

 GOVERNMENT OF DUBAI	Organization Unit	Public Health & Safety Department	الوحدة التنظيمية:	 بلدية دبي DUBAI MUNICIPALITY
	Form sheet title:	Guidelines for Guidelines For The control of Legionella in Dental clinics	اسم النموذج :	
	Doc Ref.	DM-PH&SD-P7-TG05	رقم النموذج :	

Control of Legionella in Dental clinics

Objectives of guidelines:

Dubai Municipality, as part of its mandate, is striving to attain the highest level of health conditions within the public establishments to achieve its goals in protecting and promoting public health through disease control measures. These guidelines are intended to ensure the use of quality water in dental clinics. This guidance is issued by Dubai Municipality to serve as a tool to enable dental clinic to comply with proposed quality guidelines.

Scope of application:

These guidelines are applicable to waters used in dental clinics.

Introduction

The problem in water that delivered by dental units frequently contain high levels of bacteria.

The numbers of bacteria in the water are not just one or two or even ten or twenty times above what are usually found in drinking water, usually they are 10,000 to 100,000 times more concentrated than in drinking water.

This paper highlights some of the problems associated with microbial contaminated water supplies and discusses the risks to patients and dental staff from some of these organisms.

Clinical relevance:

Patients and dental staff are continually exposed to high levels of microbial contamination in dental unit water supplies.

These guidelines explain the risks involved and current recommendations to reduce these risks.

What micro-organisms are found in dental unit water systems and do they pose a risk to health?

Organisms of concern include: *Pseudomonas*, *Klebsiella*, *Legionella*, and non-tuberculosis *Mycobacterium* species. *Pseudomonas* is a well-known opportunistic pathogen and a common contaminant in dental unit water. *Legionella* (*L. pneumophila* and over than 30 other species) is commonly found in natural and domestic waters. It frequently exists inside of protozoa and causes Legionnaires' disease (pneumonia either from inhalation from the outside source or aspiration from colonized oropharynx).

What is Legionella?

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A genus of bacteria of the family Legionellaceae. It currently consists of at least 51 serogroups comprising over than 30 species. It has the ability to colonize water in distribution systems. It can cause disease in humans (e.g., Legionnaires' disease or Legionellosis) that is progressive and sometimes fatal (lifeless), or a milder form of pneumonic illness (Pontiac fever) that is self-limited (i.e., heals on its own) with respiratory symptoms similar to influenza.

Legionella infection manifests in two very different forms: Pontiac fever and Legionnaires disease. Pontiac fever is an acute self-limiting flu-like illness without pneumonia. In Legionnaires disease a broad spectrum of illness may be apparent ranging from a mild cough and slight fever to pneumonia with multi-organ failure. There are over than 30 species of Legionella, but most disease is caused by *L. pneumophila*.

Interestingly, the Legionella bacteria appear to occupy a unique niche within the biofilm by surviving as intracellular parasites of protozoa (organisms similar to amoeba). This intracellular existence may partly explain the difficulties in eradicating Legionella species from some water systems. Legionella bacteria have been found in dental unit water supplies and there is an obvious concern that this will cause Legionella infections in patients or dental staff.

High-speed drills and ultrasonic descaling devices generate fine aerosol within the patient's mouth and organisms within the water droplets may be inhaled or pass into the blood stream when tissue around the gums and mouth is broken during dental treatment.

What is the CFU?

Colony Forming Units

A CFU is a bacteria cell or clump of cells, which will form a distinct colony on an agar growth plate when cultured. Usually this number is referred to as CFU/ml. Most studies of water from dental handpieces and air-water syringes have demonstrated contamination levels, which are hundreds or even thousands of times greater than is permissible in drinking water supplies.

What is a biofilm?

