulations related to occupational exposures to tuberculosis in healthcare facilities. This instruction provided information concerning OSHA's general enforcement policy and procedures for conducting inspections and issuing citations related to occupational tuberculosis (TB) hazards.[6]

The rapid spread and impact of the COVID-19 pandemic on all workplaces required OSHA to respond in March 2020 with a series of recommendations in a booklet entitled Guidance on Preparing Workplaces for COVID-19.[7] In addition to providing guidance to protect workers and the public against COVID-19 disease, the dental profession was categorized by OSHA as an overall "Very High Risk" category for COVID-19. This assessment was due to the potential for exposure to known or suspected sources of SARS-COV-2 during specific aerosol-generating procedures (AGPs). AGPs may include, in dentistry, procedures using high and low speed handpieces, ultrasonic scalers, air/water syringes and air polishing. OSHA further designated risk levels broken down by task. Later OSHA infection control directives and recommendations were published as new science-based evidence became know about this airborne disease. That evidence led to updates and reinforcement of OSHA's "hierarchy of controls" for limiting the spread of COVID-19 (**Table 2**).[8] Many of these steps were also incorporated into CDC recommendations for COVID-19 infection control in dental settings.[9-10]

Standard Precautions

Earlier infection control recommendations for dentistry have routinely focused on the use of universal precautions (UP). These precautions were designed to prevent the transmission of HBV, HIV, HCV and other bloodborne pathogens during treatment procedures. While the adoption and

Table 2 - Protecting Workers: Guidance on Mitigating and Preventing the Spread of COVID-19 in the Workplace

Identification of combinations of control measures to limit the spread of COVID-19 in the workplace, in line with principles of hierarchy of controls published by OSHA in 2020:

a. eliminating the hazard by separating and sending home infected or potentially infected people from the workplace;
b. implementing physical distancing in all communal work areas (includes remote work and telework);
c. installing barriers where physical distancing cannot be maintained;
d. suppressing the spread of the hazard using face coverings;
e. improving ventilation;
f. using applicable personal protective equipment (PPE) to protect workers from exposure;
g. providing the supplies necessary for good hygiene practices; and
h. performing routine cleaning and disinfection. (OSHA. January 29, 2021)

While much of the content of previous guidelines remained unchanged, there were substantive modifications aimed at addressing droplet and airborne transmission of SARS-CoV-2 in clinical settings.

routine use of UP proved to be very successful in minimizing the potential for transmission of bloodborne pathogens, these practices did not eliminate the need to address disease-specific isolation precautions for non-bloodborne infections in outpatient settings.

A body substance isolation system (BSI) was proposed in the early 1990's that focused on the reduction of transmission of infectious materials from any moist body substances. The BSI was designed to address isolation procedures of all moist, potentially infectious body substances regardless of their presumed infectious status. The BSI system protocol advocated additional protection for the HCW, including immunization against selected infectious diseases transmitted by airborne or droplet modalities (measles, mumps, rubella, varicella) and the use of appropriate barriers (protective clothing).

CDC developed and published new guidelines for isolation precautions in hospitals in 1996,[11,12] in an effort to prevent any potential infectious problems that might arise as a result of the confusion between BSI and UP. The 1996 guidelines incorporated the major features of UP and BSI. Since that time, the use of Standard Precautions has replaced the use of both of its individual components. Standard Precautions apply to contact with blood, body fluids, secretions, and excretions (except sweat). Standard precautions should be used in the care of all patients. A second tier of precautions (Transmission-Based Precautions) is designed only for the care of specified patients. There are three types of Transmission-Based Precautions: Airborne, Droplet, and Contact Precautions. These additional precautions are sometimes needed in dental settings to interrupt transmission of highly transmissible or epidemiologically important pathogens (tuberculosis, influenza, and chicken pox).

Comprehensive dental infection control guidelines were published by the CDC in 2003.[13] In addition to the change in conceptual terminology from "universal" to "standard" precautions, this document contains updated knowledge pertaining to infectious disease and epidemiology, available dental devices, and practices. The rationale for the published recommendations is more detailed than contained in previous guidelines and includes the components of standard precautions noted above. A follow up this CDC update was published in 2016, based on application of Standard Precautions during patient care. This document served as a supplement to the 2003 recommendation by providing checklists pertaining to specific infection control areas, as well as updated references. These features were included to assist dental professionals in evaluating compliance with the CDC's science-and clinical-based recommendations.[14] As mentioned above, the CDC has also continued to update guidance and publish infection control recommendations to protect health care workers and patients against COVID-19.[10] Specific applications to dentistry will be discussed in later sections.

