If we had only known...

Reactions to Dental Waterline contamination

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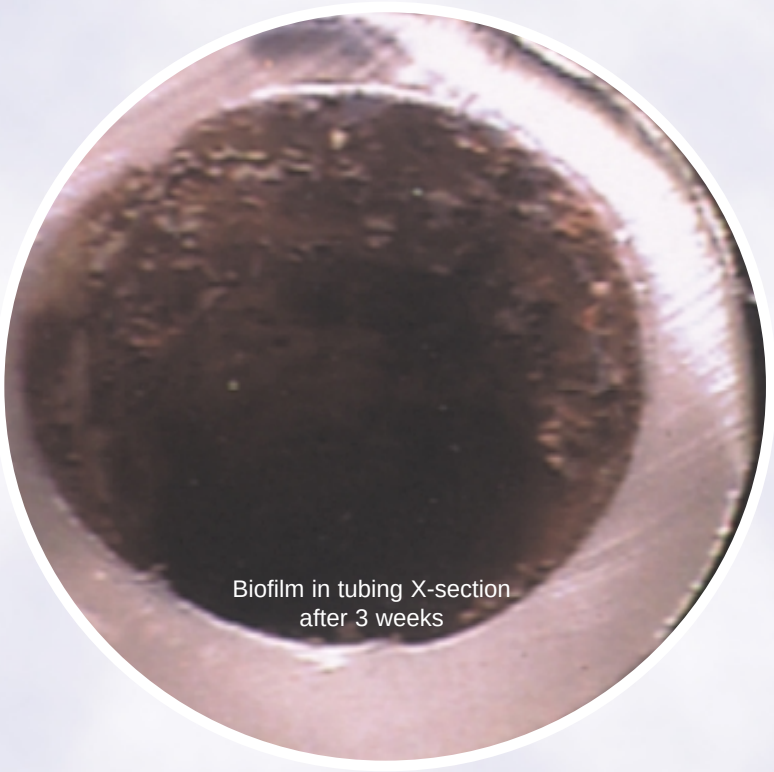
By now, either through journals, conventions or the media we all know that there exists serious bacterial and fungal contamination of Dental Unit Waterlines. We all also know that it is NOT the city water supply that is truly the culprit. It is specifically those yards/metres of narrow plastic tubing that are found between the control block and the handpiece or syringe in the Dental Operatory that become the home of such substantive and prolific biofilms.



Biofilm in tubing X-section
after 3 weeks

Crisis, Non-Issue or Opportunity ?

During this recent period of information overload about the Waterline contamination, the response of the Dental Profession has fallen into three categories. Those who have viewed it as a crisis may have decided to rearrange their affairs and retire early. Those who believe it is a non-issue either don't think the science is true or hope that the issue will go away. Finally, there is a serious group who believe that Waterline Contamination is primarily an Ethical Responsibility and secondly, an Opportunity to market their practice by showing their patients that they are concerned about their safety and well-being.

Remember

"CBS 60 Minutes/Street Scenes"

(Florida AIDS Dentist 1990)

If you knew the program was coming, and had pro-acted by posting signs in your office stating "This office sterilizes ALL Dental Handpieces and Instruments" ***Then*** would your patients have greeted the Sunday night "60 Minutes" viewing without stress and told the Monday morning Water Cooler Group at work - "My Dentist does that already"?

How Bad is it?

Extensive testing of over 4,000 Dental Waterlines across North America has shown that traditional Dental Clinics with a city water feed will average 375,000 Colony Forming Units (CFU) of bacteria per millilitre of water sample. Those who ventured into independent water bottle systems and did not maintain them averaged 1,200,000 CFU/mL.[1] Over 10% of the offices tested had pathogenic *Pseudomonas aeruginosa* in their lines.[1] One study showed that 50% of the Dental samples had *Mycobacterium* species (TB family) in them.[2] In another recent study, 29 of 35 offices tested had ORAL Streptococci in the Dental Waterlines,[3] indicating that retraction is a very real problem. Federal Standards for potable drinking water in the United States and Canada state that the MAXIMUM is 500 CFU/mL of bacteria with NO *E. coli* or *Pseudomonas aeruginosa.* In 1996 the American Dental Association recommended that all dentists provide treatment water with less than 200 CFU/mL by the year 2000.