A slime layer, which naturally develops when bacteria attach to an inert support that is made of a material (solid surface). There are also non-filamentous bacteria that will produce an extra cellular polysaccharide that acts as a natural glue to immobilize the cells. In nature, nonfilament-forming microorganisms will stick to the biofilm surface, locating within an area of the biofilm that provides an optimal growth environment. Since nutrients tend to concentrate on solid surfaces, a microorganism saves energy through cell adhesion to a solid surface rather than by growing unattached and obtaining nutrients randomly from the medium. Some bacteria, such as Legionella species can even hide within other microorganisms such as protozoa! Bio-films are important because they are the source of microbial contamination in dental unit water lines and monitoring the quality of water gives an indication of the level of biofilm build up in dental units. Dental Unit Waterline Biofilm Formation

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1- Initial Attachment

- Microbes enter the tubing from incoming water and to a lesser degree from dental clients during treatments
- The microbes have the ability to adhere to the surfaces and to the inside walls of the dental tubing within hours.

2- Accumulation

- The attached microbes begin to multiply and start to form a spreading film on the tubing walls.
- Additional microbes from the incoming water continue to attach and multiply.
- The microbes produce polysaccharide that coats the cells, forming a slime layer.
- Within a few weeks, the biofilm has covered most of the inside walls of the tubing.

3- Release

- Microbes are continuously released from biofilm into the flowing water.

Conditions that Facilitate Biofilm Formation in Dental Unit Waterlines:

- Low numbers of microbes are continually entering the tubing.
- Nutrients are continually being supplied in the incoming water.
- Stagnation of the water in the tubing facilitates accumulation.
- The water's natural flow rate is low near the tubing walls.
- Water in the tubing is not under high pressure.
- The tubing's smaller diameter creates a large surface-to-volume ratio.

If ordinary tap water goes into my dental unit why does it come out full of bacteria?

There are two main reasons for this:

1. The materials used in the internal construction of dental unit water lines commonly contain polyurethane tubing which encourages attachment and proliferation of bacteria.
2. The large number of narrow bore plastic tubes creates a high surface area to volume ratio, i.e., there is a large surface area of biofilm formed compared to the volume of water it contains

Legionella Control Methods:

There are various methods advocated for disinfecting water and their effectiveness depends on numerous factors that must be considered prior to deciding which method

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is most applicable for the particular application. These factors are: condition of the water prior to treatment, pH value, hardness, debris, rust, turbidity, minerals and metals in solution and any treatment methods that may conflict with the proposed process.

- Ultraviolet (UV) can be impaired by shadows caused by turbidity and bubbles, restricting the radiation, but its advantage are that it does not introduce chemicals. The disadvantage is that no residual is introduced to treat established sites where bacteria proliferate downstream from the treatment area and, therefore, bacteria harboring biofilm is not attacked. Therefore, its main uses are at point of entry or at point of use. Ozone (O₃) systems generally operate by drawing air into the apparatus where it is dried and passed to a chamber containing a high-voltage discharge system, generates O₃, which is then drawn into the water by a venture action. This solution forms an efficient oxidizer and, like UV, kills organisms passing through the system but again, like UV, it does not produce a residual that will circulate throughout a water system, as O₃ is highly unstable and corrosive.
- Water supplies are generally treated with chlorine and, by the time the chlorine enters buildings, it is at a low level and not capable of killing bacteria that thrive in manufactured water systems (where temperature and stagnation encourage rapid multiplication from the low levels of bacteria that seed the system from the incoming water). Injecting chlorine is one of several accepted processes. Many organisms are resistant to levels those are acceptable for drinking water and the limited corrosion.
- Recently, chlorine derivatives have been introduced, such as chlorine dioxide and monochloramine. These have a longer residual life, whereas chlorine is more volatile and decays more rapidly within pipe work, therefore demanding higher levels to be injected. Chlorine dioxide and monochloramine are in turn longer-lived and less corrosive.
- In the past, guidance has recommended raising the hot-water temperature to a minimum of 60°C to inhibit bacterial growth in hot water systems. Unfortunately, many water systems have a tortuous and lengthy distribution system, where the temperature drops even with extensive lagging and, thus, it is extremely difficult to maintain this temperature. Even when the temperature of the water on return to the heating system is 55°C, bacteria, including Legionella, frequently remain within the system. The disadvantage of raising the hot-water temperature is the possibility of scalding and, therefore, it has been recommended that thermostatic mixing valves be fitted at outlets to prevent this. Unfortunately, it has been found that the secondary and outlet side of thermostatic mixing valves, which do not receive the raised-temperature hot water, becomes a site for the proliferation of bacteria, seeded from the cold-water blend. The water system in modern dental equipment, which supplies water to the dental pedestal feeding the drill head, contains valves, pressure pumps and a morass of capillary pipe work where biofilm may become established and support the proliferation of bacteria. The capillary pipe work is relatively low and the water temperature will be no lower than ambient in most cases, allowing bacteria to multiply if they are present.

