

## Dental Unit Waterlines

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### Nightly Air Purging of Dental Unit Waterlines (5/11)

**Question:** Are we supposed to empty the water bottle on the dental unit each night and dry the lines by air purging?

**Answer:** It depends on what type of waterline treatment product you are using. If you are using a product only once a week (periodic use) to clean the lines, it is recommended to empty the bottle and dry the lines via air purging at the end of the day to minimize biofilm proliferation. Remember, in simple terms, the microorganisms in the biofilm thrive in moist environments. With continuous-use products (e.g., adding the product each time the water bottle is filled) the theory is that the active ingredients in the product provide continual cleaning of the waterlines and it is usually not necessary to air purge each night. As always, you need to follow the manufacturer instructions for the waterline treatment product that you are using.

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### Selecting Evacuation Line Cleaners (2/11)

**Question:** Our dental clinic is considering purchasing a new evacuation line cleaner. Are there any special characteristics or ingredients we should look for and be aware of? What are some items we should take into consideration when choosing a product?

**Answer:** There are many manufacturers and distributors that sell line cleaners for vacuum systems with and without amalgam separators and collection tanks. The characteristics of your particular system will determine what type of line cleaner you should use. Your first step should be to check with the Biomedical Equipment Maintenance repair shop and your facilities department. These valuable resources can tell if you have a wet-ring pump or a dry vacuum system and the type of an amalgam separator if one is being used. This information is critical to know when asking the dental delivery system, vacuum system and the amalgam separator manufacturers what line cleaning products they recommend or what is compatible with their equipment. Many disinfectants or line cleaner products possess oxidizing properties that have the potential to liberate mercury ions into the waste water system from amalgam that has been captured in the separators or may have built up in the vacuum lines or collection tanks. Since this is a concern, it is highly recommended to avoid any products that contain bleach or chlorine to help minimize the dissolution of amalgam. Another characteristic to be aware of is the pH balance of the product you choose. Amalgam separator operation may be hindered with products that have an acidic (low pH), while



basic (high pH) cleaners may cause premature wear on material used in the amalgam separators. The closer a product is to neutral pH (pH7) the better. As always, the DECS staff is always ready to help answer any questions that you may have when you are choosing a product for use in your clinic.

### Questions To Ask When Selecting an Evacuation Line Cleaner

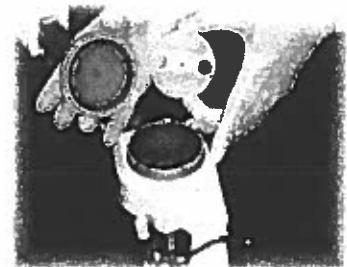
- Is the product compatible with my current vacuum system and dental delivery unit?
- Is the product compatible with my amalgam separator system?
- Is the product in compliance with local waste water policy?

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### Cleaning Suction Lines and Traps (11/10)

**Question:** How often are we supposed to clean the dental unit evacuation/suction lines and traps? Should we change the trap daily?

**Answer:** According to the *USAF Guidelines for Infection Control in Dentistry* the high-volume evacuator and low-volume suction lines and traps are to be cleaned daily using an evacuation system cleaner according to manufacturer instructions. Many line cleaner products possess oxidative potential to liberate mercury ions into solution from amalgam. Products that do not contain bleach, or chlorine, minimize the dissolution of amalgam. Therefore, only non-chlorinated line cleaning products can be used unless the trap has no chance of containing amalgam residue (e.g., the unit is dedicated strictly for hygiene patients). Changing the trap out daily is probably not indicated. The length of time that you decide to keep it will be based upon on the amount of debris that collects. In other words, if the trap becomes clogged with debris sooner than one week, then it may have to be changed more frequently. From past experience and what I've heard from other clinics, a week is generally a good time period. As a reminder, do not rinse chairside traps containing amalgam over drains or sinks as this could introduce dental amalgam into the waste stream. Also, used chairside disposable traps cannot be disposed into municipal waste unless the trap has no potential to contain amalgam residue (e.g., the unit is dedicated strictly for hygiene patients). The trap must be disinfected, stored in a sealed container and processed for proper disposal according to local policy.



### References

- American Dental Association. Best Management Practices for Amalgam Waste. Available at [http://www.ada.org/sections/publicResources/pdfs/topics\\_amalgamwaste.pdf](http://www.ada.org/sections/publicResources/pdfs/topics_amalgamwaste.pdf). Accessed November 2010.
- Batchu H, Chou H, Rakowski D, Fan PL. The effect of disinfectants and line cleaners on the release of mercury from amalgam. *J Am Dent Assoc* 2006;137:1419-1425.
- USAF/SGOD. USAF Best Management Practices for Amalgam Waste Policy Letter—FY11 Update.
- USAF Guidelines for Infection Control in Dentistry.