1 Continent-Wide DUWL Study. Micrylium Laboratories, Phoenix / Toronto 1997-99

2 Mycobacterium species in Dental Water. Springthorpe, S. University of Ottawa, 1999

3 Detection of Oral Streptococci in DUWL. Shepherd, P.A. University of Louisville, 1998

Caution

Although it is perceived that city water is inferior, it is actually of excellent microbiological quality. It often contains Chlorine which helps maintain low bacterial levels in water that has minimal organic material, provided high flow rates are maintained. We, however, may sometimes wish to get away from city water to avoid the occasional outbreaks of *Legionella*, Cryptosporidia and perhaps *Mycobacterium avia* in our communities. Prior to using Independent Water Reservoirs, ensure that your water bottle has been disinfected by a non-toxic solution. The water that is to be added to the bottle should be either sterile or distilled from a commercial supplier. After opening, it must be refrigerated. In-house distilled water often can have bacterial counts in excess of 100,000 Colony Forming Units of Bacteria per millilitre. Remember that in standing water that has no kill (*i.e.* distilled water), bacteria populations may double in only 20 minutes.

Seize the Moment - Be Pro-active

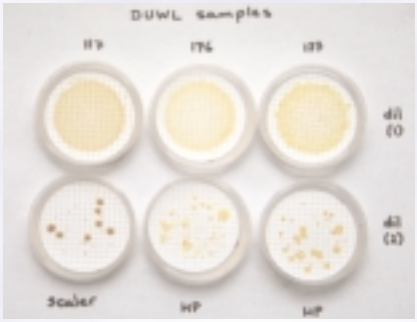
Take the time now to invest in the protection of your practice. "Independent Delivery/Purge Systems" are available that can allow substitution and access to the waterline tubing. The visibility of these systems is an opportunity to promote your practice. A Water bottle system is NOT enough by itself. Get a Protocol for maintaining your system. Follow that protocol without exception. Remember, just as patient compliance is necessary to prevent gum disease, routine maintenance of the Waterlines is essential. Get your water tested by an independent third party laboratory. Make sure that that micro laboratory has dental water experience, provides cooler packs for shipping and enumerates specific microbial pathogens such as *Pseudomonas sp*.

Get Tested

Once you have a protocol in place for at least 3 weeks, get a comprehensive test kit from a quality microbiological laboratory. Sample the water from three representative pieces of equipment and the air from the 3-way syringe. Overnight refrigerated Courier service to the lab will ensure your test gets treated right away. Experienced technicians will then enumerate bacteria accurately and identify pathogens such as *Pseudomonas aeruginosa*. Results should be sent out after 10 days and those with counts complying with the FDA potable water standard would be issued a Certificate of Water Quality.

Maintenance - Compliance

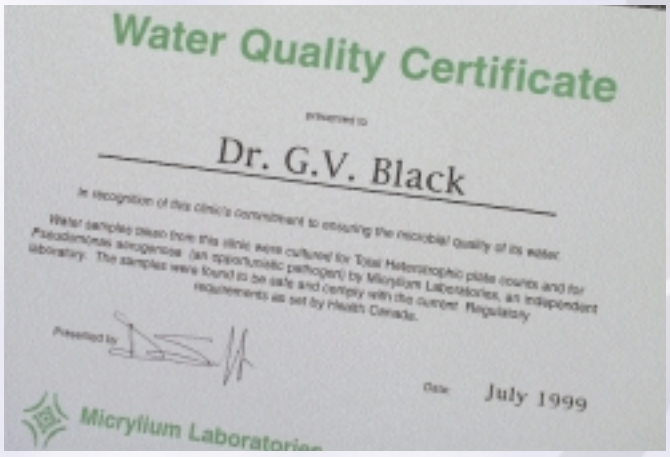
Starting each day with fresh, refrigerated water in a disinfected water bottle is only half of the story. Just as teeth build-up plaque biofilms in less than 24 hours, so do waterline tubings. If these independent systems are not maintained, water from handpieces has been shown to exceed 40,000,000 CFU (Colony Forming Units) per millilitre. (One ounce ≈ 28 millilitres). Original protocols had suggested bleach (NaOCl) to maintain the lines. Research has shown that bleach does not remove the biofilm from the tubing and takes up to two hours of maintenance time per week. Studies[1] have shown that when Bleach is in contact with biofilm carcinogenic Trihalomethanes (*e.g.* chloroform) are produced. In addition, the costs of replacing parts that become corroded can be considerable.



