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Orotol Plus: A DUWL Disinfectant

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Abstract

The eminence of dental unit water is of significant consequence as patients and dental staff are frequently exposed to water and aerosols produced from the dental unit. Dental unit water lines are a source of infectivity from aspirations and from biofilms that form in which ever watery atmosphere. The centers of small-diameter tubing in dental unit waterlines are extra susceptible to biofilm development since they are prepared from a mixture of plastic materials which promote bacterial growth on it. Various method are used for prevention of bio-film formation-Anti-retraction valves, Chloridation of water, Use of ozone and ultraviolet light system and biocides or disinfectants like chlorhexidine gluconate, quaternary ammonium compound, povidine iodine, ethanol, hypochlorite, peroxide and glutaraldehyde. Hence, the purpose of the research was to assess bacterial infectivity of Dental Unit Water Lines before and after the use of OROTOL PLUS amongst the various DUWL.

Keywords: Aspiration, Bacterial contamination, Biofilms, Dental unit

Introduction

Bacteria and fungi occur as individual, free-floating (planktonic) cells or clustered together in aggregates of cells (biofilms). A microbial biofilm is 'a structured consortium of microbial cells surrounded by a self-produced polymer matrix'. In addition to microorganisms, components from the host, such as fibrin, platelets or immunoglobulins, may be integrated into the biofilm matrix.(1) It is development of microbial communities on submerged surfaces in aqueous environment, which are well-organized communities of co-operating microorganisms that can include bacteria, algae, fungi and diatoms, heterogeneous and complex in structure, function and metabolism.(2) The bio-films stick to every attractive surface resembling a astound, tooth surface, dental implant, removable dental prosthesis or the hull of a boat.(3) Biofilms typically cause chronic infections, which means that the infections persist despite apparently adequate antibiotic therapy and the host's innate and adaptive defense mechanisms. Infection management in dental offices remains a problem because of contagion of the air and water lines in the dental units. Special attention was given to the build-up of biofilm in dental unit waterlines (DUWLs), which are small-bore flexible plastic tubing to bring water to different hand pieces. They are coated with well-established biofilms. It is a source of microbial contamination of DUWLs water. The safety of dental treatment requires a good quality of the water used. The knowledge of nature, formation and the ways to eliminate the biofilm is the first step towards reducing health risk, both for patients and dental personnel.

Epidemiological studies have found evidence linking biofilm with infectious processes with common characteristics: presence of adherent, biofilm-producing bacteria, infections induced by small bacterial innoculants, bacterial biofilm-mediated resistance to host defense mechanisms and to antimicrobial treatment, infections commonly caused by Staphylococcus aureus, Staphylococcus epidermidis and Pseudomonas aeruginosa, the presence of inflammation, damaged cell tissue and necrosis of the tissue-implant interface.(4) Biofilm development is a dynamic process of growth and separation (detachment) of bacterial cells and aggregates that can disperse and colonise new surfaces or new hosts (through inhalation, ingestion or erosion). This dispersion process of isolated microcolonies with antibiotic resistance phenotype, results in the production of chronic bacterial infections.

The bacteria lives in the form of biofilms, which may be due to genetic material which can be easily exchanged between microorganisms, nutritive substances and the shelter provided by other organisms against excess of nutritive substances, toxic substances, drying and dessication.(5-8)

Various methods are used for prevention of bio-film formation: By utilization of anti-retraction valves, Chlorination of water, Utilization of ozone and ultraviolet light system. The most effective method is use of biocides or disinfectants like chlorhexidine gluconate, quaternary ammonium compound, povidine iodine, ethanol, hypochlorite, peroxide and glutaraldehyde.(9-11)

OROTOL PLUS is highly effective aldehyde liberated contemplate for the concurrent disinfection deodorization clean-up, dental suction systems and amalgam separators. It contains quaternary ammonium compound, alkaline cleaning agents, special antifoaming agents and auxiliary agents in aqueous solution. It is toxicologically safe, foam free and biodegradable. It acts as a bactericidal, tuberculocidal, fungicidal and antiviral.(12)

Hence, the purpose of the research was to assess bacterial infectivity of Dental Unit Water Lines before and following the use of OROTOL PLUS among the hospitals in Ahmedabad.

Materials and Method

This study was conducted in private Hospitals of Ahmedabad city followed by analysis in Microbiological laboratory. The sample sizes of Dental Unite water lines were consisted of two groups; Group 1 contains 10 samples before disinfection and group 2 contains 10 samples after disinfection.

Biofilm forms atenacious layer that is strongly adherent to the walls of the tubing and often contains different types of pathogenic bacteria. Several pathogens such as Pseudomonas, Mycobacterium and Legionella have been isolated from dental unit water lines (DUWL). Some of these pathogens can be responsible for severe diseases, and immune-compromised patients in particular may be at high risk.

