

WATERLINE UPDATE: OUTBREAKS OF INVASIVE NONTUBERCULOUS MYCOBACTERIUM IN PEDIATRIC DENTAL PRACTICES AND HOW TO AVOID DISASTER

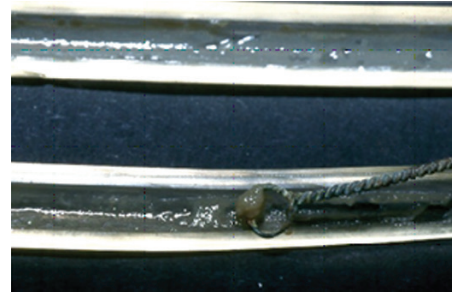


Figure 2—Biofilm in dental unit tubing used for 15 years, circa 1990s. —Courtesy of Sam Rosen, PhD, College of Dentistry, Ohio State University



GUEST ARTICLE

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Learning Objectives:

After reading this article, the reader should be able to:

- state the current standard for dental water quality in terms of colony-forming units per milliliter;
- develop an easy-to-use dental unit water maintenance protocol and monitor its effectiveness;
- identify different methods to use for sterile saline and water irrigation during oral surgery.

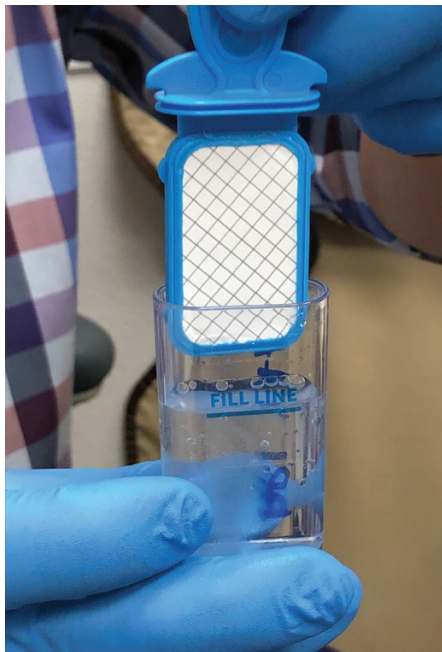


Figure 1—ProEdge In-house test—Carl

FOREWORD

When I first wrote about waterlines in the 2011 June *Inscriptions*, I stated that that there was no government entity that forced us to handle our dental unit

water (DUW) in a specific way. There also seemed to be no real reason to be concerned because we were not seeing any evidence of DUW causing medical issues. There were products available for treatment but not a clear path for monitoring. That has changed. In 2012, an 82-year woman's death in Italy was traced to legionella-contaminated water from a dental unit.¹ Since 2014, epidemiologists have now proven causal relationships between contaminated dental water and serious morbidity in children in two separate states, Georgia, and California. And finally, we now have products and procedures readily available and reasonably priced for treating and testing DUW in private practice. My job, as I see it, is to inform you of any new technologies or new procedures to reduce risk in your practice, risk to the patient, to the employee and to the practitioner. In addition, my job is to find the most practical way and cost-effective way to do it so you will be able get it done and still be able to find time to give the best care to your patients.

HISTORY

In the 1950s and '60s, as the dental "drill" became modernized and air driven, the faster rotation of the burs generated heat and there was concern that the high temperature could devitalize teeth. Dental researchers tackled this problem and added a water source to the handpiece to cool the burs but then the water would drip on the patients during procedures even after the handpiece was turned off. Retraction valves were developed and installed in dental units to correct this problem. In 1986, when the Center for Disease Control (CDC) first wrote Recommended Infection-Control

Practices for Dentistry,² it was noted that the possibility existed that some microorganisms from the patient's mouth could be aspirated back into the dental unit, via these retraction devices, and be transmitted to others. The '86 guidelines recommended antiretraction check valves to limit this back flow of contaminated fluids into the dental unit. In addition, it was recommended to establish a routine to flush the handpieces for several minutes at the beginning of the clinic day and for 20-30 seconds after completion of a procedure. For invasive surgery such as the cutting of soft tissue or bone, sterile water or sterile saline should be used as a coolant /irrigant.³ These recommendations were unchanged in the 1993 Recommended Infection-Control Practices for Dentistry.⁴

Further research revealed that not only can bacteria be found in DUW, they could quickly grow into complex colonies and flow out through the dental lines into patients' mouths and into the air. Researchers established that microbial counts could reach in the hundreds of thousands of colony-forming units (CFU) per mL within days after installation of new dental unit waterlines and counts in water from untreated systems could reach into the millions. By 1995, the American Dental Association (ADA) responded to concerns that this may be a public health issue and published a position paper on dental waterlines. It was a call to manufacturers of dental equipment to provide a method to deliver safe DUW to patients. Over the years, after much deliberation, it was determined to follow the Environmental Protection Agency (EPA) recommendations for limits of <500 CFU/mL of heterotrophic bacteria in drinking water.

