Opportunistic Bacteria in Dental Unit Waterline Biofilms

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Abstract

Dental unit waterlines can provide favorable conditions for microbial colonization and biofilm development, potentially allowing opportunistic bacteria to persist in dental water systems. This study aimed to investigate the presence of opportunistic bacteria in dental unit waterline biofilms and to evaluate the effectiveness of selected disinfectants against the resulting biofilms.

Materials and Methods: Fifteen samples (12 water samples and three biofilm swabs) were collected from three dental practices located in Baba Hassen and Algiers Centre and Beni Merad (Blida). Samples were collected from taps, reservoirs, turbines, ultrasonic scalers and tap surfaces. Bacteria were recovered by membrane filtration or swabbing and cultured on selective media. Presumptive identification was based on colony morphology, Gram staining and biochemical tests. Biofilm formation and disinfectant susceptibility were assessed in 96-well microplates using methylene blue staining. Sodium hypochlorite, hydrogen peroxide and ethanol were evaluated by visual comparison of residual biofilm biomass.

Results: Culture-based analysis revealed variable contamination among dental practices. Pseudomonas spp., Klebsiella spp., Escherichia coli, Staphylococcus spp. and Streptococcus spp. were detected, with the highest and most diverse contamination. Biofilm formation differed among isolates: E. coli and Klebsiella spp. showed strong biofilm formation, Staphylococcus spp. and Streptococcus spp. showed moderate formation, while the mixed bacterial biofilm showed very strong biomass. Sodium hypochlorite was highly effective against all tested biofilms. Hydrogen peroxide showed moderate and strain-dependent activity, whereas ethanol was generally ineffective.

Discussion and Conclusion: The findings demonstrate that dental unit waterlines can harbor diverse opportunistic bacteria and support persistent polymicrobial biofilms. The variable disinfectant response highlights the importance of appropriate and regular waterline disinfection and microbiological monitoring. Sodium hypochlorite showed the strongest activity under the conditions tested, although routine management should consider equipment compatibility and appropriate maintenance procedures.