Twenty ml of ten water trials were kept together in sterile containers from water lines of different dental units of the hospitals. Commercially available disinfectant OROTOLPLUS was utilized in dental unit water pipelines. It stands on a grouping of quaternary ammonium compounds, alkaline cleansing agents, complexing agents, particular antifoaming agents and adjutants in aqueous solution. Fifty percent OROTOL PLUS was utilized on tendental units and its efficiency in bacterial count and eliminating biofilm was assessed. The disinfectant was ready as per the producer's directions. The 20 ml of disinfected solution was mixed in 1 liter of water. The pink colored vegetative dye was mixed to the colorless OROTOL PLUS solution since it can be observe effortlessly into the water line.

Technique of appliance of OROTOL PLUS: The ready solution with colored dye was mixed to the booster of the unit. The arranged disinfectant OROTOL PLUS solution was prepared to sprint through the system awaiting the colored solution emerged at the last part of the air/ water syringe and hand-piece lines. The air turbine was forever detached. The solution was permitted to sit down in the unit all night. The trimmings of waterlines were located into a sink in case whichever colored solution leaked during the night. At the start of the subsequently workday, residual solution was surplus and the outside water bottle was rinsed with hot water.

The bottle was packed with boiling water, every dental unit water lines was flush till froth moved out and apparent water could be visualized. Distilled water was ready to sprint through the tubing. At this instant the booster bottle was again packed with distilled water. This procedure was repetitive for 3 days. At the finish of the 3rd day all the 10 specimens were collected and sent for bacteriological examination at the microbiological lab. At the microbiological lab, centrifugation of samples was done at 3000 rpm for five minutes. Afterward, supernatant was removed and centrifuged deposit will be utilized for cultures. The unruffled samples were subjected to both aerobic and anaerobic cultures. Feasibility count study was prepared by utilizing decant plate and likely figure method.

Results

In the current research following bacteria were visualized in the aerobic and anaerobic examination.

I. Before the application of orotol plus disinfection

Sample No	Bacteria
1	Scanty growth of E.coli, Yerisinia, Legionella
2	Moderate growth of Klebsiella, Legionella, Haemophilus
3	Moderate growth of Klebsiella, Haemophilus, Yerisinia
4	Heavy growth of E.coli, Yerisinia, Legionella, Haemophilus
5	Scanty growth of Pseudomonas, Legionella, Haemophilus
6	Scanty growth of E.coli Legionella, Yerisinia
7	Moderate growth of pseudomonas, Haemophilus
8	Scanty growth of E.coli, Legionella, Yerisinia, Haemophhilus
9	Scanty growth of Klebsiella, Legionella, Haemophilus
10	Scanty growth of E.coli, Haemophilus, Yerisinia

II. After the application of orotol plus disinfection

Sample No	Bacteria
1	No development
2	No development
3	No development
4	Scanty development of E.coli
5	No development
6	No development
7	No development
8	No development
9	No development
10	No development

Before the application of OROTOL PLUS untreated water contains 100% bacteria but after the application of OROTOL PLUS treated water contains 10% bacteria. The recovery is high which is 90%. So, there was highly significant difference (p value=0.001) was seen before and after the application of OROTOL PLUS disinfectant.

Discussion

The present study was performed to assess bacterial infectivity of Dental Unit Water Lines before

and following the use of OROTOL PLUS among the hospitals in Ahmedabad. The sample sizes of Dental Unite water lines were consisted of two groups; Group 1 contains 10 samples before disinfection and group 2 contains 10 samples after disinfection.

Biofilm is a microbial-derived sessile population differentiated by cells that are irrevocably close to a substrate or to each one, and are surrounded in a matrix of extracellular polymeric substances.[5] There are different structural uniqueness of biofilm which are as follows: its structure defends the existing bacteria from environmental intimidation, configuration of biofilm authorized trapping of nutrients and metabolic considerately between occupant cells of same species and diverse species. Composition of Biofilm shows prearranged interior compartmentalization, which permits bacterial species with diverse development necessities to live on in each compartment.

Sample number 4 had scanty development of E.coli which may be due to application of OROTOL PLUS after in the state where microorganisms cannot removed from biofilm completely. Biofilm formation is reversible in the early stages if adhesion to the surface is not strong. The inner surfaces of the tubing are first conditioned by absorbed macromolecules and low molecular weight hydrophilic molecules from the water mains which enhances the efficacy of bacterial adhesion.

Dental unit waterlines are an essential division of dental surgery utensils, providing water as a coolant for air-turbines and ultrasonic scalers. The handpiece is connected by flexible plastic lines to the dental unit that reins air and water supplied to the handpiece.

The character of DUWLs is that it will grow a biofilm, and water curving down the biofilm-coated water lines will add to microbial load in the water as it departs the tubing. Numerous durations of water stagnation in DUWLs and the properties of the plastics used in DUWLs building can encourage the affection and colonization of biofilm-forming microorganisms. Most plastic dental tubing has an inside diameter of 16 mm to 8mm. This generates an extremely huge ratio of surface part to water volume of narrow bore tubing. The laminar flow of water transitory during the DUWLs consequences is extreme at the centre of the lumen and least at the fringe, encouraging evidence of organisms onto the surface of the tubing, thus cheering additional uninterrupted bacterial proliferation.[12,13]

The foundation of bacteria for biofilm in DUWLs may be: (1) municipal water tubed into the dental unit and, (2) suck-back of patient's saliva sticked to the line owing to be short of anti-retraction valves. The objective of infection control of DUWLs water is to reduce the danger from contact to possible pathogens and to generate secure functioning surroundings for management of patients.[2]

Biocides are antiseptic, disinfecting chemical compounds, having both bactericidal and bacteriostatic properties. Other properties includes, they are effective at low concentrations, non-toxic and biodegradable.