WHAT HAPPENED IN GA & CA?

Georgia: In September 2015, the Georgia Department of Public Health was notified of a cluster of pediatric *Mycobacterium abscessus* odontogenic infections by a hospital treating nine children who had pulpotomy procedures at a pediatric dental practice. Further investigation identified 20 patients with confirmed or probable *Mycobacterium abscessus* infections from March 12, 2014 to November 12, 2015. *M. abscessus*, is a rapidly growing, nontuberculous mycobacterium that commonly causes skin and soft tissue infection and can cause disease in multiple organs. The practice used tap water for pulpotomies without water quality monitoring or bleaching of waterlines at the end of each day, as recommended in the manufacturer guidelines.⁵ All water samples from the seven dental stations had bacterial counts above the CDC recommended <500CFU/mL. Their results averaged 91,333 CFU/mL. *M. abscessus* was isolated from all water samples.⁶

California: In an Infectious Diseases Open Forum from the US National Library of Medicine, National Institutes of Health, it was reported in 2016 that an Orange County, California pediatric dental clinic's contaminated water system led to the "largest outbreak of odontogenic Invasive nontuberculous *Mycobacterium* infections yet described". From January 1 to September 6, 2016 1,089 patients were found to be at risk having undergone pulpotomy procedures at this Anaheim clinic. 71 cases were confirmed and 49 were determined probable. Of the 71 cases, 70 were hospitalized and underwent surgical debridement. Findings varied from pain and swelling to loss of permanent teeth, and necrotic bone or osteomyelitis seen at surgery.⁷

DENTISTRY'S RESPONSE

These recent outbreaks have initiated a multitude of responses in the dental field: OSAP: The Organization for Safety, Asepsis and Prevention, Dentistry's Infection Prevention Organization, issued a Dental Unit Water Quality White Paper and Recommendations in 2018 with a

myriad of recommendations including quarterly testing, the values of in-office test kits and third-party validation.⁸

Dental Board of California: The board initiated a dental water quality law that took effect Jan 1, 2019. The emphasis was on providing sterile or treated dental water for procedures on exposed dental pulp.⁹

Washington State Dental Board: This year, the board has pending proposed rules for DWU quality including treating the water, testing quarterly, and maintaining records for five years.¹⁰

ADA: The American Dental Association issued a standard on treating biofilm in water lines available for comment by members with a deadline of March 6, 2020.¹¹

CURRENT CDC GUIDELINES

Most dentists rely on the Center for Disease Control and Prevention (CDC) Dental guidelines for their practice standards. In 2003 the CDC updated their dental guidelines for the third time. These guidelines stood the test of time, but in March of 2016, the CDC provided clearer recommendations for safe dental care in a new format, *Recommendations from the Guidelines for Infection Control in Dental Health-Care Settings—2003*¹² and in addition, they added a user-friendly check list for implementation.¹³



Figure 3—sterilized irrigating syringe with sterile saline—Carl

Many times when you read these documents, the information tells you what to do but not how to do it. This new format is quite helpful and following the standard of care can save you a lot of money and a lot of grief so check it out. A current recommendation listed is to 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.¹⁴ For DUW quality, the guidelines stress that policies and procedures be in place for meeting EPA standards for drinking water and still recommend that sterile water or sterile saline be used as a coolant/irrigator when performing surgical procedures involving the cutting of soft tissue or bone. The DUW should be completely bypassed for surgical procedures. One can now use sterile irrigating syringes with single-use sterile or saline water or devices with disposable single-use products.

TREATMENT AND MONITORING CHOICES

Where to Start

First check with the manufacturers of your dental unit and other water dispensing devices such as cavitrons as to what they recommend for treatment. Ensure that your dental unit has an independent water reservoir, separate from municipal water supplies. This allows more control for treating the waterlines. Chemical treatment, filtration, or a combination of the two are ways to render the water safe to use in regular dental treatment. In my experience, chemical treatment is by far the more commonly used method. Products are readily available from time-released cartridges and straws to more labor-intensive products that need to be added to each water container. I have always leaned toward the systems that free the healthcare worker to have more time for patient care.

