Waterline contamination and role of flushing dental water unit lines in private dental clinics of Mangalore

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ABSTRACT

Aim: To determine the bacterial count in different sources of water in the dental unit and the role of flushing dental water lines for the removal of the bacteria.

Materials and Methods: Five private dental clinics were surveyed in this study. Initial water samples were collected in a sterile leak proof container from air-water syringe, high speed air turbine hand-piece and from oral rinse source following infection control protocol. They were then subjected to microbiological analysis for the bacterial count. A second sample was taken after three minutes of flushing from the same sources and quantitatively analyzed for bacterial count. The results were analyzed statistically.

Results: The flushing process reduced the bacteria by 0.245 $\log_{10}$ CFU/ml in case of air water syringe, 6.181 $\log_{10}$ CFU/ml in case of high speed air turbine hand-piece and 2.828 $\log_{10}$ CFU/ml in case of oral rinse. The highest amount of bacterial contamination was seen in high speed air turbine hand-piece followed by oral rinse source and finally air water syringe.

Conclusion: The results support U.S. Centers for Disease Control and Preventive recommendations that the process of flushing dental water lines cannot be relied upon as a sole means of reliably improving the quality of water used in dental treatment.

Keywords: dental unit water line, biofilm, infection, bacterial contamination.

Introduction

Microbial colonies that adhere to solid surfaces wherever there is sufficient moisture are referred to as the biofilm. These microbes in the biofilm produce a protective polysaccharide matrix that provides a mechanism for surface attachment and retention to the waterline. Dental unit water quality has become an issue of concern in both infection control practices and occupational exposures in dental health care settings. In 1993 the U.S. Centers for Disease Control and Prevention recommended that water lines should be flushed to reduce the microbial load in dental unit water.

The contamination of dental unit water lines is of great concern to the dental profession, since the water in these lines has the capacity for rapid development of biofilms combined with the generation of potentially contaminated aerosols.

These biofilms protect the organisms from the effects of heat and chemicals thus reducing their susceptibility to disinfection process. Dental unit

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water lines (DUWL) provide a particularly favorable environment for biofilm formation. Water at the tubing walls is almost stagnant, allowing bacteria to adhere and colonize the tubing surfaces. In DUWL, biofilm formation starts by presence of conditioned layer. The risk of acquiring infections through DUWL supplies are known to be not very uncommon.

Different standards and strategies have been adapted to control DUWL transmitted infections. According to American Dental Association (ADA), dental water should not have more than 200 colony forming units per milliliter (CFU/ml) of aerobic, mesophillic and heterotrophic bacteria. Different methods have been suggested to control DUWL contamination and one such method is to flush the DUWL.

Nithish Bhandary et al[2] reported a case of Melioidosis in a 63 year old doctor caused by Burkholderia pseudomallei. This bacterium is found in contaminated water and soil. In this case, the patient probably contracted the organism during a dental procedure due to contaminated dental unit waterline. This report as well as numerous other reports emphasizes the need for effective mechanisms to reduce the microbial contamination in DUWL and highlight the risk for cross-infection in general practice, especially in view of the ever-increasing number of immuno-compromised persons who present themselves at outpatient dental clinics.

Williams et al[10] assessed microbial contamination in clean water dental units and compliance with disinfection protocol suggested that the most commonly used procedure was that of flushing hand piece with water so as to lower bacterial counts.

Method

Five private dental clinics were surveyed in this study. Initial water samples were collected in a sterile leak proof container from air-water syringe, high speed air turbine hand-piece and from oral rinse source following infection control protocol. They were then subjected to microbiological analysis for the bacterial count. A second sample was taken after three minutes of flushing from the same sources and quantitatively analyzed for bacterial count. The results were analyzed statistically.

