DENTAL UNIT WATER
What Are You Doing About Yours?

Infection Prevention Corner
- Kay C. Carl, RN, BS

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

- describe the difference between standards and laws as they apply to dental practice;
- state the current standard for dental water quality in terms of colony forming units per milliliter;
- identify different methods to use for sterile water irrigation during oral surgery;
- develop a easy-to-use dental unit water maintenance protocol and monitor its effectiveness.

Foreword
I know, I know, I seem to be hitting you docs pretty hard lately as to what you must and should be doing in the course of your practice, and you deserve an explanation on the difference. When I say, “must”, it means that there is a law that applies to what has to be done. When I say, “should”, it means that it is a standard of care to be followed. Most dentists rely on the Center for Disease Control and Prevention (CDC) Dental guidelines for their practice standards. That is the way it should be, but we have to remember those guidelines were written in 2003, and there have been new developments since then. Following the standard of care can save you a lot of money and a lot of grief. 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, the employee and the practitioner. In addition, my job is to find the most practical and cost-effective way to do it, so you will be able to find time to give the best care to your patients.

This month, I am going to present a subject that is more nebulous: dental unit water. The reason that it is so imprecise is that no government entity forces doctors to handle their dental unit water in a specific way. In addition, dental unit water experts have different views on the subject. So this time, I am not going to give you hard and fast rules on treating dental unit water and monitoring that water, just food for thought, information you can use to make your own decision on what direction to take. Virtually everything that I mention in this article, are things you “should do”, rather than things you “must do”.

History
In the 1950’s 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, 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 anti-retraction 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...
In the 1990s, research on dental unit water revealed that not only can bacteria be found in dental waterlines, they could quickly grow into complex colonies. Many different organisms live in symbiosis and form slime layers inside the tubing. Together they are more resistant to removal by disinfection. Chunks of debris can break off at any time from these tiny ecosystems and flow out through the dental lines into patients’ mouths and into the air. 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, by the year 2000, a method to deliver dental unit water to patients, that had no more than 200 colony forming units per milliliter (CFU/mL) of aerobic mesophilic heterotrophic bacteria. This would be at any point in time in the unfiltered output of the dental unit during nonsurgical dental treatment.

This upper limit was derived from the standard set by the Association for the Advancement of Medical Instrumentation (AAMI) for water quality in hemodialysis units. The maximum level of bacteria in water used to prepare dialysis fluid and reprocess hemodialyzers must not exceed the AAMI standard of 200 CFU/mL. With this number in mind, in addition to the Environmental Protection Agency (EPA) limits for heterotrophic bacteria of <500 CFU/mL of drinking water, researchers set out to see what could be done.

What was found was quite alarming. Researchers established that microbial counts can reach in the hundreds of thousands of CFU/mL within days after installation of new dental unit waterlines and counts in water from untreated systems could reach into the millions. Microorganisms identified were primarily heterotrophic bacteria commonly found in tap water. However, pathogenic bacteria such as *Pseudomonas aeruginosa* and *Legionella* species were also found that could place immuno-suppressed patients at risk.

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In private practice, dentists were not able to do much about these findings until someone could come up with a practical approach at a reasonable cost. By this time, I was a member of OSAP, the Organization for Safety, Asepsis and Prevention, the dental infection control association, which holds yearly symposiums. At the 1998 meeting, an abstract was presented by Richard Karpay and Shannon Mills, dentists and officers at Robbins Air Force Base, who collaborated with the University of Texas at San Antonio for a study at the base. The purpose was to evaluate compliance with a dental unit water maintenance protocol. They retrofitted 395 A-dec units with self-contained water reservoirs. Baseline testing of the unit water ranged from 4,000 to 160 million CFUs/mL. Over half of the units tested over 250,000 CFUs/mL. Then the new protocol was initiated. A 1:10 bleach solution was prepared by using 1 part 5.25% sodium hypochlorite and 9 parts water to dilute the bleach to a .525% solution. The solution was then run through the units with a ten-minute contact time. Then the units were air flushed. Distilled water was then flushed through the unit to clear the bleach from the unit and lines. A solution of chlorinated water, consisting of one drop of bleach to each 750mL reservoir bottle, was then used for clinic use. No air purging of lines at the end of the day or the end of the clinic week was required. By the end of the testing, between 70% and 85% of the units passed (less than 200CFU/mL).5 There was a correlation of more failures when students were involved with the maintenance protocol, but it did show that there was a way to meet the ADA goal for dental water quality. What really impressed my dentist husband was the display that Doctors Karpay and Miles set up that showed no apparent damage to handpieces used in the study. We had heard horror stories that the use of bleach could cause major damage to dental equipment, but after getting this information, we thought we really could do this. Other systems available at the time required daily maintenance and removal of water from the units at the end of the clinic day, and we really did not want to deal with that.