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### Flushing Dental Unit Waterlines (10/10)

**Question:** Is the 1-2 minute waterline flush still indicated each morning and why are we supposed to flush devices connected to the air and waterlines between patients?

**Answer:** In the past it was recommended to flush dental waterlines at the beginning of the clinic day for several minutes to reduce the microbial load. However, studies have demonstrated this practice does not affect biofilm in the waterlines or reliably improve the quality of water used during dental treatment. Therefore, this has not been recommended since the publication of the CDC Guidelines for Infection Control in Dental Health-Care Settings in 2003. It is still



necessary 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 (e.g., handpieces, ultrasonic scalers, and air/water syringes). This procedure is intended to physically flush out patient material that might have entered the turbine, air, or waterlines. Even though the initial flush of the day is no longer indicated, it's still a good idea to perform a quick flush of the lines before each patient to ensure everything is working (e.g., that the air/water syringe is attached correctly, water/air is flowing) before you begin patient treatment.

#### References

- CDC. Guidelines for infection control in dental health-care settings - 2003. MMWR 2003; 52(No. RR-17):1-66.
- USAF Guidelines for Infection Control in Dentistry.

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### Sterile Irrigation Solutions (4/10)

**Question:** After opening a bottle of sterile water, can we use it for other surgical procedures later in the day?

**Answer:** No. Sterile irrigation fluids (e.g., saline, water) are considered single-use or single-dose items. Once you open the bottle, the contents can no longer be considered sterile because there is no bacteriostat, antimicrobial agent or added buffer. Therefore, you can only use it for one patient and the remaining contents must be discarded. If you find that you are not using the entire container during the procedure and are concerned about waste, you should purchase smaller containers. The practice of dating and initialing the bottle upon opening is no longer indicated or valid as the product can only be used for one patient. The *USAF Guidelines for Infection Control in Dentistry* have been updated to reflect this and now state: "Use sterile irrigating solutions for one patient and dispose of them appropriately. Do not date or save for later use, even on the same patient."

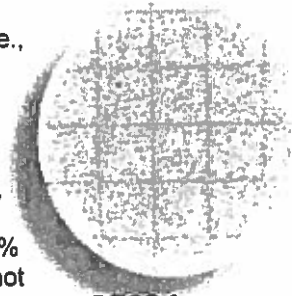


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### Dental Unit Water Samples With Over 500 CFU/mL (7/05)

**Question:** Is there a recommended protocol to follow when a dental unit water sample has over 500 CFU/mL?

**Answer:** In the event that standards are not met when monitoring dental unit water (i.e.,  $\geq 500$  CFU/mL), review work practices, waterline treatment protocols, and waterline treatment and monitoring records. Correct any identified procedural problems, retreat the waterlines, and retest the dental unit. If the test remains positive, a shock treatment of the waterlines may be indicated. Many dental unit waterline product manufacturers offer guidance on initial or periodic shock treatments for the waterlines, which may include using a higher concentration of their product or an extended treatment time. Cleaning or shocking the lines with diluted bleach (1 part household 6% bleach to 10 parts water) is another option. In the event that a unit consistently does not meet standards (i.e.,  $\geq 500$  CFU/mL) contact the waterline treatment product manufacturer or DECS for guidance.



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### Waterline Monitoring Frequency (6/05)

**Question:** How often should we monitor the water from our dental units? Should we take the water samples from the handpiece lines or the air water syringe?

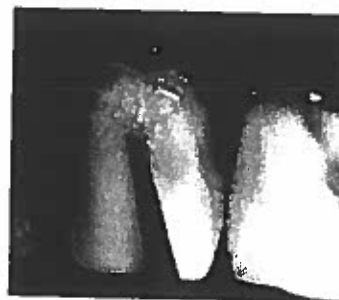
**Answer:** Many dental unit waterline product manufacturers provide guidance regarding the frequency of monitoring. A partial listing of monitoring recommendations can be found by visiting the DIS Synopsis of Dental Unit Waterline Treatment Products and Devices. In the absence of manufacturer recommendations, the USAF Guidelines for Infection Control in Dentistry recommend testing the dental unit water from each unit monthly for three months when beginning to use a new product. If the unit meets standards (i.e.,  $\leq 500$  CFU/mL) during this period, then monitor the water from the dental unit quarterly at a minimum. It is recommended to use a rotating schedule testing several dental units each month. To obtain a representative water sample, obtain a pooled sample from all lines (e.g., air water syringe, handpiece, ultrasonic scaler) and place in a sterile specimen cup.

