

Microbial contamination of samples of dental unit water systems in Saudi Arabia

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الغرض من هذه الدراسة هو تحري تلوث مياه الوحدات السنية في عينة من عيادات الأسنان في بعض مناطق المملكة العربية السعودية. تم جمع عدد ٢٧٠ عينة من مياه مقابض حفر الأسنان و بخاخات المياه ومصادر مياه الأخرى. تم تحديد الجراثيم المتواجدة باستخدام المزارع الجرثومية المتعارف عليها. أظهرت النتائج ارتفاع نسبة التلوث الجرثومي في وحدات الأسنان (٨٥٪) وبخاخات المياه (٦٤٪) ووصلت النسبة إلى ١٠٪ في مصادر المياه الأخرى. كانت غالبية الجراثيم التي تم الكشف عنها من النوع المرضي (٧٣٪). يستدل من نتائج هذه الدراسة أن نسبة تلوث المياه في وحدات الاسنان مرتفعة ويجب بذل الجهود للتخفيف من نسبة التلوث هذه.

The **purpose** of this study was to investigate contamination of the dental unit water systems in a sample of dental clinics in Saudi Arabia. **Materials and Methods:** A total of 270 water samples (200 mL/sample) was collected from the handpieces line, air-water spray and tap water sources of the dental clinics. Microorganisms were identified using established culturing techniques (Analytab Products Inc.). **Results:** The prevalence of bacterial contamination was 84% in dental unit water lines of handpieces and 64% in air-water spray, while it was 10% in tap water samples. *Bacillus* and *Pseudomonas* were found to be the predominant (52%) pathogenic microorganisms. **Conclusion:** The results indicated that dental unit water systems tested were contaminated. Therefore, more efforts should be directed to reduce (if not totally eliminate) the number of pathogens in the dental unit water systems.

INTRODUCTION

Water delivered into dental units by an "in line" system can be contaminated with exogenous microorganisms.¹⁻⁵ This might be due to the aspiration of microorganisms into the dental unit handpieces or direct contamination by the operator.^{6,7}

Contamination of dental unit water could also be from the tube lumens from microorganisms in water-containing systems attached to surfaces to produce a protective polysaccharide amorphous matrix. This biofilm could act as a reservoir of microorganisms and facilitate rapid recontamination.⁸ The contamination of dental unit water may increase the infections to patients and/or dental team.

Some evidence indicated that dental personnel could be at increased risk of *Legionella* infection from dental unit water.^{9,10} Two cases were reported from Liverpool Dental Hospital where medically compromised patients were infected with *Pseudomonas aeruginosa* originating from the dental unit water supplies.⁷ Another oral infection attributed to *Pseudomonas aeruginosa* exposure from dental unit water has been documented on an immunocompromised patient.⁷

Attempts to control contamination of dental unit water have involved the use of an in-line water filter and antibacterial agents in the water reservoirs.^{11,12} American Dental Association (1986) recommended flushing water lines between patient visits.

At the present time, commercially available options for improving dental unit water quality are limited and certainly involve additional cost.

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However, there are insufficient data to establish the effectiveness of the available infection control methods. The American Dental Association has set out an aggressive proactive research agenda for the control and prevention of microbial contamination of dental unit water so that the water delivered to dental patients is of the best possible quality.

In Saudi Arabia, large numbers of dental centres have been established in the different parts of the country. In the absence of mandatory assessment of infection control of water being used in Saudi Arabian dental clinics, it is desirable to investigate the status of the water infection in the dental units. Therefore, the purpose of this study was to investigate water contamination in the dental clinic of different dental centres in Saudi Arabia and identify the types of pathogenic microorganism if there were contamination.

MATERIALS AND METHODS

Two hundred and seventy water samples were randomly collected from different private and government dental centres of nine cities in Saudi Arabia. These cities were Riyadh, Dhahran, Taif, Khamis Mushait, Sharourah, Al'Madinah, Hail, Jubail, and Hafar Al Baten. These centers were selected randomly. In every clinic, the outside nozzle of all taps, handpieces and air-water syringes were disinfected before collecting 200 ml of water in a sterile bottle. All samples were immediately kept in the incubator at 37°C for 3 days before bacterial analysis and then transferred to the testing laboratory in a sealed container.

Bacterial Detection

The presence of bacteria microorganisms in the collected samples was determined by the method of Miles

and Misra (1938). This method involved 10-fold serial dilution to 10^{-4} in sterile distilled water. Replicate 30 μ l samples of each dilution were plated on Nutrient agar (Tryptose Blood Agar Base with Yeast Extract, Difco Laboratories, Detroit, MI, USA) and incubated aerobically at 37°C for 48 h. Complete bacterial clearance was defined as the inability to culture organisms with this method. Multiple tube technique was used for detection of coliforms.⁴ Measured volumes of water samples were added to a series of tubes containing a liquid indicator growth medium and incubated at 44°C and 37°C in a lactose-containing medium (lauryl tryptose broth). The presence of coliform bacilli was confirmed by the production of gas from lactose at 37° C which subsequently changed the colour to the most probable number (MPN).

Bacterial Identification

In positive subculture media, bacteria were isolated and identified by using API (Analytab Products Inc. Plainsview, NY, USA) enzyme test system for identifying clinical microbial isolates. Further characterization was performed at the laboratory centre for disease control at Al Hada Military Hospital.