Table 3 - Transmission-based Precautions for Healthcare Facilities

Contact Precautions - for patients with known or suspected infections, diseases, or microorganisms that are spread by touching the patient or items in the room (MRSA, VRE, diarrheal illnesses, open wounds, RSV).

Droplet Precautions - to prevent diseases that are spread in large respiratory droplets caused by coughing, sneezing, and talking (pneumonia, influenza, whooping cough, bacterial meningitis).

Airborne Precautions - to prevent transmission of infectious microorganisms that remain suspended in air and travel great distances due to their small size (<5 μ) and spreading through air from one person to another (tuberculosis, measles, chickenpox)

Vaccine Recommendations

The widespread use of vaccination as a major public health strategy has historically proven to be extremely successful in providing protection against many childhood and adult infectious diseases. The benefits of vaccination were so dramatic in reducing the incidence of previously common infections, such as rubella, rubeola, mumps, polio, and diphtheria — and even eradicating smallpox — that the CDC cited vaccination as one of the 10 major public health achievements of the 20th century.[15] Thanks to widespread vaccination, an increasing percentage of the population has neither experienced nor seen many vaccine-preventable diseases.

Immunization of the HCW before they are placed at potential risk remains the most efficient and effective use of vaccines in health-care settings. An earlier perception that vaccination be limited to hepatitis B protection is clearly outdated. A trend of moving away from widespread dependency and use of antimicrobial chemotherapy has been gaining momentum since the early 1990's. A new phase of immunization practices is designed to protect the HCW from nosocomial transmission of additional vaccine- preventable infections such as influenza, measles, mumps, rubella, varicella, pertussis *(i.e.* whooping cough), and *Streptococcus pneumoniae* pneumonia.[9]

With specific regard to the hepatitis B vaccine, employers must provide it at no cost to any employee who may have occupational exposure to bloodborne pathogens, including dentists, dental assistants, dental hygienists, and lab technicians (full-time, part-time, temporary, and probationary employees) within 10 working days of initial assignment.[3] New employees can continue to provide patient care during the period required to complete the vaccination series. The time sequence for receipt of the vaccine has remained the same for each of the three currently marketed HBV vaccines, that is 0, 1, and 6 months for the three-injection regimen.

It also must be noted that employees may refuse to be vaccinated, but they must then sign the "Informed Refusal for Hepatitis B vaccination" form, currently found in Appendix A at the end of the Bloodborne Pathogens Standard.[3]

Presently, the U.S. Public Health Service guidelines do not recommend booster doses. However if a booster is recommended in the future, the employer must provide it at no cost to the employee. Documentation of hepatitis B vaccination should be placed in the employee's medical record.

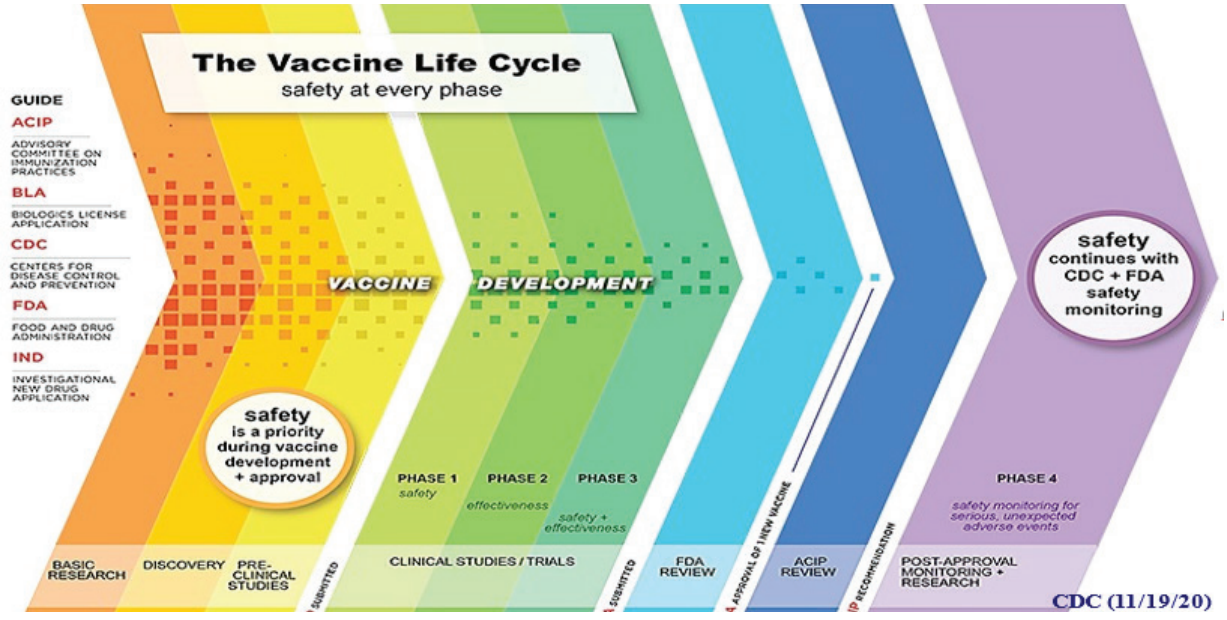
In 2020 the world was in the midst of the COVID-19 pandemic — the worst infectious disease crisis since the 1918-1919 Spanish flu. One of the positive scientific responses to COVID-19 was an aggressive global effort to develop effective vaccines against SARS-CoV-2, the etiologic agent for COVID-19. As of this writing, three vaccines have been developed, tested, and approved in the United States. Vaccines typically require years of developmental research and testing before governmental approval for widespread use in the population. Even though the Pfizer-BioNtech, Moderna, and Johnson & Johnson vaccines were approved by the FDA for Emergency Use Authorization (EUA) within a year after the projects began, the companies were still required to adhere to stringent safety and efficacy safeguards at each step in the process. These and other vaccines must meet established recognized CDC and FDA guidelines in muliple developmental stages: exploratory, pre-clinical, clinical, regulatory review and approval, manufacturing, and quality control.[16-18] A graphic summary of the required vaccine approval and safety monitoring steps from the CDC is shown in **Figure 1**.[19]

