Dental Unit Waterlines Workgroup

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Dental Unit Waterlines Workgroup: Goal & Charge

- **Update:** *Guidelines for Infection Control in Dental Health-Care Settings — 2003, Section on Dental Unit Waterlines, Biofilm and Water Quality*
- **Goal:** To provide updated information on the maintenance and monitoring of dental unit waterlines (DUWL), biofilm, and water quality.
- **Workgroup Charge:** The workgroup will focus on DUWL-specific issues for infection control in dental healthcare settings. Where information is out of date, the Workgroup will make updates using evidence-based methods *where evidence is available*.

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Discharging Blood or Other Body Fluids to Sanitary Sewers or Septic Tanks

All containers with blood or saliva (e.g., suctioned fluids) can be inactivated in accordance with state-approved treatment technologies, or the contents can be carefully poured down a utility sink, drain, or toilet (*6*). Appropriate PPE (e.g., gloves, gown, mask, and protective eyewear) should be worn when performing this task (*13*). No evidence exists that bloodborne diseases have been transmitted from contact with raw or treated sewage. Multiple bloodborne pathogens, particularly viruses, are not stable in the environment for long periods (*302*), and the discharge of limited quantities of blood and other body fluids into the sanitary sewer is considered a safe method for disposing of these waste materials (*6*). State and local regulations vary and dictate whether blood or other body fluids require pretreatment or if they can be discharged into the sanitary sewer and in what volume.

Dental Unit Waterlines, Biofilm, and Water Quality

Studies have demonstrated that dental unit waterlines (i.e., narrow-bore plastic tubing that carries water to the high-speed handpiece, air/water syringe, and ultrasonic scaler) can become colonized with microorganisms, including bacteria, fungi, and protozoa (*303–309*). Protected by a polysaccharide slime layer known as a glycocalyx, these microorganisms colonize and replicate on the interior surfaces of the waterline tubing and form a biofilm, which serves as a reservoir that can amplify the number of free-floating (i.e., planktonic) microorganisms in water used for dental treatment. Although oral flora (*303,310,311*) and human pathogens (e.g., *Pseudomonas aeruginosa* [*303,305,312,313*], *Legionella* species [*303,306,313*], and nontuberculous *Mycobacterium* species [*303,304*]), have been isolated from dental water systems, the majority of organisms recovered from dental waterlines are common heterotrophic water bacteria (*305,314,315*). These exhibit limited pathogenic potential for immunocompetent persons.

Clinical Implications

Certain reports associate waterborne infections with dental water systems, and scientific evidence verifies the potential for transmission of waterborne infections and disease in hospital settings and in the community (*306,312,316*). Infection or colonization caused by *Pseudomonas* species or nontuberculous mycobacteria can occur among susceptible patients through direct contact with water (*317–320*) or after exposure to residual waterborne contamination of inadequately reprocessed medical instruments (*321–323*). Nontuberculous mycobacteria can also be transmitted to patients from tap water aerosols (*324*). Health-care–associated transmission of pathogenic agents (e.g., *Legionella* species) occurs primarily through inhalation of infectious aerosols generated from potable water sources or through use of tap water in respiratory therapy equipment (*325–327*). Disease outbreaks in the community have also been reported from diverse environmental aerosol-producing sources, including whirlpool spas (*328*), swimming pools (*329*), and a grocery store mist machine (*330*). Although the majority of these outbreaks are associated with species of *Legionella* and *Pseudomonas* (*329*), the fungus *Cladosporium* (*331*) has also been implicated.

Researchers have not demonstrated a measurable risk of adverse health effects among DHCP or patients from exposure to dental water. Certain studies determined DHCP had altered nasal flora (*332*) or substantially greater titers of *Legionella* antibodies in comparisons with control populations; however, no cases of legionellosis were identified among exposed DHCP (*333,334*). Contaminated dental water might have been the source for localized *Pseudomonas aeruginosa* infections in two immunocompromised patients (*312*). Although transient carriage of *P. aeruginosa* was observed in 78 healthy patients treated with contaminated dental treatment water, no illness was reported among the group. In this same study, a retrospective review of dental records also failed to identify infections (*312*).

Concentrations of bacterial endotoxin ≤1,000 endotoxin units/mL from gram-negative water bacteria have been detected in water from colonized dental units (*335*). No standards exist for an acceptable level of endotoxin in drinking water, but the maximum level permissible in United States Pharmacopeia (USP) sterile water for irrigation is only 0.25 endotoxin units/mL (*336*). Although the consequences of acute and chronic exposure to aerosolized endotoxin in dental health-care settings have not been investigated, endotoxin has been associated with exacerbation of asthma and onset of hypersensitivity pneumonitis in other occupational settings (*329,337*).

