WATER SUPPLY ANALYSIS OF A DENTAL UNIT AT EAC-COLLEGE OF DENTISTRY

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INTRODUCTION:

First it was Hepatitis, then HIV. Now, dental clinicians are concerned with water supply to dental units. The drinking tap water is used by most of the dental practitioners for cavity preparation, crown cutting, scaling, minor surgical procedures, etc. Hence, there's possibility of drinking of water mistakenly by the patient or contaminating open vascular lesion, which may cause water borne and other systemic diseases. The water borne disease is one of the major cause of ill health and death of millions in developing countries. Though, there is no documented case of such diseases in patients who have undergone dental treatment but many may have suffered silently.

Water is necessary for surgical or non-surgical procedure.

a. To prevent pain and hyperemia
b. To prevent overheating of burs
c. For cleansing of teeth.

The water being supplied in dental units of EAC is from Maynilad Water Services Incorporation. This drinking water undergoes filtration, sedimentation and chlorination. This treatment can eradicate wide range of microbes. The possible sources of contamination are: human faeces, inadequate treatment, leakages in distribution pipe and mutated to become resistant. When the instruments are not in use, the water stagnates inside the tubings stagnates. Small number of environmental bacteria naturally found in the water quickly multiply and clings to the walls of the tubing. The oral cavity of human being hosts varieties of normal flora microbes and they are capable of contaminating hand piece and air/water syringe from patient's saliva or tissue fragments. These normal flora may become opportunistic in immuno-compromised patients. The microbes form biofilm along lines of dental unit line and they multiply rapidly. When the equipment is used again, the bacteria can be flushed into the mouth of patients.

OBJECTIVES:

a. To study presence of bacteria in mainline water supply.
b. To ascertain presence of bacteria in hand piece, fountain and air/water syringe.
c. To compare presence of bacteria before and after water is supplied to dental units.

PROCEDURE:

It is an empirical study of dental unit water to determine presence of contamination.

A. Sample Collection

4.5L sample water was collected from mainline, handpiece, air/water syringe and fountain separately in a sterile gallon.

B. Filtration

Nine Plates were prepared for each of the sample water so all in all 36 plates were prepared.

C. Incubation

All plates were incubated at 37 degree centigrade for 24 hours. The growth of microbes was recorded.

D. Gram Staining

A portion of colony was picked up with a flamed and cooled loop then mixed with a drop of sterile water on a glass slide and gram stain was prepared using conventional technique. Then the slides were viewed on compound microscope under oil immersion objective with 1000X magnification. The gram stain results were recorded.

E. Isolation of bacteria

a. TSI agar

A well-isolated colony from MacConkey plates were picked up with a flamed and cooled inoculating needle and stabbed the butt at the base of the slant. The slant was streaked by "fish tailing". Then, all tubes were incubated and read after 24 hours.

b. API 20E

To identify specific bacteria isolated from TSI, APRI 20E was used. In this procedure, 5 ml of 0.85% saline was dispensed in sterile test tube. A well isolated colony was picked up with a flamed inoculating loop and thoroughly mixed with saline in the tube.

c) Coagulase Test

Initially, 0.5 ml citrated human plasma was placed in a test tube. A loopful of yellow colony from MSA plate was added in the tube. Then, the tube was incubated at 37 degree centigrade for 5-6 hours. The results were recorded.

RESULTS AND DISCUSSION

A. Table I For growth of bacteria

Sample	MAC	TCBS	MSA
Handpiece			
1.	- TNTC	- No growth	58 colonies
2.	- No growth	- No growth	- No growth
3.	- No growth	- No growth	- No growth
Air/Water Syringe			
1.	- 167 colonies	- No growth	- No growth
2.	- TNTC	- No growth	- No growth
3.	- No growth	- No growth	- No growth
Fountain			
1.	- No growth	- No growth	- No growth
2.	- No growth	- No growth	- No growth
3.	- No growth	- No growth	- No growth
Mainline			
1.	- No growth	- No growth	- No growth
2.	- No growth	- No growth	- No growth
3.	- No growth	- No growth	- No growth

Note: TNTC – Too numerous to count

The table I shows that there was no growth of bacteria in all TCBS medium. This indicates total absence of Vibrios. While MSA medium shows growth of bacteria in hand piece and air/water sample. This indicates growth of bacteria may be Enterobacteriaceae and other gram negative. There was growth only in one specimen collected from hand piece. The MSA is selective medium for staphylococcus.