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### Dental Unit Waterline Treatment and Bond Strengths (11/04)

**Question:** What effect does dental unit waterline (DUWL) treatment have on the bond strength of composite resin to tooth structure?

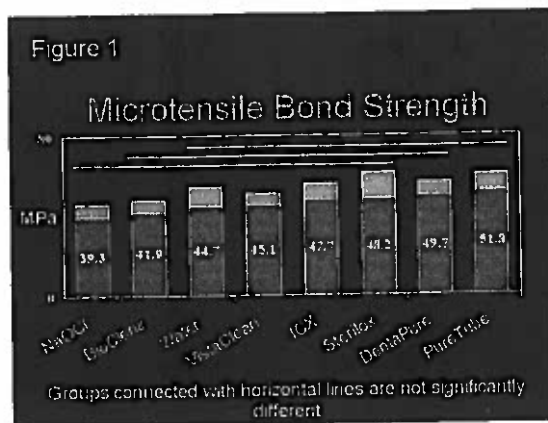
**Answer:** When using continuously delivered waterline treatment products, the tooth is exposed to chemical agents during preparation and restoration, including adhesive bonding procedures. The impact of the interaction of the continuously delivered dental waterline product and the adhesive procedure should be of concern to the restorative dentist. Several studies have addressed this potential interaction with somewhat equivocal results.<sup>1-5</sup> A study was conducted by DIS using seven dental unit waterline treatment products, with different chemical compositions, to determine the effects, if any, on microtensile bond strength ( $\mu$ TBS) to dentin. A synopsis of this study is given below.



#### Effect of Dental Unit Waterline Treatment on Microtensile Bond Strengths of Composite Resin to Dentin

**Materials and Methods:** Sixteen recently extracted third molars (eight groups of two teeth each) were sectioned and rinsed using water from a dental unit (Mini-Troll 4225, A-dec) treated with one of seven different treatment solutions (sodium hypochlorite [4ppm], Clorox; BioClenz, Frontier Pharmaceutical; DentaPure DP40, MRLB International; ICX, A-dec; PureTube BR90, Sterisil; VistaClean, Pelton&Crane; Sterilox, Ultradent) or distilled water (control). Composite resin (Z100, 3M ESPE) was bonded incrementally to the dentinal surface using a two-step total-etch bonding agent (Single Bond, 3M ESPE). Specimens were sectioned in X and Y directions to obtain bonded beams with a cross-sectional area of  $0.62 \pm 0.02$  mm<sup>2</sup>. Fifteen beams per group (n=15) were tested in tension in a universal testing machine (Alliance RT/5, MTS) at a crosshead-speed of 1 mm/min. Data were analyzed with 1-way ANOVA/Tukey;  $\alpha=0.05$ . After microtensile bond strength testing, the specimens were examined with a stereomicroscope at  $\times 8$  magnification to determine the failure mode.

**Results:** Significant differences were found in mean  $\mu$ TBS among waterline treatments ( $p=0.003$ ). See Figure 1 below. No significant difference was found between any treatment group and untreated water (control) ( $p > 0.05$ ).



**Discussion:** Several studies have evaluated the effect of DUWL treatment products on the shear bond strength of resin composite to tooth structure.<sup>1-5</sup> von Fraunhofer and others<sup>1</sup> found no significant decrease in bond strength when rinsing specimens with ICX solution after dentin conditioning. ICX contains sodium percarbonate, cationic surfactants and silver nitrate. The authors speculate that the surfactants combined with the oxidizing action of the percarbonate could promote adhesive penetration. Similar results were found with this study, which found no significant difference in microtensile bond strength between ICX and water (control). A study by Roberts and others<sup>2</sup> found a significant loss in shear bond strength with the use of Listerine (Warner Lambert) and Bio 2000 (Micrylium) compared to distilled water. Both Listerine and Bio 2000 contain essential oils, which may have contributed to the adverse effects. The manufacturer of Bio 2000 recommends rinsing the etched surfaces with untreated water when using their product. One study found no reduction in enamel bond strength when this procedure was followed.<sup>3</sup>

Similar to our study, Roberts and others found that the use of sodium hypochlorite (3 ppm) did not cause a statistically significant loss in dentin bond strength.<sup>2</sup> Sodium hypochlorite in much higher concentrations has been found to completely remove collagen fibers in dentin and decrease shear bond strength.<sup>6</sup> Taylor-Hardy and others found a significant loss in enamel bond strengths with the use of a 5-ppm solution of sodium hypochlorite.<sup>3</sup> The authors could not explain the exact reasons for the deleterious effects when bonding to enamel.