Dental Unit Water Quality

Research has demonstrated that microbial counts can reach ≤200,000 colony-forming units (CFU)/mL within 5 days after installation of new dental unit waterlines (*305*), and levels of microbial contamination ≤10^6 CFU/mL of dental unit water have been documented (*309,338*). These counts can occur because dental unit waterline factors (e.g., system design, flow rates, and materials) promote both bacterial growth and development of biofilm.

Although no epidemiologic evidence indicates a public health problem, the presence of substantial numbers of pathogens in dental unit waterlines generates concern. Exposing patients or DHCP to water of uncertain microbiological quality, despite

and informed of the possible health and safety hazards (IC) (*13*).

2. Management of Regulated Medical Waste in Dental Health-Care Facilities
   a. Use a color-coded or labeled container that prevents leakage (e.g., biohazard bag) to contain nonsharp regulated medical waste (IC) (*13*).
   b. Place sharp items (e.g., needles, scalpel blades, orthodontic bands, broken metal instruments, and burs) in an appropriate sharps container (e.g., puncture resistant, color-coded, and leakproof). Close container immediately before removal or replacement to prevent spillage or protrusion of contents during handling, storage, transport, or shipping (IC) (*2,8,13,113,115*).
   c. Pour blood, suctioned fluids or other liquid waste carefully into a drain connected to a sanitary sewer system, if local sewage discharge requirements are met and the state has declared this an acceptable method of disposal. Wear appropriate PPE while performing this task (IC) (*7,9,13*).

VIII. Dental Unit Waterlines, Biofilm, and Water Quality

A. General Recommendations

1. Use water that meets EPA regulatory standards for drinking water (i.e., ≤500 CFU/mL of heterotrophic water bacteria) for routine dental treatment output water (IB, IC) (*341,342*).
2. Consult with the dental unit manufacturer for appropriate methods and equipment to maintain the recommended quality of dental water (II) (*339*).
3. Follow recommendations for monitoring water quality provided by the manufacturer of the unit or waterline treatment product (II).
4. Discharge water and air for a minimum of 20–30 seconds after each patient, from any device connected to the dental water system that enters the patient's mouth (e.g., handpieces, ultrasonic scalers, and air/water syringes) (II) (*2,311,344*).
5. Consult with the dental unit manufacturer on the need for periodic maintenance of antiretraction mechanisms (IB) (*2,311*).

B. Boil-Water Advisories

1. The following apply while a boil-water advisory is in effect:
   a. Do not deliver water from the public water system to the patient through the dental operative unit, ultrasonic scaler, or other dental equipment that uses the public water system (IB, IC) (*341,342,346,349,350*).
   b. Do not use water from the public water system for dental treatment, patient rinsing, or handwashing (IB, IC) (*341,342,346,349,350*).
   c. For handwashing, use antimicrobial-containing products that do not require water for use (e.g., alcohol-based hand rubs). If hands are visibly contaminated, use bottled water, if available, and soap for handwashing or an antiseptic towelette (IB, IC) (*13,122*).
2. The following apply when the boil-water advisory is cancelled:
   a. Follow guidance given by the local water utility regarding adequate flushing of waterlines. If no guidance is provided, flush dental waterlines and faucets for 1–5 minutes before using for patient care (IC) (*244,346,351,352*).
   b. Disinfect dental waterlines as recommended by the dental unit manufacturer (II).

IX. Special Considerations

A. Dental Handpieces and Other Devices Attached to Air and Waterlines

1. Clean and heat-sterilize handpieces and other intraoral instruments that can be removed from the air and waterlines of dental units between patients (IB, IC) (*2,246,275,356,357,360,407*).
2. Follow the manufacturer's instructions for cleaning, lubrication, and sterilization of handpieces and other intraoral instruments that can be removed from the air and waterlines of dental units (IB) (*361–363*).
3. Do not surface-disinfect, use liquid chemical sterilants, or ethylene oxide on handpieces and other intraoral instruments that can be removed from the air and waterlines of dental units (IC) (*2,246,250,275*).
4. Do not advise patients to close their lips tightly around the tip of the saliva ejector to evacuate oral fluids (II) (*364–366*).

B. Dental Radiology

1. Wear gloves when exposing radiographs and handling contaminated film packets. Use other PPE (e.g., protective eyewear, mask, and gown) as appropriate if spattering of blood or other body fluids is likely (IA, IC) (*11,13*).