When to Test

The OSAP white paper recommends quarterly testing. This paper, with lead author, Shannon Mills, DDS, is very thorough and is based on decades of research. Dr. Mills has been researching DUW maintenance protocol since the

90's and is highly respected for his work. The quarterly testing should be your baseline.

How to Test

Having known Dr. Mills since the 90's, and following his recommendations for years, I asked him for advice about the testing and reporting. He told me that it is important for third-party verification for the testing, but it may not be necessary for each quarter once you have verification that your system is working. Third-party testing should be at least once a year.



Figure 4—preparing water sample to send to Loma Linda—Carl

First shock your water system then use your preferred treatment. If you go to YouTube and enter “shock dental water,” there are many results to choose from, showing products available from various manufacturers for shocking and treatment. So, do you start with laboratory testing or in-office test kits? You may want to start with the in-office test kits to see if you have growth and trouble shoot from there otherwise it can get cost-prohibitive testing with a third party. If you look closely at these YouTube demonstrations, you will see that one company offers a free sample of a quick test that can be read in 48-72 hours. Do not expect all your lines to pass first time around. Keep in mind it is not necessary to test for pathogenic bacteria, such as *Legionella*, unless the unit is implicated in an outbreak investigation.

All you really need is a count of the number of colonies on the sampler at the end of incubation, not determine what kind of bacteria is present. You want the number to be under 500 CFU/mL. As to the third-party testing, I have experience with the Loma Linda University School of Dentistry DUW Monitoring Service and recommend them.¹⁵ They have a step-by-step process that is easy to follow. And their documentation for your records is excellent. The in-office tests will have instructions for use and documentation forms.

Trouble Shooting

So, you have tested all your waterlines, including air/water syringes, handpieces and cavitrons and find that the only failure is in the handpieces. Why is that? Do you have a motor for your handpiece that you are not sterilizing? The CDC states “Handpieces and other intraoral devices that can be removed from the air and waterlines of dental units should be cleaned and heat-sterilized between patients... These devices include high-speed, low-speed, electric, endodontic, and surgical handpieces, as well as all handpiece motors and attachments”¹⁶

SUMMARY

We have come a long way since first identifying the fact that dental unit water can be teeming with microorganisms and having a practical way to do something about it. We have the ADA to thank for challenging researchers and dental product and equipment manufacturers to make DUW safe for patient use. The guidelines have not changed since 2003 but new methods to meet these standards have been developed. With guidance from the manufacturers, it is now possible to maintain DUW to meet this standard without it being labor intensive or prohibitively expensive. New products and devices can help you meet CDC guidelines that state you should by-pass the dental unit for oral/invasive surgery and use a direct sterile water system. Simple to use monitoring devices can be used to determine if your water maintenance procedures are successful. And document your monitoring findings for the welfare of your patients and for risk management issues.

Steps for Testing

- Check with manufacturer
- Shock
- Treat
- Test
- Troubleshoot if needed
- Test until you reach EPA standard then test quarterly
- Use third-party verification at least once a year
- Document and keep records

KAY'S TWO CENTS

Contracting with the Arizona Dental Association since 1991, providing continuing education in infection control, I first started out emphasizing OSHA law because that was what the dentists were most concerned about. Over the years, my shift has been from control to prevention and risk management. For some time, I have been stressing that epidemiology has progressed to the point that disease can be traced back to the source with present technology. So be prepared. Reading between the lines you can see that large numbers of infected children had pulpotomies performed in a matter of few months. News reports have indicated that the patient populations were poor minority children that had Medicaid or Medi-Cal insurance coverage. Kids ended up in pediatric intensive care, some losing permanent teeth, parts of their jaws and were treated with strong antibiotics which use can lead to long-term consequences. Recent news reports indicate the number of children affected in Anaheim is up to 200. Malpractice complaints stress that the dentists performed hundreds of unnecessary pulpotomy procedures for production quotas. 150 lawsuits against the Anaheim dental clinic worth hundreds of millions of dollars are pending. So do the right thing and take the high road. ■

REFERENCES & TO TAKE THE QUIZ FOR ICEU

See page 31, <https://inscriptions.azda.org/2020jun/31/>
To take the quiz: <https://bit.ly/IPC6-20>

Kay has worked in collaboration with AzDA since 1991 to provide continuing education in OSHA, infectious diseases and infection control. She is an active member of APIC, the national infection control and epidemiology association. She is married to a dentist.