OROTOLPLUS depends on a mixture of quaternary ammonium compounds, alkaline cleansing agents, complexion agents, particular antifoaming agents and adjutants in aqueous solution. OROTOLPLUS is bactericidal, tuberculocidal, fungicidal, virucidal with limited effectiveness and effective against non-enveloped viruses. It is not effective against spores.[12]

Before the application of OROTOL PLUS untreated water contains 100% bacteria but after the application of OROTOL PLUS untreated water contains 10% bacteria. There was highly significant difference (p value=0.001) was seen before and after the application of OROTOL PLUS disinfectant. These findings indicated that completely filling the DUWL with Orotol Plus provides superior disinfection relative to aspiration disinfection, probably due to increased contact time, contact area and disinfectant availability throughout the suction system. Barbeau et al.[14] also reported a virtual absence of oral streptococci, whereas Merchant and Molinari also reported the recovery of Gram-negative bacilli and staphylococci from DCU suction hoses and coarse filter housings.[15] To date, few studies have focused on infections in patients and/or dental healthcare staff resulting directly from exposure to contaminated DUWL and none has reported definitive cases. A number of studies however, have highlighted the potential for cross-contamination between patients due to backflow/pressure changes in low volume suction.[14,15,16]

Conclusion

Dental biofilm is a complex, organized microbial community that is the primary etiologic factor for the most frequently happening dental infections such as, dental caries, periodontal diseases, and endodontic pathology. Bacteria comprise extremely flourishing existence form. In their development, they have developed victorious polices for endurance which comprise affection to the surfaces and growth of defensive biofilms where they act very in a different way than free-floating bacteria.

It is imperative to understand and to realize the complexity and nature of the biofilm, especially the role it plays in harboring and protecting the microorganisms, thus, contributing to persistent infections. Some developments in science and technology provide answers to the control of biofilm formation and disease. Dental services, equally public and private, require a dependable technique to stop the growth of biofilms within DUWLs. These techniques must be cost-effective and necessitate least attempt to utilize on the part of dental staff.

References

1. Wirthlin M. Evaluation of ultrasonic scaling unit waterline contamination after use of Chlorine Dioxide Mouthrinse Lavage.
2. Szymanska J. Biofilm and dental unit waterlines. Ann Agric Environ Med 2003;10,151-157.
3. Liaqat I, Sabri A: Biofilm, Dental unit water line and its control; African journal of clinical and experimental microbiology;12;15-21.
4. Venkatesh V et al. Evaluation of bacterial contamination of dental unit water lines and the efficacy of a commercially available disinfectant; 2006;9;93-98.
5. Donlan RM: BIOfilms: microbial life on surfaces. Emerging infectious diseases 2002,8,881-890.
6. Putnis et al: Dental unit waterline contamination and its possible implications during periodontal surgery, J Periodontol.2001 Mar;72(3):393-400.
7. Whitehouse et al, Influence of biofilms microbial contamination in dental unit water, J Dent 1991,19,290-295.
8. Williams JF et al, Microbial contamination of dental unit waterlines: origin and Characteristics. Compend Contin Educ Dent 1996,17,538-540,542 passim; quiz 558.
9. Brown MRW, Allison DG, Gilbert P: Resistance of bacterial biofilms to antibiotics: a growth-rate related effect? *J Antimicrob Chemother*1988, 22,10Al-Hiyasat A, Ma'ayeh S, Hindiyeh M, Khader Y. The presence of Pseudomonas aeruginosa in the dental unit waterline systems of teaching clinics. Int J Dent Hyg. 2007 Feb;5(1):36-44.
10. Holmes J. Dental unit waterlines-A review of the problem and solutions
11. Ananthanarayan and Paniker. Textbook of Microbiology. Seventh edition. Orient Longman Private Ltd, Chennai.
12. BG Shearer: Biofilm and the dental office: J Am Dental Office;1946;127;181-189.
13. Russell A. D. Bacterial adaptation and resistance to antiseptics, disinfectants and preservatives is not a new phenomenon. J. Hosp. Infect. 2004;57:97-104.
14. J. Barbeau, L. ten Bokum, C. Gauthier, A.P. Prévost Cross-contamination potential of saliva ejectors used in dentistry J. Hosp Infect 1998;40:303–311.
15. V.A. Merchant, J.A. Molinari Evacuation system lines and solid waste filter traps: associated flora and infection control Gen Dent 1990;38:189–193.
16. M.L. Sole, F.E. Poalillo, J.F. Byers, J.E. Ludy Bacterial growth in secretions and on suctioning equipment of orally intubated patients: a pilot stud Am J Crit. Care 2002;11:141–149.