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- Although flushing recommendations are found in a number of published infection control guidelines, Studies have shown that biofilms cannot be removed by flushing alone, and that biofilm bacteria can quickly recontaminate treatment water. Flushing between clients however may be beneficial to eliminating retracted client material.
- Another method is ionization. This method is thought of as non-chemical and works by introducing a minute stream of positively charged silver and copper ions into the water by a process of electrolysis. This minute stream of ions forms a stable residual that is both non-corrosive and nonvolatile. Being long-lived it will circulate throughout water systems, attacking biofilm (slime) that harbors bacteria, particularly Legionella, which multiplies readily within biofilm and is released in bursts as the biofilm becomes saturated. Ionization has no effect on water balance, does not produce any odour and complies with international drinking-water standards. The equipment consists of a power source that can be controlled from a water meter to ensure exact proportional dosing and is equally applicable to both hot and cold-water being unaffected by temperature.

Guidelines For Dental Water Quality:

Dubai municipality (DM) recommendation the acceptable limit of:

- TBC (Total Bacteria Count) is 200CFU/ml as a maximum for contamination of water used in dental treatment,
- Legionella bacteria should *not* be detected in any sample and complete elimination of biofilms and bacterial contamination.

Only sterile solutions (TBC should be zero CFU/ml) are used for surgical procedures that involve the cutting of bone.

There are conditions to improve dental water quality:

1. Water Source:

To improve the quality of the incoming water,

- Use a non municipal water source (separate reservoir),
- Drinking Water
- Sterile Water

2. Waterlines:

To control biofilm in the tubing:

- a) Continuous application of chemicals at levels which can control or eliminate biofilms, but are below threshold levels for toxicity in humans.
- b) Yearly replace and decontaminate the lines.
- c) Air purges lines and dry (let set empty) overnight.
- d) To control water quality as it leaves the tubing, continue to use High Volume Evacuation (HVE) with all water sprays.

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3. **Flush water lines at the beginning of the day for 30 seconds (may temporarily reduce the level of microbes in the water). Flush air/water through handpieces for 20 seconds after each patient (helps reduce any patient-borne microbes that may have entered the handpiece and were "sucked back" down the dental unit line).**
4. **Monitoring water quality:**
- a) testing the water coming out of each Dental unit . water sample should be taken from (handpieces & cap filler), Testing should accurately detect a Legionella sp, Heterotrophic Plate Count. Monitoring recommended for good operating practice as shown below;-

<u>parameter</u>	<u>Timing</u>
Aerobic count	Four weeks
Legionella	Quarterly

- b) the test results must be available for inspection by the Dubai Municipality (DM) staff or DM representatives.
- c) The analysis of microbiological samples must be undertaken by a laboratory that is accredited by Dubai Municipality to perform the required testing (for more information about dental guideline pls. visit www.dm.gov.ae) and accredited laboratories list (www.dac.gov.ae). Or contact Dubai Municipality \ Public Health & Safety Department \ Safety Section on DM contact centre 800900
- d) If the owner of premises on which Dental unit is installed receives a report of the results of microbiological testing of water taken from the system indicating the existing of Legionella bacteria, he or she must submit the report to Dubai Municipality\public health &safety department within 24 hours of receiving the report.
5. **Keeping of records and manuals;**
- a) Inspections, maintenance, infection control dates and results of each inspection.
- b) Details of treatment procedures, type and use of chemical germicidal treatment.
- c) Result of any testing of the systems and microbiological testing of water samples.

Important notice:

All devices and chemicals that claim to improve the quality of water used in dental treatment and control biofilms should be Food Grade.