

Letters to the Editor

Dental Unit Water Systems Harbor Large Numbers of Microorganisms

To the Editor:

Narrow dental unit water lines provide a favorable environment for the multiplication of bacteria to high levels. Warming of the unit water to 37°C, water storage tanks, slow flow or stagnation of water, and biofilm promote bacterial growth in the tubing. Dental unit water may contain common environmental aquatic microorganisms, or infectious material may be aspirated through the dental handpiece or three-way syringe from the patient's mouth during treatment. Even very low concentrations of microorganisms from municipal water may rapidly colonize the dental tubing. The minimum standard of the quality of water in dental units should be that of drinking water from municipal sources (the European Economic Community Council Directive is <100 colony-forming units [CFU] per mL).¹

The health risk associated with microbial loads in dental unit water systems remains to be defined. One study reported two cancer patients acquiring *Pseudomonas aeruginosa* infection at the site of reparative dental treatment,² and it was found that the dental unit water harbored the microbe. However, healthy individuals had been treated on the same units without onset of clinical illness. Thus, patients with compromised host resistance due to nutritional deficiencies, aging, alcoholism, cancer, diabetes, autoimmune disease, or infectious disease may be susceptible to infection.³ However, an association between infections with extended incubation times and dental treatment might be difficult to show.

We carried out a study to evaluate the microbial contamination level of dental unit water in two geographically distinct clinical settings with the same quality requirements for input water. The effect of flushing of defined duration was also determined. At location 1, water samples

were collected from the handpiece (n=28) and three-way syringe (n=30) water lines in a university dental clinic. At location 2, samples were collected from handpiece water lines in a university dental clinic (n=3) and in a health center (n=3).

At location 1, the total microorganism counts in handpiece outlets, without prior flushing, ranged from 900 to 60,800 CFU/mL (mean, 12,854±11,915 standard deviation [SD] CFU/mL; water flow from the handpiece ranged from 50 to 200 mL/min [mean, 100±55 mL/min]). In three-way syringe samples, total microbial counts showed a range of 300 to 42,600 CFU/mL (mean, 13,340±12,370 CFU/mL). The quality of incoming water monitored in water faucets met the criterion of <100 CFU/mL.

The effect of flushing was highly variable, but it considerably reduced the microbial load from the tested handpiece (n=10) outlets. Flushing reduced the average CFU/mL from 29,286 to 457 over 8 minutes of flushing; the lowest mean value was at 7 minutes, with 171 CFU/mL. Flushing the lines for 30 seconds reduced the average bacterial counts by 80%; 1 minute, 93%; 2 minutes, 96%; 3 minutes, 98%; 4 minutes, 98%; 5 minutes, 98%; 6 minutes, 99%; 7 minutes, 99%; and 8 minutes, 98%. Even if 1 minute of flushing reduced microbial counts by 93%, an average of 2,043 CFU/mL remained to be detected. Only 1 unit of 10 showed acceptable microbial levels after 5 minutes, and another after 7 minutes of flushing.

At location 2, the number of CFU varied from 4 to 5,500 mL. The reduction in CFU after flushing was statistically significant after 5 minutes in both clinics. Further reduction was achieved after 15 minutes, but this reduction was not statistically different from the count obtained after 5 minutes' flushing. The water at the health center clinic (location 2) was always of better quality than that of the university clinic.

Our study showed high levels of microbes, exceeding acceptable parameters in dental unit water. Considerable variation was seen between individual units and from day

to day in the same unit. Counts of viable bacteria in previously published reports have ranged from a few hundred to as high as several million CFU/mL. Such a great variation in numbers (and also in types) of microorganisms recovered in different studies may be explained by the quality of input water, water-system structure of dental units, frequency of use, sampling methods, sample size, and, particularly, bacterial culture media and culture conditions.

Flushing reduces the microbial load significantly, but it is not a reliable method for reducing microbial levels below recommended values. Importantly, because the water flow rate, use patterns, and degree of bacterial accumulation in individual units vary, no reliable standard flushing time can be recommended. Most units even showed fluctuation after the minimum CFU value had been reached.

The most frequently recovered microorganisms were *Pseudomonas* species, including *Pseudomonas vesicularis*, *Pseudomonas paucimobilis*, and *Pseudomonas stutzeri*. Other identified microorganisms included *Comamonas acidovorans*, *Neisseria sicca*, and *Bacillus cereus*. A great number of aerobic gram-negative rods was seen. Of the water samples, a few (10%) contained only a single bacterial species. But most contained more than one (usually two or three) species.

