Dental Unit Water Quality

Research has shown that in newly installed dental unit waterlines, microbial counts can reach a count of 200,000 colony-forming units per milliliter (CFU/mL) within five days.¹ In fact, counts as high as $10^6$ CFU/mL of dental unit water have been found in unmonitored dental unit waterlines.²,³ Bacteria and other microorganisms form a biofilm, which adheres to the inside of the tubing that supplies water to the dental instruments. As water moves through the tubing, or waterline, microorganisms slough off into the water, thus contaminating it.

Drinking water must meet a certain standard for concentrations of contaminants and chemicals. The maximum concentration of heterotrophic bacteria set by the EPA, the American Public Health Association (APHA) and the American Water Works Association (AWWA) is 500 CFU/mL of drinking water. Appropriate infection control measures should be implemented to meet this standard. Additionally, the quality of water delivered by dental units should be regularly monitored to ensure standards compliance.

There is no evidence that dental unit water is harmful to patients.⁴ Nevertheless, the CDC (Centers for Disease Control and Prevention) states that, “Exposing patients or dental health care personnel to water of uncertain microbiological quality, despite the lack of documented adverse health effects, is inconsistent with generally accepted infection control principles.”⁵

Cleaning dental unit waterlines

1. Identify the source of water for your dental unit.

   **Municipal water supply** This source may provide limited access to the waterline, but in such instances there are options for controlling water quality: 1) install a point-of-use filter between the dental instrument and the waterline tubing, 2) retrofit the dental unit so that the water is supplied by a self-contained water system for easy delivery of chemical treatments (contact the dental unit manufacturer about installing a self-contained water system), or 3) install a system that allows delivery of cleaning agents at the junction box.

   **Self-contained water system** A reservoir (bottle) that attaches to the dental unit waterline, which isolates it from the municipal water supply. Water (tap, distilled, sterile etc.) must be added manually. The simple task of regularly adding cleaning agents to the bottle make this a convenient system.

2. Identify products that fit your needs and are compatible with your dental unit (contact the dental unit manufacturer). Some cleaning agents, like bleach, can corrode parts of the dental unit.

3. Develop a schedule for waterline maintenance (based on manufacturer recommended treatment methods) and assign the duty to a particular person.

4. Establish a protocol for monitoring the quality of dental unit water.

Products

Inclusion or omission of any product in the following tables does not imply its endorsement, approval, or disapproval by the ADA (report omissions to science@ada.org). This information was collected from publicly accessible documents.

   **Filters** may be installed in-line near the point-of-use (e.g. between the waterline and the dental instrument) to block the passage of microorganisms. Filters will have no effect on the development of biofilm in the waterlines, but will remove microorganisms as the water is delivered to the patient.
Filters must be periodically replaced, the frequency of which will depend on the amount of biofilm in the waterlines. Filters may or may not remove endotoxin.

<table>
<thead>
<tr>
<th>Product</th>
<th>Mode of action</th>
<th>Contact information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pall-Aquasafe™</td>
<td>In-line filter</td>
<td>Pall Corporation Ann Arbor, MI</td>
</tr>
<tr>
<td></td>
<td>0.22 micron pore size</td>
<td>800-645-6578</td>
</tr>
<tr>
<td>DentaPure®</td>
<td>In-line filter that continuously releases iodine</td>
<td>DentaPure Fergus Falls, MN</td>
</tr>
<tr>
<td></td>
<td>0.22 micron pore size</td>
<td>800-972-3543</td>
</tr>
</tbody>
</table>

**Chemicals** remove, inactivate, or prevent formation of biofilm. Chemical treatments are either continuously infused into, or are intermittently added to, the dental unit water. These products may not result in delivery of purified water should the water pass through waterlines containing biofilm. If the waterline is contaminated with biofilm, it may be necessary to remove the biofilm with another treatment before using the products described below. Consult the directions for use.

