



CLINICAL: WATERLINES

THE CHALLENGES OF WATERLINE DISINFECTION

Why the latest improvements in dental waterline disinfection are so critical for dental practices.

[curated by Dr. Lou Shuman, with Owen Boyd, Founder and CTO, Toppen Dental Solutions]

Last month I had the opportunity to meet with a company that is pursuing technologies that promise to change the game in their category. Water disinfection is an area I never thought I would get excited about but walked away incredibly impressed with the level of genius of Owen Boyd and Al Dube.

I sat down with Owen Boyd, an expert on dental water disinfection and treatment technologies. Mr. Boyd has 25 years of water treatment experience. We discussed the challenges with dental unit waterline

disinfection and breakthrough technology solutions that are on the near horizon.

Why do dental unit waterlines (DUWL's) require disinfection?

This is an issue of protecting patients and staff. Serious illness from cross-contaminated DUWL's is no longer just a theoretical possibility. In the last two years alone there have been cases in California and Georgia where large numbers of patients contracted serious infections traced back to contamination in the waterlines.

In Italy in 2011, a patient contracted a fatal case of Legionnaire's disease from water in her dentist's office.

Besides what goes directly into the patient's mouth, the water from a high-speed drill creates a four-foot diameter circle of potentially contaminated mist around the doctor, the patient and the hygienist. Masks are good at stopping fluids, but not bacteria. If that water is loaded with bacteria, you and your staff are breathing the organisms suspended in that mist.

Why are dental unit waterlines such a disinfection challenge?

The environment of a dental unit waterline, being essentially a smooth, small-diameter hose that operates at a warm temperature and at a low flow rate, is a near-perfect setting for accelerated bacterial growth—so perfect that bacteria counts double every 15 minutes. Meaning, even if your lines are safe at the beginning of the day, they could be thousands of times unsafe by the end of the day without proper treatment.

The other difficulty is that bacteria form biofilms on smooth surfaces like the inside of waterlines. For lack of a better definition, the biofilm becomes a sort of housing that prohibits many disinfectants from destroying the bacteria colony inside.

Aside from being an obstacle to disinfection, biofilms can clog the lines. Certainly, it's not good when a patient is sitting in a dental chair and you have no water flow.

What's the current state of dental unit waterline disinfection technologies?

Several decades ago, when the dental community recognized the DUWL contamination problem, they turned to chair manufactures to help resolve the problem. In response, chairside bottles were added to replace municipal well-water feeds with high-purity water. Tablets—usually chlorine, ammonium compounds, or iodine—have since been added to provide daily disinfection.

While these chemical technologies do a decent job of destroying free-floating bacteria, none of them have much impact on biofilms. Let's say you have two parts per million of iodine in the bottle which you release into a line loaded with bacteria. The biofilm actually "senses" when that iodine concentration is exhausted from killing free-floating bacteria, opens to release additional bacteria for recolonization and then closes again. So, you'll constantly get bacterial buildup.

Other drawbacks are inherent in the chemical agents themselves. A lot of these chemistries are not dental-

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chair friendly. They are oxidants that degrade or clog internal valves, shut-offs and tubing. Studies have shown that chlorine and iodine can have a negative impact on dental sealants. Additionally, some of these chemicals are not as “green” as they could be. Most oxidants react with other compounds and create by-products that you really would prefer not to discharge into the environment.

A final very important point is that the recommended protocols aren't always followed to the letter. That was a big topic of discussion at the annual Organization for Safety, Asepsis and Prevention (OSAP) meeting held in Atlanta. There's a human factor that has a significant impact of the effectiveness of ADA and CDC disinfection recommendations.

What are some of the new technologies on the horizon for DUWL disinfection?

Until very recently it seemed like there was no quick fix. However, several recent technological breakthroughs suggest that we can solve this problem without creating others.

The first technology, called quantum disinfection, requires no power, no chemicals and no maintenance. Using semi-conductor principles, scientists in France have created a media that destroys bacteria, viruses and protozoa at the quantum level by lysis, a process that shreds the bacterial membrane. This media, in the form small, round white pellets, is packed in cartridge that attaches to waterlines. As the water passes through the cartridge, the media tears electrons from the cell walls and membranes destroying any microorganisms it contacts. In my estimation, one of these technologies for water treatment comes along every 50 years.

While quantum technology sounds like science fiction, the second technology harnesses one of nature's most potent disinfectants. Ozone is about 50 times more powerful than chlorine and kills bacteria and viruses three times as fast, which means you get a marvelous disinfection response with very low concentrations. The truly unique property of ozone is that it

destroys biofilms.

When ozone reacts with bacteria the by-products are water and oxygen. So, ozone is environmentally sound, patient safe and dental chair friendly – it's also a great cleaner and deodorizer. While astonishing, these properties are well understood and ozone has been used for disinfection for some time.

What is new are breakthroughs in generator technology which allow for ozone systems that can be integrated directly into dental chairs. It is now possible to produce sufficient ozone for DUWL disinfection from a generator that is 90 percent smaller and considerably more energy efficient. Since ozone in water degrades relatively quickly, integration into the dental chair with on-board monitoring and alerts is critical. Using ozone integrated into the dental chair and in-line quantum cartridges as primary and secondary disinfection, we can create a fully automated solution which minimizes staff responsibilities of maintenance and monitoring.

I believe these technologies will address the existing challenges of keeping dental unit waterlines clean, eliminating a significant risk to patients and staff.

To learn more about new and emerging water treatment and antibacterial technologies visit www.toppen-dental.com. ●

ABOUT OWEN BOYD

As founder SolmeteX, where he served as CEO from 1994 to 2010, Mr Boyd is credited with pioneering amalgam separation in dentistry. He holds numerous patents for water treatment technologies and has consulted with regulatory agencies including the EPA. He is currently founder and CTO of Toppen Dental Solutions, a water treatment company dedicated to serving the dental community.

ABOUT DR. LOU SHUMAN

Dr. Lou Shuman is a long-time contributor to Dental Products Report and a member of the DPR editorial board. He is president and CEO of Cellerant Consultant Group. He is also the chairman of the Technology Advisory Board at WEO Media, a Venturer-in-Residence at Harvard's Innovation Lab, and founded a dental education internet company.