Dental Water Quality

It is known that non-pathogenic and pathogenic organisms contaminate the dental unit and its waterlines. These organisms quickly form biofilms inside the lumens of the waterlines. Although the water coming into the dental unit from an external source is of potable quality (< 500 cfu/ml of bacteria and < 1 coliform), water coming out of the unit may be contaminated up to 1 million cfu/ml.[20-22] This occurs because several factors (system design, flowrate, materials) promote bacterial growth and development of biofilm. Multiple types of organisms have been identified in dental unit water samples including: *Corynebacterium* species; gram-negative *bacilli* and *cocci*; *Klebsiella* species; *Pseudomonas* species, including *P. aeruginosa, P. pyogenes*, and *P. capacia*; *Staphylococcus epidermidis*; *Streptococcus mutans*, *S. salivarius,* and *S. mitis*; *Actinomyces* species; *Enterococcus* species; *a-hemolytic streptococci; Staphylococcus aureus; B. subtilis; Escherichia coli; Legionella pneumophilia; Mycobacterium* species; *Aspergillus niger;* and *Alkaligenes fecalis*. The Environmental Protection Agency, the American Public Health Association and the American Water Works Association establish standards for safe drinking water.[23] They have set limits of no more than 500 colony- forming units (CFUs) of heterotrophic bacteria per ml of drinking water Thus, the CDC and the ADA recommend that the number of bacteria in water used as a coolant/irrigant for non-surgical dental procedures should be as low as reasonably achievable and, at least < 500 CFU/ml, the regulatory standard for safe drinking water.[22,24]

Until recently, there was little published evidence of serious health problems for either a patient or HCW from contact with water from a dental unit. However, in early 2012 an article published in The Lancet[25] described the first documented case of a dental patient contracting Legionnaires' Disease from water used during treatment. Subsequently in 2015[26] and 2016,[27] two outbreaks of *Mycobacterium abscessus* infections were reported among pediatric dental patients after treatment with dental

Figure 1 - FDA Required Steps for Vaccine Approvals



water that was heavily colonized with bacteria. These tragic cases reinforce the premise that exposing patients or dental personnel to water of poor micro-biological quality is inconsistent with both universally accepted infection control principles and the high level of asepsis standards routinely exhibited in most dental offices.

Successful engineering and manufacturing approaches to improve water quality continue to provide dental professionals with choices for exerting better control over the quality of source water used in patient care.

These include:

1. An alternate water supply that bypasses the community and dental unit water by providing sterile and/or distilled water directly into waterline attachments from a separate reservoir, combined with chemical treatment.
2. Filtration involving in-line filters to remove bacteria immediately before dental unit water enters instrument attachment.
3. Chemical disinfection involving periodic flushing of lines with a disinfectant followed by appropriate rinsing of lines with water, or a continuous release chemical disinfection system.
4. Thermal inactivation of facility water at a centralized source.
5. Reverse osmosis or ozonation using units designed for either single chair or entire practice water lines.
6. Ultraviolet irradiation of water prior to entrance into individual unit waterlines.[13]