1 Release of disinfection byproducts during NaOCl use on contaminated dental unit water systems. Puttaiah, R. Baylor College of Dentistry 1998

Market Your Practice

Take time to explain to your patients the seriousness of your concern for their safety and that of immuno-compromized patients. Show your new equipment and explain your protocol so that patients understand your level of commitment.



Ensure that the protocol is followed, as the independent water bottle systems can actually become incubators for bacterial growth. Display your Water Quality Certificate prominently so that patients will ask questions and realize that your practice is a leader in professional Dentistry.

Concept

If the situation is so serious-
Why has no one died in the chair?
Period of Bacterial Incubation

The process of disease manifestation has three stages. The first is the transmission of infection. It may occur via an aerosolized cough, or by direct mucosal, skin, blood or saliva contact. As soon as a microbe touches the recipient, they are deemed infected. There is then an intermediary stage where the recipient's immune system battles the infection. This is called the incubation stage. Finally, at the end of incubation, the body has either resisted and will continue with a healthy life, or the disease takes over and conquers the recipient. For many common infections such as food poisoning (*Salmonella*) the incubation period is often only a few hours. For a cold, perhaps three days. We are all familiar with the incubation periods for Chicken Pox and Influenza. Incubation times are much longer for Hepatitis B and Tuberculosis where 6 months is the norm. Each disease has a specific incubation period between date of infection and beginning of the disease phase.

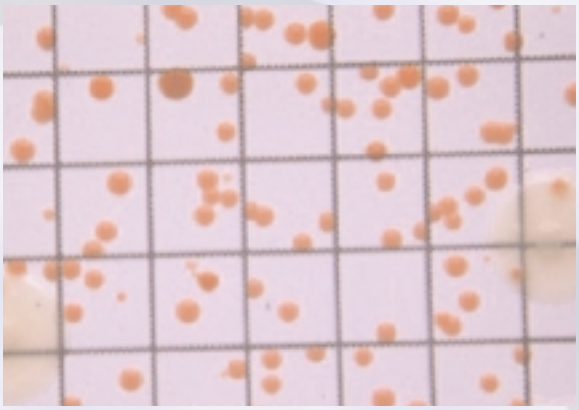
Analogy: A few days after someone sneezes in your face, you develop a fever and runny nose. You remember the incident and make a point of reminding your co-worker to cover their mouth when sneezing or coughing.

Dentistry: Until now, very few patients ever thought that they may have contracted an illness at the dentist. With an increased number of elderly and immuno-compromized patients (those who cannot fight infection) visiting the dentist, every precaution should be taken to prevent the transmission of disease.
Dental Practices have changed and are changing. For example, 15 years ago what were the numbers of patients on long-term cancer therapy drugs or with AIDS? How many patients over 65 went to the Dentist? With the advent of esthetic dentistry and implants large numbers of older people now visit the Dental office regularly.