RESULTS

Data showed that dental clinic water system investigated in this study was contaminated with microorganisms. The prevalence varied among sources of water sample (Figure 1). Bacterial contamination was highest in the water samples collected from handpieces (84.5%) and lowest in tap water (10.9%).

The type of bacteria found in the collected water samples is shown in Figure 2. In 38.8% of the water samples, no bacterial growth was seen. The highest bacteria was *Bacillus* type (29.6%) followed by *Pseudomonas* (22.8%).

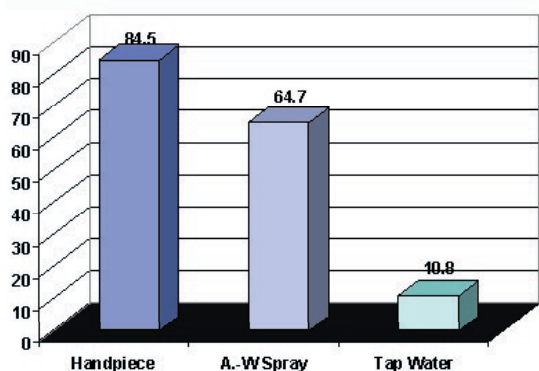


Fig. 1. Occurrence of different microorganisms in water from dental unit water lines and tap water.

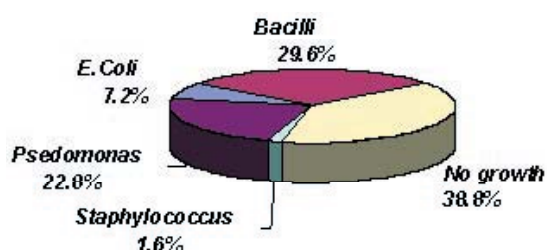


Fig. 2. Prevalence of microorganisms in water samples from dental unit water line and tap water.

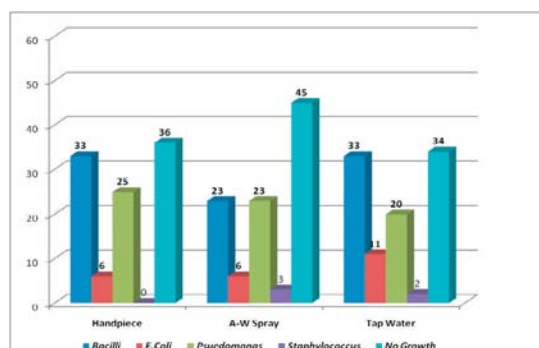


Fig 3. Occurrence of pathogenic microorganisms in water samples from dental unit water line and tap water.

The type of bacteria per source is shown in Figure 3. *Bacillus* and *pseudomonas* were found predominantly in handpieces and air-water syringe. Majority of tap water showed no bacterial growth.

DISCUSSION

Dental clinics have been described as potential contributors to the transmission of infections. For this reason, strict

infection control policies have been recommended to be followed in the dental clinics. Water supply to the dental clinics is one such potential source of infection. Dentistry aims to ensure total safety in the dental office and all efforts should be directed to reduce if not eliminate cross infections in the dental clinics.

In this study, we have investigated the presence of microorganisms in the water systems of different dental centres in Saudi Arabia. It should be noted that the screening technique used in this study did not exclude the possible presence of micro-organisms other than those assayed. There is no known single culture method that can disclose all microorganisms.

Results showed that dental units selected in the study had water contamination. The highest contamination was found in the dental unit water lines of handpieces followed by air-water spray. The lowest was seen in tap water. These results are in agreement with previous studies.^{7,10,15}

Previous studies showed that different factors might influence bacterial levels in the dental units; the type of materials used in the tubing and the frequency of use.¹⁵⁻¹⁷ Another possible reason for the increase in water contamination in the dental unit is the model of the dental unit rather than the type of dental procedures generally performed with the dental unit.¹⁰ It should also be noted that the quantity of water sampled may affect the chances of isolating bacteria. It has been recommended that 100-mL samples are sufficient.¹⁰ In this study, 200 ml samples were used to ensure sufficiency of the quantity.

Data from this study showed that majority of bacteria found were *Bacillus* type followed by *Pseudomonas*. This is in agreement with previous studies.^{7,18,19} It should be noted that *Pseudomonads* are not

common causes of oral infections, but can infect medically compromised patients.²⁰ The presence of *Pseudomonas* in water supply of dental units may therefore represent a potential source of danger. Retrospective survey showed no evidence that either local or systemic infections had occurred in patients treated on units contaminated with *pseudomonas* except in immunocompromised patients.⁷

In summary, results showed that water contamination by microorganisms was prevalent in the water of the dental centres examined. Efforts should be focused on reducing if not eliminating such contamination for better dental care of patients. A variety of reagents and techniques have been recommended for reducing the bacterial contamination of water supplying the dental units.^{4,7,12,13}

Based on the results of this study, we recommend that dental staff members should perform the recommended methods to disinfect the dental clinic including water that is being used in patient clinical treatment aiming to reduce the risk of infection's spread in the dental clinic. In addition, further structured study should be carried out at multi-centres in Saudi Arabia. The need for such studies is crucial as the number of transmissible infection is increasing.

CONCLUSIONS

Within the parameters of this study, the results showed that:

1. Prevalence of bacterial contamination was very high in samples of dental unit water systems tested in this study.
2. *Bacillus* and *Pseudomonas* was found to be the predominant pathogenic microorganism found in water systems in the centres included in this study.

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