Most studies evaluating the effect of waterline treatment on bond strengths used treated water only for rinsing the etched surfaces.<sup>1,2,5</sup> This study, and a study by Taylor-Hardy, also used treated water to prepare the teeth, in order to better simulate clinical conditions.<sup>3</sup>

Many of the waterline treatment products evaluated in this study are relatively new to the market, with minimal information available in the literature. One recent abstract published in the *Journal of Dental Research* evaluated the effect of VistaClean, which contains a botanical extract from citrus, on the shear bond strength of composite resin to dentin. No significant difference was found between the groups using treated or untreated water.<sup>4</sup>

A two-step, total-etch bonding agent was used in this study. Other types of adhesives (e.g., self-etching) may give different results.

**Conclusion:** Based on the limitations of this study, no significant differences in microtensile bond strength were found between the teeth restored with untreated water or water containing a dental unit waterline treatment product.

Overall, the effect of dental waterline treatment on the bond strength of composite resin to tooth structure appears to be product specific, with only a few waterline treatment regimens causing a loss in bond strength while the majority apparently have no significant effect.<sup>1-5</sup> New waterline treatment products continue to be introduced, therefore future research will be necessary to study the effects of these new agents on adhesive dentistry.

## References

1. von Fraunhofer JA, Kelley JI, DePaola LG, Meiller TF. Effect of a dental unit waterline treatment solution on composite-dentin shear bond strengths. *J Clin Dent*. 2004;15:28-32.
2. Roberts HW, Karpay RI, Mills SE. Dental unit waterline antimicrobial agents' effect on dentin bond strength. *J Am Dent Assoc* 2000;131:179-183.
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5. Knight JS, Davis SB, McRoberts JG. The effect of dental unit waterline treatment regimen on the shear bond strength of resin-based composite. *J Am Dent Assoc* 2001;132:615-619.
6. Cederlund A, Jonsson B, Blomlof J. Do intact collagen fibers increase dentin bond strength? *Swed Dent J* 2002;26(4):159-166.

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## Sterile Surgical Irrigation **UPDATED** (6/09)

**Question:** Is it recommended to use sterile irrigating solutions when performing surgical procedures? What devices are available to deliver sterile irrigating solutions during surgical procedures?

**Answer:** Although the definition of a surgical procedure has changed slightly over the years, the practice of using sterile solutions (e.g., sterile saline or sterile water) for cooling and irrigation during surgical procedures is not a new policy. Current and past Centers for Disease Control and Prevention (CDC) dental infection control guidelines address the need for using sterile solutions when performing oral surgical procedures. The USAF clinical practice and dental infection control guidelines support the CDC recommendations.

Conventional dental units cannot reliably deliver sterile water even when equipped with independent water reservoirs because the water-bearing pathway cannot be reliably sterilized. Sterile bulb syringes or single-use disposable products should be used to deliver sterile water. Oral surgery and implant handpieces, as well as ultrasonic scalers, are commercially available that bypass the dental unit to deliver sterile water or other solutions by using single-use disposable or sterilizable tubing. Several examples of commercially available products capable of delivering sterile solutions include:

- ACSIS Water System (bypasses dental unit waterlines to deliver sterile solutions through dental handpieces) by Aseptico International: [www.aseptico.com](http://www.aseptico.com).
- AquaSept™ Heat Sterilizable Independent Water Delivery System (bypasses dental unit waterlines to deliver sterile solutions through dental handpieces) by Genesis Dental Technologies: [www.aquasept.com](http://www.aquasept.com).
- Cavitron® Steri-Mate® Handpiece Sterile Lavage Kit by Dentsply Professional: <http://professional.dentsply.com>.
- Implantmed by W & H distributed by A-dec Corporation: [www.a-dec.com](http://www.a-dec.com).
- KaVo INTRAsurg 500 by KaVo America: [www.kavousa.com](http://www.kavousa.com).
- Osteopower 2i Modular Surgical Handpiece System by Osteomed Corp: [www.osteomedcorp.com](http://www.osteomedcorp.com).
- Piezosurgery® Dental // Unit by Piezosurgery, Inc.: [www.piezosurgery.com](http://www.piezosurgery.com).
- Piezotome Ultrasonic Surgery Unit by ACTEON North America: [www.acteongroup.com](http://www.acteongroup.com).