Results

The effect of flushing on the presence of bacteria as determined by the three sources is shown in Figure 1 and was evaluated by Wilcoxon signed rank sum test. The mean level of bacteria present in the initial samples using air water syringe was 2.124 $\log_{10}$ CFU/ml and 1.879 $\log_{10}$ CFU/ml in flushed samples. The mean level was 11.576 $\log_{10}$ CFU/ml in initial samples and 5.395 $\log_{10}$ CFU/ml in flushed samples using high speed air turbine hand-piece. The oral rinse source yielded a mean of 5.734 $\log_{10}$ CFU/ml in the initial samples and 2.906 $\log_{10}$ CFU/ml in the flushed samples.

The differences between the levels of bacteria present in the initial and flushed samples were highly significant in case of high speed air turbine hand-piece and significant in case of oral rinse source. In case of air water syringe source the difference between the levels of bacteria in the initial and flushed samples were not significant.

Discussion

The results of this study indicates that flushing

Samples collected in sterile leak proof containers from three sources following infection control protocol

Air water syringe

High speed air turbine Hand-piece

Oral rinse

Samples collected in leak proof containers

A 4mm wide inoculation loop dipped in sample and spread over 100mm Muller Hinton Agar plate

Incubated at 37°C for 48 hours

Colonies counted manually

The number of colonies per ml (CFU/ml) of the water sample was calculated by multiplying the number of colonies by 250(a 4mm loop holds 0.004 ml liquid) and results evaluated statistically

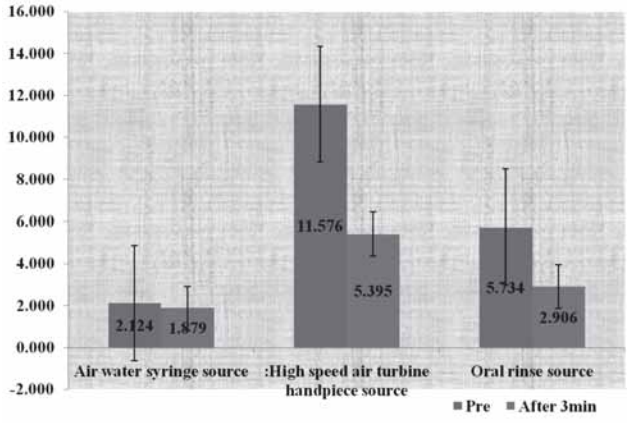

Figure 1: Levels of bacteria in initial and flushed dental water samples in case of air water syringe source, high speed air turbine hand-piece source and oral rinse source.

can substantially reduce the level of bacteria present in water used for dental treatment from three various sources such as air water syringe, high speed air turbine hand-piece and oral rinse. Regardless of the bacteriological method used, flushing was able to reduce the microbial content. In our study, the three minute flushing procedure may have reduced the bacterial count but did not eliminate its presence completely.

The results of earlier studies revealed a complex diverse microbial community in DUWL biofilms as determined by both culture and cultivation by independent methods. Prospective case control studies on infection risks from DUWL are non existent and would probably now be deemed unethical , therefore we would have to rely on indirect data extrapolated from surveillance studies. Much of our current knowledge is derived from comparable studies of hospital outbreaks of water borne infections.

Dental equipment manufacturers have responded to the variety of approaches to this complex problem. Clinicians have also advocated the use of biocides / disinfectants as effective decontamination methods to control DUWL contamination.

However in the present study we have used the most practical method of flushing the dental water lines for removal of bacteria. The close association between these organisms and biofilms in dental unit water lines suggests that other strategies beyond flushing would be required to effectively address the issue of biofilm removal. The use of chemical germicides has been recommended for the removal or inactivation of biofilms in dental water lines. Commercial devices and microfiltration are currently available for use in dental water treatment.

Conclusion

The result of this study confirms the latest Centers of Disease Control recommendations that flushing alone is not reliable procedure for improving water quality used in dental treatment. A reasonable protocol for disinfecting and monitoring the water supply in busy dental practices is urgently required, so that water used for dental patient treatment satisfies accepted safe public health standards.

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