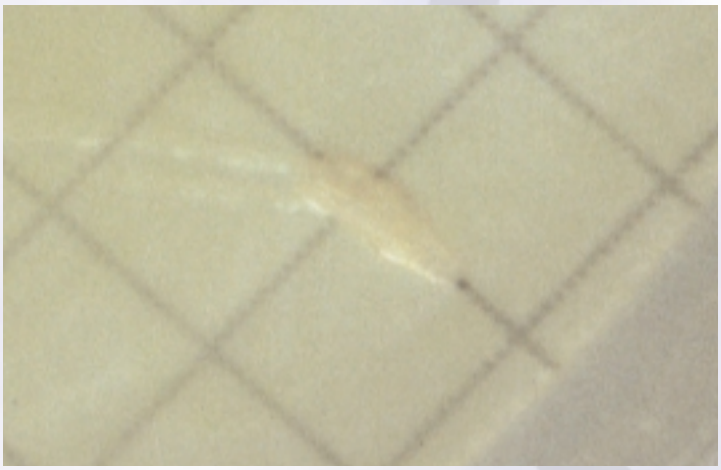
Concept

Transmission from Dental lines has been proven[1]

From a British Dental Clinic, two patients developed serious *Pseudomonad* Infections. The waterlines were tested and revealed the identical bacterial strain. In a retrospective study, all other patients were tested for *Pseudomonas sp.* infection. Out of 78 patients, ALL 78 had a positive titre. This represents a 100% infection rate. Fortunately, the individuals were all healthy. Had they been immuno-compromized, many results could have been fatal.



In 1998 a hygienist in Washington state inadvertently splashed water from her ultrasonic scaler into her eye. Within a week a serious infection ensued. After a rigorous antibiotic course she recovered only to have several reoccurrences of infection. The bacteria was of the pathogenic *Serratia* family (shown at right), an ENTERIC or bowel bacteria. How did such a bacteria get into Dental Waterlines? Primary cause - poor maintenance of Independent Water Supply Bottles and inattention to the in-bottle supply tubing.



Many other interesting organisms have been found in Dental Unit waterline samples. Shown at the left is a type of parasite larvae found in a Dental Unit water sample from the Mid-West.

The organisms of real concern are *Pseudomonas* and *Legionella*. *Pseudomonas* is a natural water-loving biofilm producer, that when aerosolized is almost guaranteed to cause severe pneumonia-like disease in elderly or immuno-compromized individuals. In well discussed cases from San Francisco, *Legionella* has been found in waterlines where Dentists have become seriously ill. Recent advances in molecular biology now make it possible to determine the exact source of infection. With this high level of traceability and the knowledge that infection could come from a Dental office, should Dentists not be pro-active in reducing and limiting their liability?

1. The Significance of the bacterial Contamination of Dental Unit Water Systems. Martin, M.V., British Dental Journal 1987

Background

Concept

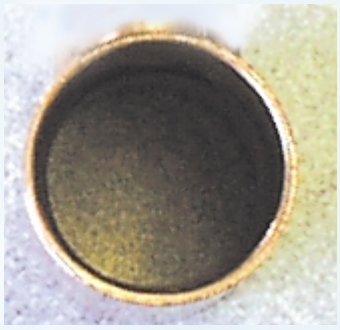
Tap Water and Dental Water come from the same source-
How can they be different?

Most Dental tubing has a diameter of 1/16 inch. At the busiest of times the flow rate in a Dental Handpiece is between 2 and 10 millilitres per minute. It is absolutely stagnant on weekends and evenings. It has been found that only after flushing each line for 20 minutes[1] does Dental water approach the potable drinking water standard of 500 CFU/mL.

1 Influence of Biofilms on Microbial contamination in Dental Unit Water. Whitehouse, R. & Peters, E. University of Alberta, 1991

Most household pipes are made of 1/2 inch diameter copper. The flow rate is about 5 litres per minute or 1,000 times greater than Dental water.

Flow Rate



Composition

Copper as a metal and as a dissociated ion is Antimicrobial/Bacteriostatic. In addition the smooth interior of the pipes makes it resistant to biofilm attachment.

Plastic tubing has a very large surface area to volume ratio. It also is a source of carbon for Bacteria. The hydrophobic surface makes biofilm attachment easy. Some tubings have a rough interior as they are extrusion molded.

