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ORIGINAL ARTICLE

Colony Forming Bacterial Count in Dental Unit Water Lines of Rehman College of Dentistry, Peshawar

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ABSTRACT

Bacterial invasion of dental unit water lines is a global issue, which if left untreated, leads to formation of a bacterial biofilm within the water lines. The aim of this study was to determine the number of colony forming units (CFU) in dental unit waterlines of Rehman college of dentistry. Samples from air-water syringes of 44 different dental units in various departments of the dental hospital were collected. Tip of each air-water syringe was heated using direct flaming to eliminate any bacteria residing therein. The samples were collected in 100ml sterile bottles and labelled according to the unit number and department name. The bottles were sent for bacteriological analysis to public health food analysis laboratory, Peshawar. The results concluded that according to the WHO standards of water contamination, all samples fall in category B (1-10cfu/ml) and were deemed fit for drinking.

Keywords: Colony forming units, dental unit water lines (DUWL), dental unit water system (DUWS), Peshawar, Pakistan, bacterial load.

INTRODUCTION

Dental unit is an important equipment in a clinical setup which supplies necessary water, air and electricity for treatment procedures. In some extensive dental treatment procedures, heat is generated, and water is required to provide a cooling effect on dental tissues to avoid damage. This water usually comes from a local water supply, either connected directly or through a reservoir to a dental unit. Water reaches the dental instruments through dental unit water lines (DUWL).(1-4)

Bacterial invasion of dental unit water lines is a global issue, which if left untreated, leads to formation of a bacterial biofilm within the water lines. Water is part of some vital dental treatments and also used for rinsing a patient's mouth or clearing the field off blood within a patient's mouth. A wide range of bacteria's have been reported in various studies to be found residing in DUWL including S. Aureus, KlebsiellaPneumoniae, Pseudomonas Aeruginosa, Legionella Pneumophila and Streptococci(2, 5, 6). According to American dental association (ADA) the bacterial count in DUWL should not exceed 200 colony forming units per milliliter(7, 8).

A study conducted in Iran found that bacterial load was high according to the American Dental Association recommendations, i.e., less than 200 CFU/ml, in both air/water syringe (84%, CFU/ml: 500-20000) and high-speed handpiece (96%, CFU/ml: 710-36800) samples (8). Another similar study which was conducted to find out the bacterial contamination in dental unit water lines concluded that mesophile bacteria were found in all 107 tested water samples (9).

The aim of this study was to determine the number of colony forming units (CFU) in dental unit waterlines of Rehman college of dentistry.

MATERIAL AND METHODS

Samples from dental unit water lines of all functional dental units in Rehman college of dentistry on 25th March 2019 and were taken in 100ml sterile bottles. While taking samples the authors wore double gloves and a single disposable face mask to avoid contamination of the bottles and its contents. A total of 44 dental units were included in this study. Samples were taken from the air-water syringe attached to each dental unit. All the bottles were labelled by the authors according to unit numbers and their respective wards (prosthodontics, endodontics, operative dentistry, pedodontics, orthodontics, oral surgery and periodontics). As a control, the tips (nozzles) of air-water syringes were heated using direct flaming to eliminate presence of any bacteria at the tip which could alter the results. The nozzles were heated for 60 seconds under direct flame, and same protocol was repeated for every dental unit.

After collecting the samples on 25th march, the bottles were boxed and delivered to public health food analysis laboratory, Peshawar for their bacteriological testing on the same day to avoid any contamination. Results were expected in 4 days.

RESULTS

After 4 days of testing by the laboratory, the results were compiled on 29th march 2019. The interpretation of results was done according to world health organization (WHO) standards as shown in table 1 below.

Table 1: WHO Standards for bacteriological testing of water and beverages.

Mean Count of Coliform (per ml)	Category
0	A
1-10	B
10-50	C (unacceptable)
More than 50	D (grossly polluted)

The results were compiled according to the wards (departments) and their respective dental units in tables 2-8 below:

Table 2: Prosthodontics Ward.

Sample Number	Source	Laboratory Number	Presumptive test for coliforms Most probable no. of MNP per ml
Unit 03	Air-water syringe	432	< 2 organisms/ml
Unit 04	Air-water syringe	433	< 4 organisms/ml
Unit 05	Air-water syringe	434	< 2 organisms/ml
Unit 06	Air-water syringe	435	< 2 organisms/ml
Unit 07	Air-water syringe	436	< 2 organisms/ml
Unit 08	Air-water syringe	437	< 2 organisms/ml

Table 3: Periodontics Ward.

Sample Number	Source	Laboratory Number	Presumptive test for coliforms Most probable no. of MPN per ml
Unit 21	Air-water syringe	438	< 2 organisms/ml
Unit 22	Air-water syringe	439	< 2 organisms/ml
Unit 17	Air-water syringe	440	< 2 organisms/ml

Table 4: Operative Dentistry Ward.