Water used for irrigation, or as a coolant, during therapy that does not involve surgery (excision, incision or reflection of tissue) and/or exposure of bone can be of potable quality (<500 cfu/ml) and need not be sterile. When therapy involves surgery or exposes bone, sterile water or saline must be used to reduce the chance of postoperative infection. In these cases, the water delivery system must be sterile to avoid contaminating the water/saline. Filtered and bacteria-free water is not necessarily sterile water and therefore filtered or distilled water is not to be used in this instance. The clinician should also remember that conventional dental units cannot reliably deliver sterile water even when equipped with independent water reservoirs because the water-bearing pathway cannot be reliably sterilized. Sterile water systems for surgery procedures must bypass the dental unit and employ sterile disposable or autoclavable tubing. In addition, handpieces or ultrasonic scalers used during surgical procedures must deliver sterile water or other solutions using sterilizable or single-use, disposable tubing.[28]

The keys for accomplishing dental unit waterline asepsis remain the same as for other infection control goals - application of basic infection control principles and compliance with product instructions. Contaminated waterlines, like contaminated hands, instruments, and environmental surfaces, should be cleaned first to remove accumulated microbial and extracellular material before treatment. Compliance with a manufacturer's step-by-step procedures for accomplishing this removal is essential. Minimizing subsequent waterline colonization may require another series of protocols, some of which may be more time consuming than anticipated. Thus, the whole dental team needs to be aware of product costs, necessity for compliance, and the time required to reach recommended waterline microbial concentrations. Research developments in recent years have led to not only greater individual options for dental practitioners, but also the availability of combination system products, which contain separate waterline cleaning agents and maintenance chemicals.

Summary

Effective infection control must occur as a routine component of dental professional activity. Much has been accomplished over the years. Implementation and routine application of a vast array of logical, effective techniques and procedures have served to protect both the HCW and their patients who expect safe care. Recognition, understanding, and compliance with appropriate recommendations by dental professionals, health professional organizations, and regulatory governmental agencies continue to have a major impact on the way dental treatment is provided. The field of infection control is constantly changing with the development of new products and techniques. Readers should periodically review publications of new or updated guidelines and documents to stay informed of current infection control recommendations and practices as new information and technologies become available. It is important to respond to emerging challenges in this area by not only realizing the success of the practices called for years ago, but also realize we must remain current in our infectious disease control approaches.

Infection Control and OSHA Update Part Two 5th Edition describes additional office procedures for infection control.

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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.

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

1. **The primary objective of standard infection control precautions is to:**
   a. provide a sterile environment for dental treatment.
   b. primarily protect the patient from cross-contamination.
   c. protect health professionals against exposure from infectious pathogens.
   d. primarily protect the patient from cross-infection.

2. **At the present time, which of the following statements best applies to CDC hepatitis B vaccine recommendations?**
   a. the vaccination regimen consists of 3 injections
   b. a booster dose is recommended at 5 year intervals
   c. both a and b are correct
   d. neither a nor b are correct

3. **Which set of current precautions applies to provision of dental care for all patients?**
   a. Isolation
   b. Standard
   c. Universal
   d. Anti-microbial

4. **Standard precautions are designed to protect health-care workers against:**
   a. bloodborne pathogens
   b. potentially infectious body fluids
   c. both a and b
   d. neither a nor b

5. **Microbial organisms isolated from dental waterlines have included each of the following, except:**
   a. *Pseudomonas* species
   b. *Streptococcus* species
   c. *Legionella pneumophila*
   d. Hepatitis B virus

6. **OSHA regulations are developed to primarily protect:**
   a. employers
   b. employees
   c. patients

7. **CDC and ADA infection control recommendations for dental unit water (DUW) state that DUW used as an irrigant or coolant during non-surgical patient procedures should contain no more than ___ colony forming units of heterotrophic bacteria/ml.**
   a. 10
   b. 100
   c. 500
   d. 1,000
   e. 5,000

8. **The use of "universal" and now "standard" infection control precautions during provision of dental care, reinforces the concept that:**
   a. all dental practices provide the same range of treatment procedures
   b. all infectious diseases are universally dangerous for dental clinicians
   c. blood and saliva from all patients are to be treated as though they are infectious for bloodborne diseases
   d. items contaminated during treatment must be sterilized between patient appointments

9. **Engineering controls outlined in the OSHA Bloodborne Pathogens Standard, include the use of:**
   a. latex gloves
   b. sharps disposal containers
   c. single – handed scoop technique for re-capping needles
   d. hand washing

10. **Approaches to improve the quality of source water from dental waterlines include(s):**
    a. reverse osmosis
    b. chemical disinfection of waterlines
    c. separate bottled water supply
    d. all of the above

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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