## Selected References

1. CDC. Recommended infection-control practices for dentistry. *MMWR* 1986;35:237-242.
2. CDC. Recommended infection control practices for dentistry, 1993. *MMWR* 1993;41(No. RR-8):1-12.
3. CDC. Guidelines for infection control in dental health-care settings - 2003. *MMWR* 2003; 52(No. RR-17):1-66.
4. Garner JS. CDC guideline for prevention of surgical wound infections, 1985. Supersedes guideline for prevention of surgical wound infections published in 1982 (Originally published in November 1985). *Infect Control* 1986;7:193-200.
5. Mills SE. The dental unit waterline controversy: defusing the myths, defining the solutions. *J Am Dent Assoc*

**Oral Surgical Procedure Definition**  
—Involves the incision or reflection of tissue that exposes normally sterile areas of the oral cavity. Examples include biopsy, periodontal surgery, apical surgery, implant surgery, and surgical extractions of teeth (e.g., removal of erupted or nonerupted tooth requiring elevation of mucoperiosteal flap, removal of bone or sectioning of tooth, and suturing if needed).

**CDC Guidelines for Infection Control in Dental Health-Care Settings—2003**

2000;131:1427-1441.

6. USAF Clinical Practice Guidelines. Available by visiting the USAF Dental Service Web site.

7. USAF Guidelines for Infection Control in Dentistry.

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### **Guidelines for Properly Treating Dental Unit Waterlines (Updated September 2004)**

**Question:** What are the latest recommendations regarding dental unit waterlines?

**Answer:** Today, research continues to highlight how important it is to perform proper treatment of dental unit water and to monitor the water after it is treated. It is important that we strive to provide the highest quality of treatment water that can be achieved. All dental clinics should consult the manufacturer of their dental units before initiating a particular waterline treatment protocol. The following are the latest recommendations for managing waterlines:

1. Follow current ADA and CDC recommendations to flush handpiece hoses and air/water syringes for 20-30 seconds between patients. Also, if recommended by the dental unit manufacturer, install and maintain antiretraction valves to prevent oral fluids from being drawn into dental waterlines.
2. Do not heat dental unit water. Warming the water promotes biofilm formation.
3. Consider implementing equipment and procedures that have been shown to improve the quality of water such as separate reservoirs, chemical treatment protocols, and sterile water delivery systems.
4. Use a separate water reservoir system to eliminate the flow of municipal water into the dental unit. This allows better control over the quality of source water for patient care, and eliminates interruptions in dental treatment when local health authorities issue boil-water notices. Contact the manufacturer of the dental unit for recommendations for a compatible system and treatment protocols before purchasing.
5. Use sterile solutions for all surgical irrigations.
6. Educate and train all dental health-care personnel on effective treatment measures to ensure compliance and minimize risks to equipment and personnel.
7. Follow recommendations for monitoring dental unit water quality provided by the manufacturer of the unit or waterline treatment product to assess compliance with recommended protocols and identify technique errors or noncompliance. In the absence of manufacturer's instructions, monitor dental unit water quarterly.
8. Monitor scientific and technological developments to identify improvements as they become available.
9. Ensure that sterile water systems and devices marketed to improve dental water quality have received FDA clearance.

Compliance with treatment protocols is critical for long-term success. Control of biofilm depends on technique factors, effective personnel training, and an established standard operating procedure.

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### **Explaining the Issue of Dental Unit Waterlines to Patients (Originally published in the Jan 2000 issue of InCONTROL)**

**Question:** How do I explain the issue of dental unit waterlines to my patients in an easy-to-understand and nonthreatening manner?

**Answer:** When discussing this subject with your patients, it is a good idea to be concise but to tailor your answer based on the patient's interests and scientific knowledge. The following are key points to discuss with your patient.