B. For Gram Staining

Table II. Differentiation of Gram positive from Gram negative

Media	Slide	Gram Stain
MAC 1.	Handpiece	Gram negative bacilli
2.	Syringe	Gram negative bacilli
3.	Syringe	Gram negative bacilli
MSA 1.	Handpiece	Gram positive cocci

Table I & II shows all MAC specimens are Gram negative bacilli and MSA is Gram positive cocci. This result implies confirmation of result in table I.

C. For isolation of bacteria

TSI tubes were observed after 24 hours of incubation. All three TSI tubes showed k/k reaction i.e. none of the three sugars (lactose, glucose and sucrose) were fermented. Hence, they were confirmed to be non-fermenters. To identify the specific bacteria that grew on TSI tubes, these isolates were inocubated on API 20E. After incubation at 37 degree centigrade for 24 hours, the biochemical reactions were all compatible with Acinetobacter calcoaceticus with API # 0204042.

The coagulase test was done for one specimen with gram positive reaction. The test tube was observed after incubation of 5-6 hours at 37 degree centigrade. The plasma in test tube showed no clot formation indicating coagulase negative test. The coagulase negative bacteria may be Staphylococcus epidermidis, S. hemolyticus, S. saprophyticus etc.

CONCLUSIONS

On the basis of findings, the researchers have come to the following conclusions:

A. For growth of bacteria

1. The mainline and fountain water sample were negative for any kind of bacteria.
2. The hand piece and air/water syringe were positive for gram negative coccobacilli and gram positive cocci.
3. Bacterial contamination in hand piece and air/water syringe could have come from environment or cross contamination from patients.

B. for isolation of bacteria

1. Acinetobacter calcoaceticus is an opportunistic bacteria and it may cause nasocominal infection such as endocarditis, cellulitis, septicemia etc.
2. Coagulase negative bacteria may be Staphylococcus epidermidis, S. saprophyticus, S. hemolyticus or other coagulase negative Staphylococci. They are also causative agents of endocarditis. It causes septicemia in immuno-compromised patients.

Though, there is no published evidence of a serious public health risk from biofilm contaminated dental unit water, coagulase negative and non-fermenter have potential to cause diseases in immuno-compromised people. However, topmost matter of

concern is presence of high levels of opportunistic organisms may overload the defense systems of immuno-compromised patients and occupationally exposed dental staff members.

RECOMMENDATIONS:

1. Take thorough medical history of patients to identify immunocompromised patients and allow for their minimal exposure to potentially cotaminated water.
2. Sterile distilled water or saline should be used for flushing open vascular lesion in invasive dental procedures.
3. The use of rubber dam is encouraged to prevent ingestion of water during operative procedures.
4. Do not allow patients to close their lips and form a seal around suction device, particulrly saliva ejectors.
5. Chemical treatment protocols (whether intermittent or continuous) ozone, hydrogen-peroxide, sodium hypochlorite, ethanol, providine iodine etc. may be used.
6. Use of autoclavable self contamined water delivery systems.
7. Use of disposable filters (0.2 micron) at the terminal end of the dental waterlines.
8. Flushing waterlines for several minutes before the first patient of the day and 20-30 seconds in between patients.
9. Periodic inspection and replacement of antiretraction valves.

We, researchers would like to recommend successive clinicians to conduct a study to determine efficient and cost effective method of safer dental water delivery system for EAC-College of Dentistry.

BIBLIOGRAPHY

Books

1. Connie R., Mahon and George Manuselis, Jr. Diagnostic Microbiology, 1995, 326-7, 330-1; 514; 523-5; 502-505; 1061-2 and 1068-6.
2. Philippine National Standards For Drinking Water, 1993.

JOURNALS

1. Williams JF, Molinari JA, Andrews N. Microbial contamination of Dental Unit Water Lines: Origins and characteristics. Compendium, Vol. 17. June 1996. 538-555.
2. Nancy Andrews. Management of Biofilm and Water Quality in Dental Devices.
3. Practical Hygiene July / August 1996. 33-40.
4. Williams JF, Johnston MA, Johnson b, Huntington MK and Mackenzie CD. Microbial Contamination of Dental Unit Waterlines: Prevalence, Intensity, and Microbiological characteristics. JADA, Vol. 124, October 1993. 59-65.

ARTICLES

1. Prof. Dr. K. Bossmann. Hygienic Decontamination Procedures For Dental Handpieces, Contra-angle Handpieces and Turbines, APDF Newsletter Oct/Nov 1988.
2. Dr. Robin Woods. Universal Precautions and Pathways of Infection.
3. Infection Control: How to Prevent Microbial Contamination of Dental Unit
4. Dr. Margaret Johnston: Coalition for Safe Water Supply in Dental unit, 1996.