Chlorine rapidly dissipates over 24 hours, allowing standing water to be rapidly colonized over a weekend.

Concept

Exponential Population Growth of Bacteria

Bacteria can double their population every 20 minutes on average in a warm environment.
(In a refrigerator, growth is arrested)

Example:	1 Bacteria	@ 8 AM
	4096 Bacteria	@12 NOON
	134,217,728 Bacteria	@ 5 PM

Analogy: You arrive in a restaurant for lunch on a Monday. There is already a waterjug on your table when you arrive. What would your reaction be if the waiter told you he poured it on Friday? In the Dental waterline, the water sits stagnant all weekend long, hence the musty, moldy smell on Monday mornings.

Dentistry: In addition to stagnant incubation in the evenings, there is retraction from the oral cavity into the water tubings. Many species of specific oral bacteria have been found in the waterlines. Where else could specific organisms such as these come from?

Dental Unit Waterline Contamination
1999 Summary
Quick Facts from Background Studies

Micrylium, with laboratory locations in Phoenix and Toronto has tested over 4,000 Dental Waterlines ('97-'99)

Geographical Basis: Dental Offices from Los Angeles to Newfoundland
(CFU = Colony Forming Units of Bacteria)

Note: Federal Water Quality Regulation 500 CFU/mL with no Pseudomonas Aeruginosa

Average Bacterial Counts:	Dentist with City Water Feed:	375,000 CFU/mL
	Dentist with Independent Reservoir	1,200,000 CFU/mL
	Dentist with Excellent Cleaning Protocol	<200 CFU/mL
Highest # of Bacteria found in a Dental Waterline:		41,000,000 CFU/mL

% of Dentists with Pathogenic Pseudomonas Aeruginosa:	10 %
Highest # of Pseudomonas Aeruginosa in a Dental Waterline:	21,000,000 CFU/mL

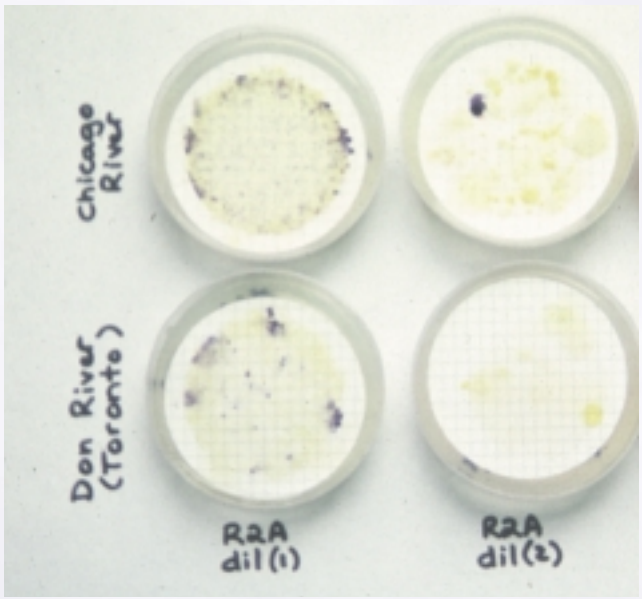
% of Dental Waterlines with Mycobacterium species (TB family)	50 %
# of Bacteria in newly manufactured Dental Units as delivered:	5,000,000 CFU/mL

Other Waterlines

Grocery Store Produce Department Misting lines for Vegetables 20 Stores Tested	avg	512 CFU/mL
Arizona Restaurants Outdoor Patio Water Misting lines 20 Restaurants Tested	avg	243 CFU/mL

Major Rivers

Average of the rivers including Chicago, Ohio, St. Lawrence, Rio Grande	235,000 CFU/mL



Bio 2000 ® from **Micrylium** requires only 25 seconds per unit per day and less than half an ounce of product.
In summary: Less than 25 seconds,
Less than 25 cents,
Less than 25 CFU/mL.

Micrylium
1-800-489-8868
www.micrylium.com

Waterline Facts