<table>
<thead>
<tr>
<th>BluTab</th>
<th>Tablet added to water bottle for continuous use</th>
<th>ProEdge Dental Products Centennial, CO 888-843-3343</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGN 500</td>
<td>Proprietary chemical for continuous use</td>
<td>Airel West 909-394-1770</td>
</tr>
<tr>
<td>Micrylium Lines</td>
<td>Chlorhexidine gluconate based for intermittent use</td>
<td>Micrylium Laboratories Toronto, ON, Canada 800-489-8868</td>
</tr>
<tr>
<td>Mint-A-Kleen</td>
<td>Water, glycerin, alcohol, chlorhexidine gluconate, xylitol, dye for continuous or intermittent use</td>
<td>Anodia Systems Danville, KY 866-246-2548</td>
</tr>
<tr>
<td>PureTube™ ShockTube™</td>
<td>In-line cartridges that deliver the chemical treatment</td>
<td>Sterisil, Inc. Castle Rock, CO 877-755-PURE</td>
</tr>
<tr>
<td>Sterilex Ultra</td>
<td>Hydrogen peroxide based for intermittent use</td>
<td>Sterilex 800-511-1659</td>
</tr>
<tr>
<td>VistaClean™</td>
<td>Aqueous cleaner derived from natural citrus botanicals for continuous or intermittent use</td>
<td>Vista Research Group Ashland, OH 419-281-3927</td>
</tr>
</tbody>
</table>

**Water purifiers** treat the water entering the dental unit (source water). These systems treat the source water by some method that kills/removes microorganisms (e.g. filtration, heat, UV light). For these systems to deliver clean water at the point of use (to the patient), a chemical treatment must be used to remove/inactivate biofilm in addition to intermittent chemical treatments to maintain waterlines. The advantage of purified water systems is that they may delay formation of biofilm or enhance the effectiveness of other treatment methods. However, these systems will not result in delivery of purified water should the water pass through waterlines containing biofilm.

<table>
<thead>
<tr>
<th>VistaClear™ Dental Waterline Treatment System</th>
<th>Filtration combined with other proprietary technologies</th>
<th>Vista Research Group Ashland, OH 419-281-3927</th>
</tr>
</thead>
<tbody>
<tr>
<td>PureLine Systems™ Filtration</td>
<td>Designed for use with PureTube™ to keep waterlines clean</td>
<td>Sterisil, Inc. Castle Rock, CO 877-755-PURE</td>
</tr>
</tbody>
</table>

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Monitoring

The only way to know that a dental unit waterline cleaning regimen is effective is to test the water coming out of the unit. Dental unit water testing products and services are used to monitor the dental unit water quality. Testing is usually done using three samples of water taken from the same dental unit. Dental equipment (e.g., handpieces) should be removed before the samples are taken. It is important that you do not contaminate the water during sampling; therefore, wear gloves and follow the directions for the particular product or service carefully.

The following is a list of dental unit water testing products and services available to the dental profession. Currently, the American Dental Association does not have an evaluation program for these products or services. The listing or omission of a product or service does not imply endorsement, approval, or disapproval by the Association (report omissions to science@ada.org). Not all biological monitors can be used with all types of sterilization devices; contact the manufacturer regarding the proper use of these products.

Dental Unit Water Quality Testing Products (for in-office use)

HPC Total Count Sampler (product # MHPC10025)
Millipore
Billerica, MA
Phone: (800) 645-5476

Disinfection Control Paddle Tester (product # 26195-10)
Hach Company
Loveland CO
Phone: (800) 227-4224

Dental Unit Water Quality Testing Services

Loma Linda University School of Dentistry
E-mail: SAS@llu.edu
Phone: (909) 558-8069 or (909) 558-8176

MicroTest Laboratories
E-mail: microtestlabsinc@yahoo.com
Phone: (800) 713-3334

ProEdge Dental Products
E-mail: miker@proedgedental.com
Phone: (888) 843-3343

The Texas A&M University System Health Science Center
Baylor College of Dentistry
E-mail: cdms@bcd.tamhsc.edu
Phone: (214) 370-7214

Glossary

Biofilm – Slime producing bacterial communities that may also harbor fungi, algae, and protozoa. These microorganisms colonize and replicate on the interior surfaces of waterline tubing, creating adherent microbial accumulations.

Colony-forming unit – The minimum number of separable cells that can give rise to a visible colony.
Endotoxin – Part of the outer layer of the cell wall of Gram-negative bacteria that is associated with the lipopolysaccharide complex. Pathogenic and non-pathogenic bacteria can release endotoxins. Endotoxins are heat stable but can be degraded by oxidizing agents (e.g. peroxide and hypochlorite).

Heterotrophic bacteria – Bacteria that require a carbon source to grow. These bacteria are not necessarily harmful, but determining the heterotrophic plate count is used as an indication of the amount of residual disinfectant present in a water supply.

Point-of-entry filters – Filter water entering the dental unit.

Point-of-use filters – Filter water exiting the dental unit. Usually installed between the waterline and the dental instrument.

References