So we went home from the conference and started using the protocol. My husband performed it himself for the longest time to make sure that the procedure was properly followed, but then we made it an end-of-the-week procedure for the staff. The last two hours on Thursday afternoons was set aside to bleach the lines. It was hard to watch. Even by getting a large bucket to run both the handpiece and air/water lines at the same time, (cavitrons where needed), it was an extremely boring procedure. The expressions on the staff’s faces were so pathetic that it was difficult to look them in the eye. It was cheap but labor intensive and it cut into productive clinical time. And so we waited for something better to come along. It did. We eventually converted all the units to devices that would dispense inert Iodine into the waterlines, keep the water safe to use and only had to be replaced once a year. But we did not monitor the dental unit water. At the time, in the early 2000’s, the only monitoring available to us was from laboratories that wanted to charge us approximately $150 per line and identify specific pathogens in the water. I knew that was not necessary. We just needed something to tell us how many colonies we had.

The Present

Dental Unit Water

The 2003 CDC Guidelines for Infection Control in Dental Health-Care Settings at [http://www.cdc.gov/oralhealth/infectioncontrol/guidelines/](http://www.cdc.gov/oralhealth/infectioncontrol/guidelines/) is a very comprehensive document.6 I consider this document required reading for all dental professionals. These guidelines acknowledge that the flushing of dental lines at the beginning of the day does not reduce the water quality to a safe level. The flushing for 20 to 30 seconds after completion of a procedure is still suggested. The guidelines recognize there are now devices and procedures readily available for successful treatment of dental unit water. The guidelines recommend that the manufacturer of your dental equipment should be consulted as to how to treat and monitor the water from the dental unit. For the first time, the guidelines target a specific goal to achieve. Treatment water for dental procedures should not exceed 500 CFU/mL, the safe level for drinking water. Dental healthcare personnel should be trained in the appropriate maintenance protocols with an understanding of water quality and biofilm formation. Non-compliance with treatment regimens has been associated with persistent microbial contamination. Monitoring of the water quality can ensure that the protocols are being followed correctly.
Sterile Water for Oral Surgery

The guidelines 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 dental unit water should be completely bypassed for surgical procedures. One can now use sterile irrigating syringes with single-use sterile water or devices that utilize single-use disposable tubing or reusable tubing that can be sterilized.

Boil Water Advisory

The current CDC dental guidelines also have recommendations as to what action to take during a boil water advisory when public water is unsafe to drink. You cannot use the municipal water in your dental unit and other dental devices such as a cavitation, for handwashing or mixing disinfectants. You can use self-contained water units and use alcohol foams for washing hands or bottled water and soap for visibly contaminated hands. This is all the more reason to convert to a reservoir system and use the new waterless hand hygiene products. For more information and a CDC fact sheet go to http://www.cdc.gov/oralhealth/infectioncontrol/fact-sheets/boilwater.htm.

ADA

An updated statement on Dental Unit Waterlines from 2004, found at the ADA website, http://www.ada.org/1856.aspx, notes that there still is no proven public health issue regarding dental unit water used in treatment of a healthy patient. However, there is a concern that an immunocompromised patient may be more at risk to infection if exposed to untreated dental unit water. Therefore, they defer to the 2003 CDC guidelines that dental practices maintain their dental water lines to keep the microbial load less than 500 CFU/mL. The ADA also supports the CDC recommendations for the delivery of sterile surgical irrigation.

