Opinion –response

The devil is in the validation and design; managing the risk from opportunistic pathogens in the dental unit.

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The opinion piece by Hoogenkamp et al raises some important questions regarding patient safety linked to biofouling of dental unit waterlines. They quite rightly raise the risk to patients [1, 2] but perhaps there is also a longer term risk to the respiratory health, such as occupational asthma [3], of dental healthcare workers from inhalation of heavily biofouled aerosols into their immediate working environment in poorly ventilated dental surgeries. However, it is acknowledged that surgery ventilation rates have now improved markedly during the COVID19 pandemic.

The engineering of dental unit waterlines (DUWLs) is ideally designed to facilitate biofouling with a network of narrow-bore plastic tubing with a combined length of over 5m with a 2-mm inner diameter, multiple connections of different materials providing a high surface area to water volume ratio. Additional factors further encourage biofilm build up such as intermittent usage and room temperature storage of water. The microbial contamination of DUWLs originates principally from two sources. It can result from suck-back of saliva from the oral cavity of a patient that occurs when a negative pressure is generated on stopping equipment [4,5]. The second source is from the feed water supply [5].

The mechanisms to control the microbial risks from DUWLs should not have to rely on the testing of the microbiological quality of water effluent from the dental unit when in use: by then it will be exceptionally difficult to control any biofilm if adverse microbial counts are detected. The multiple confounding factors leading to biofilm formation in these medical devices will make this a hard nut to crack and control. Dental units are classified as Class IIa medical devices and as such manufactures of these devices must be able to supply validated instructions for re-use of these devices and processes for delivery of potable quality water through the dental units. To be fair, existing standards [6,7] for dental units do provide requirements that should be met for antimicrobial agents to control biofilms. However, these standards are now at least 6 years out of date and the delays in revisions to standards and keeping up to date with rapid changes in the biofilm assessment and control fields [8] does not bode well for patient and staff safety. The approach highlighted by Hoogenkamp et al for proxy biofilm testing would be better suited in a research and development environment during product evaluation or field testing of processes for DUWLs biofilm control methods. Future revisions of standards for dental units should use a risk control hierarchy approach and incorporate design and material innovations to limit biofilm formation.

In practice, the way forward to manage the risks from DUWLs starts at procurement to check that the manufacturer has validation data on biofilm control for their units. Users are then required to follow the manufacturer's instructions for decontamination and provide an auditable trail that these have been undertaken for regulatory and quality management perspectives. Whichever system is used, sterile water should be used for surgery that involves the raising of mucoperiosteal flaps to gain surgical access in the oral cavity.

We are both in agreement that if no changes are made, there continues to be an unsatisfactory environment for both patients and staff subjected to microbial aerosols often in poorly ventilated dental surgeries.

References

1. Martin MV. The significance of the bacterial contamination of dental unit water systems. *Br Dent J* 1987; **163**: 152–154.
2. Peralta G, Tobin-D'Angelo M, Parham A, Edison L, Lorentzson L, Smith C, et al., Notes from the Field: Mycobacterium abscessus Infections Among Patients of a Pediatric Dentistry Practice--Georgia, 2015. *MMWR* 2016; **65**: 355-356..
3. Pankhurst C L, Coulter W A, Philpott-Howard J N *et al*. Evaluation of the potential risk of occupational asthma in dentists exposed to contaminated dental unit waterlines. *Prim Dent Care* 2005; **12:** 53-59.
4. Petti S, Tarsitani G. Detection and quantification of dental unit water line contamination by oral streptococci. *Infect Control Hosp Epidemiol* 2006; **27**: 504-509.
5. Walker J.T., Bradshaw D.J., Bennett A.M., Fulford M.R., Martin M.V., Marsh P.D., Microbial biofilm formation and contamination of dental-unit water systems in general dental practice. *Appl Environ Microbiol* 2000; **66**:3363–3367.
6. BS EN ISO 16954:2015 Dentistry. Test methods for dental unit waterline biofilm treatment. British Standards On-line.
7. BS EN ISO 7494-2:2015 Dentistry. Dental units. Air, water, suction and wastewater systems. British Standards On-line.
8. STM E3161 – 18. Standard Practice for Preparing a Pseudomonas aeruginosa or *Staphylococcus aureus* Biofilm using the CDC Biofilm Reactor. https://www.astm.org/Standards/E3161.htm