1. Dental unit waterlines are small tubes (pipes) that deliver water to equipment such as the high-speed handpiece (drill), air/water syringe and ultrasonic scaler [point out these devices in the operatory]. During certain dental procedures, water is used to cool the equipment and to flush away debris. It is also used with ultrasonic instruments to remove calculus (tartar) and stain from teeth.
2. When water is used during a dental procedure, suction is used to vacuum up the water and debris.
3. Microorganisms (germs) that are found in domestic water supplies can contaminate dental unit waterlines.
4. Any surface that is exposed to water for a long period of time can develop a biofilm (organized layer of germs and their products). This problem is common wherever water is delivered through small pipes or tubes, like in the dental units.
5. Microorganisms (germs) found in dental unit waterlines pose a negligible threat to the public and dental team. At present, there are no studies that show increased health risks to dental patients from this water.
6. The bulk of microorganisms (germs) should not cause disease in normal, healthy individuals, but may lead to illness in medical compromised patients (those with a weak body defense system).
7. There are several options to lessen the problem and reduce the risk in dentistry. Some are flushing the waterlines at the beginning/end of the day and between patients, using independent water reservoirs and point-of-use filters, and chemically treating the waterlines.
8. [Explain to the patient exactly what your clinic does to address the issue.]

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### **Anti-Retraction Devices on A-dec Dental Units (Originally published in the Jan 2001 issue of InCONTROL)**

**Question:** Our clinic uses A-dec dental units. Is it necessary to periodically check them for anti-retraction?

**Answer:** All A-dec units manufactured after February 1986 are designed to be passively non-retracting and do not have an anti-retraction device that needs to be inspected. Being non-retracting means these units do not retract potentially contaminated fluids back into handpieces, three-way syringes, or waterline tubing. A-dec units manufactured before February 1986 may have anti-retraction valves installed in them that can fail over time and result in retraction of oral fluids. (This may also be true for units from other manufacturers.) A-dec will send you (free of charge) a kit to test for nonretraction for units manufactured before February 1986. If you need additional information or wish to request a test kit, contact A-dec at (800) 547-1883.

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### **Using Deionized Water in the Separate Water Systems of Dental Units (Originally published in the May 2001 issue of InCONTROL)**

**Question:** What is the difference between deionization and distillation? Is it appropriate to use deionized water in the separate water system of a dental unit?

**Answer:** Deionization is also referred to as demineralization or ion exchange. This process removes calcium, magnesium, and other ionic impurities by using synthetic resins. These resins have an affinity for dissolved inorganic cations and anions, but **they do not reduce bacteria levels.**

With distillation, water is removed from the impurities rather than the impurities from the water. Water undergoes phase changes during the process, changing from a liquid to vapor and back to a liquid. This process removes most inorganic solids, all organics with a boiling point greater than water, and all bacteria and pyrogens.

Based on this, **it is inappropriate to use deionized water in the separate water system due to the inability of the process to satisfactorily reduce bacteria levels.** However, deionized water is appropriate for use in autoclaves and in the dental laboratory. On the other hand, if the water distiller and storage container are properly cleaned, distilled water is appropriate for use in the separate water system.

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### **Backflow and Dental Saliva Ejectors (Originally published in the Sep 1998 issue of InCONTROL)**

**Question:** Is backflow possible when using a saliva ejector?

**Answer:** Backflow, meaning reverse flow, can occur from the low-volume suction line through the saliva ejector tip and into the patient's mouth. There have been some recent studies which demonstrate possible cross-contamination between dental patients due to backflow from the saliva ejector. Backflow occurs when there is more negative pressure in the patient's mouth than in the evacuator tubing (this can occur when the patient uses the saliva ejector as a straw). When this happens, there exists the possibility that material from the mouth of a previous patient may remain in the vacuum line of the saliva ejector and be aspirated into the mouth of the next patient being treated. Data also suggest the possible existence of an infection risk during backflow from potential pathogens shed from the biofilm in the tubing in low-volume suction lines.

Factors contributing to backflow are position of the suction tubing, simultaneous use of other evacuation equipment, and whether the patient's mouth is closed around the saliva ejector. Studies have shown that gravity pulls fluid back toward the patient's mouth whenever a length of the suction tubing holding the tip was positioned above the patient's mouth or when an excess of fluid collected in the tubing attached to the unit was above the patient's head. Backflow into a saliva ejector is also likely to occur when high-volume evacuation is used in an adjacent operatory because this creates a drop in pressure.

At this time the American Dental Association and the Centers for Disease Control and Prevention are not aware of any adverse health issues when using saliva ejectors. However, the following guidelines are recommended: inform patients not to close their lips around the saliva ejector tip during use; let the tubing hang below the patient's head when removing fluid during and after treatment; and rinse the low-volume suction line between patients. It is also recommended that the suction line be disinfected daily.

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