Arizona State Board of Dental Examiners

The Arizona State Board of Dental Examiners (BO-DEX) has adopted the most current State OSHA required procedures for worker protection and the most current CDC recommended Infection Control

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Practices for Dentistry as the guidelines for infection control. Should BODEX present itself with a demand for inspection, they would be doing so to investigate a possible violation of the Dental Practice Act at A.R.S.§ 32-1201(21)(n), “Unprofessional conduct” which is defined in this subsection as: “Any conduct or practice which does or would constitute a danger to the health, welfare or safety of the patient or the public.” For more information and a copy of the BODEX Infectious Disease Control Inspection audit go to http://www.az-dentalboard.us/substantive_policy.pdf. So we have both the ADA and BODEX supporting the CDC guidelines.

Treatment and Monitoring Choices

So where do you start? Your first step is to ensure that your dental unit has an independent water reservoir, separate from municipal water supplies. This allows more control for treating the waterlines. New dental units should come with reservoir bottles. If your equipment is older, you can get your units retrofitted for the bottles. 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.

You now have a myriad of choices for dental water disinfection from adding something to each reservoir bottle to attaching a device that dispenses chemical treatment and will treat your unit water for a year. Check with the manufacturer of your unit. One major manufacturer has developed a water treatment that can be used with their units and also recommend an easy to use in-house monitoring system that is not of their making.

When to Test

There are no real standards yet as to when to test. You should conduct a baseline test when you change equipment and periodic test for the effectiveness of your disinfection. There is no hard and fast rule for periodic testing. An engineer at a major dental equipment company tells me that he advocates monthly testing until it is established that the dental water treatment is effective, and then quarterly testing would be fine unless problems arise. If you get a test that is over the threshold limit (500 CFU/mL), retreat the unit before putting it back into use and then test again the following day.

How to Test

Check with your dental unit manufacturer recommendations for monitoring. An in-office testing system that had been used for dental waterline testing is no longer available, but there is another system that is available and easy for staff to use. It is not necessary to test for pathogenic bacteria, such as *Legionella*, unless the unit is implicated in an outbreak investigation. All you really have to do is count the number of colonies on the sampler at the end of incubation, not determine what kind of bacteria is present. Of course, read the directions.

Cost

Checking around I found a monitoring system that is easy to use and cost effective. This particular system costs approximately $116 for 25 individual monitor water samplers. The incubator runs around $1918 but you really do not need an incubator. You can just put it on the counter in room temperature conditions for 7 days. This is not a terrible thing to do. We are not monitoring water for hemodialysis, we are just testing our water maintenance program for effectiveness. If you are dealing constantly with immunocompromised patients, you may have to buy the incubator if you have ongoing failures and need the faster turnaround that the incubator provides.

Summary

Much progress has been made since first identifying the fact that dental unit water can be teeming with microorganisms and actually being able to do something about it. Thankfully the ADA has challenged researchers and dental equipment manufacturers to make dental unit water safe for patient use. The original goal to keep the dental unit water below 200 CFUs/mL has been changed to meet the same standard of safe drinking water, below 500 CFUs/mL. 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 dental waterlines to meet this standard without it being labor intensive. 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. I would hope that the younger dentists reading this article will appreciate the strides we have made in the area of water line treatment to make your job easier, more effective and at reasonable cost.

**Kay’s Two Cents:**

Do you think that BODEX is going to come and test your water lines? I doubt it. With recommendations from CDC to follow your manufacturer’s directions for treating and monitoring, it would be next to impossible for the board to attempt this. It would be very expensive and from what I hear BODEX money may be heading to our state’s general fund. Would you be implicated in an outbreak? I doubt it. Most of you are already spending your money on water treatment. Wouldn’t you like to see if it works? Following best practices is taking the high road and will protect you in the long run.

Ok, you know the drill; email me at kay@azda.org if you want any further information on water treatment and monitoring.

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3. Association for the Advancement of Medical Instrumentation in ANSI/AAMI RD5:1992, Hemodialysis systems.

Kay is board certified in infection control and epidemiology. She has over 35 years experience in infection control and 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 OSAP, the national dental infection control association, and a prolific contributing author and editor for various industry print and electronic media.