Background: Existing Recommendations

- CDC's *Guidelines for Infection Control in Dental Health-Care Settings – 2003* and the *Summary of Infection Prevention Practices in Dental Settings: Basic Expectations for Safe Care* provide the following recommendations for DUWL:
  - Use water that meets US Environmental Protection Agency (EPA) regulatory standards for drinking water (i.e., <500 CFU/mL of heterotrophic water bacteria) for routine dental treatment output water.
  - Consult with the dental unit manufacturer for appropriate methods and equipment to maintain the recommended quality of dental water.
  - Follow recommendations for monitoring water quality provided by the manufacturer of the unit or waterline treatment product.

https://stacks.cdc.gov/view/cdc/6743, https://www.cdc.gov/dental-infection-control/hcp/summary/index.html

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Background: Existing Recommendations (cont.)

- CDC Recommendations for DUWL, cont.
  - Discharge water and air for a minimum of 20 to 30 seconds after each patient, from any device connected to the dental water system that enters the patient's mouth.
  - Consult with the dental unit manufacturer on the need for periodic maintenance of antiretraction mechanisms.
  - Use sterile saline or sterile water as a coolant or irrigant when performing surgical procedures.

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Background: Rationale

- Since 2003, multiple published studies have documented disease transmissions from DUWL.
- In October 2022, CDC released a Health Advisory describing 3 outbreaks of nontuberculous *Mycobacteria* (NTM) in children who received pulpotomy procedures in pediatric dental clinics.
  - Evidence of high levels of bacteria in the DUWL
  - Lack of compliance in maintaining and monitoring DUWL

https://emergency.cdc.gov/han/2022/han00478.asp

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Background: Rationale (cont.)

- Special considerations for pulpotomy procedures:
  - Pediatric pulpotomy procedures expose the pulp chamber of a tooth, which contains the nerve and blood supply.
    - Exposing the pulp chamber can provide a route of infection to surrounding tissues.
  - American Academy of Pediatric Dentistry (AAPD) states:
    - "When a pulp exposure occurs and pulp therapy is indicated, irrigants for pulpal therapy should not come from dental unit waterlines."
    - "A single use disposable syringe should be used to dispense irrigants for pulpal therapy."
  - Outbreaks occurred in practices that were using water from DUWL to irrigate teeth during pulpotomies.

https://www.aapd.org/globalassets/media/policies_guidelines/bp_pulptherapy.pdf

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Background (cont.)

- Potential issues that might require further evaluation in current CDC guidelines include:
  - Manufacturer's instructions for use (IFU) for maintenance of equipment and monitoring of water quality can be confusing or incomplete.
  - No recommended frequency for monitoring water quality.
  - No recommendation for follow-up steps if monitoring results exceed recommended limit.
  - No recommendation for use of water during pulpal therapy procedures.
- Efforts will focus on streamlining recommendations to reduce redundancy, increase clarity, and address gaps.

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Status Report

- **The Dental Unit Waterline workgroup began meeting in July 2023**
  - Workgroup members were tasked with reviewing the 2003 Guidelines and providing feedback on: format and currency, gaps/missing topics that should be included, topics that should **not** be included, areas of future research, and types of data to review for the update.
  - Draft proposed sections for the Guideline update:
    1. Establishment and selection of equipment
    2. Selection for water use in DUWL / water quality
    3. DUWL maintenance
    4. DUWL monitoring and follow-up
    5. Use of sterile irrigation
    6. Drinking water advisories
    7. Implementation

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Status Report (cont.)

- After the initial scoping of the 2003 guideline, the group began to identify topics for literature review and develop key questions.
  - Selection of water/water quality
    - Should the threshold for water quality be updated?
    - Should the procedures included in “routine dental treatment” be revisited?
- Monitoring dental unit water quality
  - Review IFU recommended monitoring frequency

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Status Report: Literature Review

- Selection of Water Systematic Review Research Questions:
  - Should the threshold for water quality be updated?
    - Current Recommendation: Use water that meets US Environmental Protection Agency (EPA) regulatory standards for drinking water (i.e., <500 CFU/mL of heterotrophic water bacteria) for routine dental treatment output water.
  - RQ1a: Is there an association between heterotrophic plate count (retrieved from water systems and sources of water) and infections in dental settings across outbreak and non-outbreak contexts in the United States?
  - RQ1b: Is there an association between heterotrophic plate count and presence or quantity of pathogenic micro-organisms in water retrieved from dental settings in the United States?
- The goal is to retrieve and assess evidence from clinical settings and situations to understand the risk of infection.

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Status Report: Next Steps

- The workgroup is currently drafting recommendations.
- Literature review results and draft recommendations will be presented to the Committee at the November meeting.

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Discussion/Comments/Questions