Microbes in dental unit water are mainly opportunists with low pathogenicity, but they have a potential role in nosocomial infections in immunocompromised patients.⁴ Interestingly, bacteria of the normal oral flora, such as *N sicca* were found, showing that microorganisms in dental unit water also may originate from patients. Thus, microbes in oral fluids may be transmitted by this mechanism. Lewis and coworkers recovered viral particles from handpieces, their connecting air and water tubes, and water spray expelled from reused equipment.⁵ Viral transmission through dental unit water lines is possible, although no clinical infections have been reported to date.

Despite increasing awareness of the microbial load in dental unit water systems, dental professionals

have been surprisingly slow to respond to this problem. New methods for the reduction of bacterial accumulation are needed, especially in old dental units, whereas state-of-the-art units have sterilizable water lines and flushing devices to obtain better water quality. In biomedical laboratories, cyclic acid-based washes are used to remove biofilms from plastic tubing.

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Report on a Packaged Handwashing Antiseptic Contaminated With *Pseudomonas aeruginosa*

To the Editor:

The occurrence of bacterial contamination of disinfectants and antiseptics during their use and inside their original packaging may result in pseudobacteremias or the circulation of resistant strains within the hospital.^{1,3} We report the serendipitous discovery of the contamination of a packaged handwashing antiseptic at Umberto I Hospital in Ancona, Italy.

A study aimed at evaluating the antimicrobial activity of a new procedure in antiseptic hand washing was conducted in the blood transfusion service. The routine handwashing procedure involved the use of a pack-

aged antiseptic containing triclosan (5-Chloro-2- [2,4-dichlorophenoxy] phenol), used in our hospital since mid-1997.

The blank test of the antiseptic in use revealed contamination by *Pseudomonas aeruginosa*. After this discovery, we tested four sealed samples present in the transfusion unit; *Pseudomonas aeruginosa* was isolated from three.

Following these observations, all of the antiseptics coming from the same company still present in the hospital were identified and removed from use. Only two different lots were still present, and 13 bottles could be analyzed: 5 from different wards and 8 present in the pharmacy service. Thirteen of 17 samples analyzed belonged to lot A and 4 to lot B. *P. aeruginosa* was isolated in 7 cultures (41%), all belonging to lot A (54% of samples from this lot). The Department of Health was informed.

The cause of antiseptic contamination in the original packaging often remains unknown,^{1,3,4} as in this case; the minimal nutritional requirements of *Pseudomonas* species, as evidenced by their ability to grow in distilled water and their tolerance of a wide variety of physical conditions, contribute to their ecological success. Moreover, the ubiquity of this bacterium would increase the possibility of contact with antimicrobials and therefore the possibility of selecting, in the hospital environment, strains resistant to disinfectants. The mechanisms of resistance have been made clear, and Levy et al recently published the results concerning the acquisition by *Escherichia coli* K 12 strains of resistance to triclosan.⁵

As already observed by Oie, "At present, the necessity of measures to prevent contamination does not seem to be fully appreciated."⁴ The publication of reports of epidemics, or the accidental discovery of the spread of microorganisms, coming from antibacterial solutions represents the lack of increased hospital prevention measures by infection control committees. We believe that checking sterility of disinfectant or antiseptic products must be assured at two levels: during the production cycle and during hospital use. In our opinion, the microbiological control of samples of antiseptic products in use should become a routine procedure as far as infection control committees are concerned, taking feasibility and cost into account.

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Tuberculin Skin Testing in the Era of Multidrug-Resistant Tuberculosis

To the Editor:

The tuberculin skin test using purified protein derivative (PPD), first introduced in 1910, has been the standard and the only validated screening procedure for identifying asymptomatic tuberculosis (TB) infections in the United States since the early 1930s. PPD skin test interpretation may be problematic due to cross-reactivity, booster effect, anergy, variability in the performance or reading of the test, lot-to-lot variation of PPD, and a variety of other causes.¹ False-positive reactions may occur because antigens present in the PPD are shared with environmental mycobacteria, an overlap known to be considerable in some areas of the world.¹ We report the consequences of a PPD skin test conversion in a healthcare worker (HCW 1) who worked on an inpatient unit providing clinical care to patients with multidrug-resistant (MDR) TB, as well as to patients with *Mycobacterium avium* complex (MAC) infection.

Our 250-bed tertiary-care research hospital has a TB control plan that is congruent with Centers for Disease Control and Prevention (CDC) "Guidelines for Preventing