Summary of: An audit improves the quality of water within the dental unit water lines of general dental practices across the East of England

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Objective To evaluate and improve upon the quality of water emanating from the dental unit waterlines (DUWLs) which supply irrigation for dental handpieces and triple spray syringes in general practice. **Design** A prospective clinical audit. **Setting** Seventy-two general dental practices in the East of England. **Methods** In 2006, 124 dentists initially registered to participate in the audit. By 2007, 72 had begun and by 2008, 68 had completed the project. This involved collecting samples of water discharged from the DUWLs in the dental practices both before the start and mid-way through a morning session. These were tested microbiologically at a United Kingdom Accreditation Service testing laboratory. **Interventions** Before the audit, 56% of the DUWLs were reportedly flushed through for 2 minutes at the start of the day, 29% were purged for 20 seconds in between each patient, 50% were treated with a wide range of different disinfectant solutions, 44% were drained down dry at the end of the day and 9% had no cross-infection control measures applied to them at all. In the audit, 100% used a disinfectant solution alone, predominantly either Alpron or Sterilox. **Main outcome measures** The minimum audit standard set was for the water samples to meet the United States' Centers for Disease Control and Prevention (CDC) guideline on the quality of DUWL water, namely that the United States' Environmental Protection Agency (EPA) regulatory standards for drinking water be adopted, in that no more than 5% of water samples should be contaminated with total coliforms and that they should not have more than 500 colony forming units per ml (cfu/ml) of heterotrophic water bacteria. However, the participating dentists were encouraged to try and achieve the more stringent European Union (EU) standards for potable (drinking) water, namely for the water samples to have neither *Escherichia coli* nor any other faecal coliforms present and for the aerobic colony count to be less than 100 cfu/ml at 22°C after 72 hours of culturing. **Results** In the pre-audit survey, none of the 72 DUWL water samples were contaminated with *E. coli* but in five of them (7%) coliforms were recovered. Only 25% reached the EU potable water standard, of which 11% had zero planktonic bacterial contamination. Three percent were above the EU standard but below the CDC guideline/EPA regulatory drinking water standard, while alarmingly, 72% of them failed to reach this minimum audit standard altogether. However, after the application of a suitable disinfectant for at least a month, the audit revealed that *E. coli* still remained absent in the water samples taken from the 68 DUWLs that completed the project and in only one (1.5%) were coliforms recovered. Remarkably, nearly 81% reached the EU potable water standard, of which 54% had zero planktonic bacterial contamination, with nearly an additional 6% reaching the American CDC/EPA standard and with only 13% failing outright. **Conclusions** Clinical audit using appropriate DUWL disinfectants can result in the improvement of the quality of water that is discharged through DUWLs, thereby minimising both the risk of cross-infection to vulnerable patients as well as to dental staff chronically exposed to contaminated aerosols.

EDITOR'S SUMMARY

The potability of drinking water is the subject of EU standards and this study, as well as an earlier one by these authors, found that the required levels can be effectively achieved in dental unit water lines (DUWLs) by the use of appropriate disinfectants.

The authors, as well as Professor Chalmers writing the Commentary, draw attention to the extremely high bacterial counts found in some DUWLs in the initial assessments prior to the application

of the disinfectants in the study. This is of course not a good situation and I am not in any way suggesting that such situations are acceptable or should be tolerated.

However, I may be wrong, but I am not aware of large scale or indeed local incidents of illness stemming from dental practices due to DUWLs. I stress, that this is not a reason to lessen any form of safety nor to deviate from accepted standards. If the set levels demonstrably protect our patients then that is entirely as it should be. The only questions I ask are whether it

is demonstrable and whether the risk even from the high bacterial levels found initially in some practices were demonstrably putting patients at risk? Devil's advocate of course, but in an evidence-based world I think some answers would be reassuring.

The full paper can be accessed from the BDJ website (www.bdj.co.uk), under 'Research' in the table of contents for Volume 209 issue 7.

Stephen Hancocks

Editor-in-Chief

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IN BRIEF

- Demonstrates how clinical audit can improve standards in cross-infection control.
- Sufficient details are given for individual clinicians to replicate the audit in their own practices.
- American Dental Association and European Union water quality standards are given as appropriate standards to adopt.

COMMENTARY

The laudable aim of this study is encapsulated in the title. The total colony forming units (ie number of bacteria per millilitre) in dental unit waterlines was examined before and after application of antibacterial regimes to units in general practice. The European Union's standard for potable (drinking) water is for the aerobic colony count to be less than 100 cfu/ml. In contrast, the United States Environmental Protection Agency (EPA) states less than 500 cfu/ml. At the initial assessment 72% failed to meet the EPA standard but none had *Escherichia coli* present. After the application of a suitable disinfectant for at least a month, 87% of units reached the EPA standards, 81% reached the more stringent EU standard and half the units had zero bacterial contamination.

This is an encouraging result and demonstrates that suitable application of disinfectants can make a real difference to dental practices and that it is possible to meet water standards (in contrast to widely held views). It also demonstrates that whilst regular flushing reduces the numbers of bacteria, flushing alone is not sufficient to meet target numbers. Some studies have shown that bacterial contamination of dental units is dependent or related to the make of unit, and also that some units had high levels of contamination in three-in-one sprays and not in the high speed coolants, and *vice versa*. Unfortunately individual waterline contamination was not reported in this study but the results appear to

be independent of make of the unit. Alarming some units pre-treatment had counts of over 300,000 cfu/ml. The encouraging perspective of the study is that it demonstrates not only that audit is worthwhile in itself, but also that in spite of the presence of biofilms in waterlines, application of suitable disinfectants can make a real difference to bacterial colonisations and ultimately the safety of patients.

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AUTHOR QUESTIONS AND ANSWERS**1. Why did you undertake this research?**

This study was undertaken as a follow on from an earlier audit that was carried out on the quality of water emanating from the dental unit water lines of three separate facilities of a United Kingdom NHS Trust (BDJ 2006; 201: 565–569). While the initial levels of bacterial contamination that were found in that study were quite alarming, the improvements that were achieved after implementing an appropriate disinfection regime were remarkable. In anticipation of a similar situation being prevalent within general dental practice, support for extending the audit to a region-wide East of England study in order to potentially improve one aspect of cross-infection control was given by the Eastern Deanery.

2. What would you like to do next in this area to follow on from this work?

Levels of dental unit water line bacterial contamination are highest amongst large institutions with centralised water tanks involving complex plumbing. This is because of water stagnation at the bottom of the tanks as well as the amount of biofilm that develops inside the convoluted delivery systems to each individual dental unit. As a consequence, research into improving the quality of water within dental units that are based in district general hospitals is required and indeed, such an audit across the East of England is under way.