Sample Number	Source	Laboratory number	Presumptive test for coliforms Most probable no. of MPN per ml
Unit 37	Air-water syringe	449	< 2 organisms/ml
Unit 38	Air-water syringe	450	< 2 organisms/ml
Unit 40	Air-water syringe	451	< 2 organisms/ml
Unit 41	Air-water syringe	452	< 2 organisms/ml
Unit 42	Air-water syringe	453	< 2 organisms/ml
Unit 43	Air-water syringe	454	< 2 organisms/ml
Unit 44	Air-water syringe	455	< 2 organisms/ml
Unit 45	Air-water syringe	456	< 2 organisms/ml
Unit 46	Air-water syringe	457	< 2 organisms/ml
Unit 47	Air-water syringe	458	< 2 organisms/ml
Unit 48	Air-water syringe	459	< 2 organisms/ml
Unit 49	Air-water syringe	460	< 2 organisms/ml
Unit 50	Air-water syringe	463	< 2 organisms/ml
Unit 51	Air-water syringe	464	< 2 organisms/ml
Unit 52	Air-water syringe	465	< 2 organisms/ml
Unit 53	Air-water syringe	466	< 2 organisms/ml
Unit 54	Air-water syringe	467	< 2 organisms/ml
Unit 55	Air-water syringe	468	< 2 organisms/ml

Table 5: Orthodontics Ward.

Sample Number	Source	Laboratory Number	Presumptive test for coliforms Most probable no. of MPN per ml
Unit 56	Air-water Syringe	478	< 2 organisms/ml
Unit 57	Air-water Syringe	479	< 2 organisms/ml
Unit 58	Air-water Syringe	480	< 2 organisms/ml
Unit 59	Air-water Syringe	481	< 2 organisms/ml
Unit 60	Air-water Syringe	482	< 2 organisms/ml
Unit 61	Air-water Syringe	483	< 2 organisms/ml

Table 6: Pediatric Dentistry Ward.

Sample Number	Source	Laboratory number	Presumptive test for coliforms Most probable no. of MPN per ml
Unit 62	Air-water syringe	484	< 2 organisms/ml
Unit 63	Air-water syringe	485	< 2 organisms/ml

Table 7: Oral Surgery Ward.

Sample number	Source	Laboratory number	Presumptive test for coliforms Most probable no. of MPN per ml
Unit 66	Air-water syringe	486	< 2 organisms/ml
Unit 67	Air-water syringe	487	< 2 organisms/ml
Unit 70	Air-water syringe	488	< 2 organisms/ml

Table 8: Endodontics Ward.

Sample number	Source	Laboratory number	Presumptive test for coliforms Most probable no. of MPN per ml
Unit 31	Air-water syringe	489	< 2 organisms/ml
Unit 32	Air-water syringe	490	< 2 organisms/ml
Unit 33	Air-water syringe	491	< 2 organisms/ml
Unit 34	Air-water syringe	492	< 2 organisms/ml
Unit 35	Air-water syringe	493	< 2 organisms/ml
Unit 36	Air-water syringe	494	< 2 organisms/ml

As per the world health organization (WHO) guidelines (Table 1), the coliform count per ml of all samples were in Category B (1-10 CFU/ml). This category was deemed fit for drinking, but were not completely free of bacteria.

DISCUSSION

Bacterial invasion in dental unit water lines is confirmed scientifically by research (2). Controlling bacterial load in dental clinics is vital to run a good practice (6). During the current times of Covid-19, more patients present with underlying pulmonary problems which makes them more prone to bacterial infections (1). The results of this study concluded that the bacterial load in dental unit water of Rehman college of dentistry is very low, and is considered fit for drinking.

The only unit which recorded the highest bacterial load was with 4cfu/ml, unit no. 2 from the Prosthodontic ward, reason being the early morning cleaning was not performed on that unit. This shows that early morning cleaning of the reservoir and flushing of water lines is necessary to keep the bacterial load minimal and reduce risk of infections in patients from the dental unit water.

Further research in this topic is required to genotype the bacterial presence and find out which type is dominantly present in DUWL of Rehman college of dentistry, or, in any other dental college in Peshawar or other areas of Pakistan. It is a beneficial point to have all dental units in private practices and in dental hospitals checked regularly for bacterial loads - not only does it save the patients health, but additionally it brings confidence in the dentists using the dental units, and an institute can also use it to attract more patients in terms of its hygiene status maintenance.

CONCLUSION

This research concludes that the bacterial load in dental unit water lines of Rehman college of dentistry falls within safe range according to American dental association (ADA) – i.e., Less than 200cfu/ml and also falls within category B of world health organization (WHO) guidelines – i.e., 1-10cfu/ml.

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