

# In review: Dentaqua hypochlorous acid disinfection system

Anne O'Donnell puts the new Dentaqua hypochlorous acid disinfection system through its paces at her practice

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Dentists require disinfection solutions that are inexpensive, safe, and effective. A typical clinic purchases several different disinfectants, including surface disinfection wipes, hand sanitisers, unit waterline and impression disinfectants, to name but a few. COVID-19 has added to the disinfection requirements, costs and time.

When it comes to infection control, Mullingar Dental Centre is always looking out for new and innovative methods to improve efficiency and safety while reducing costs.

Dentaqua (Figure 1) is designed and manufactured in Ireland and was rented monthly, allowing the clinic to produce on-site eco-friendly sanitiser for use in:

1. Surface disinfection
2. Hand sanitising
3. Dental unit waterline disinfection
4. Environmental fogging between patients
5. Impression disinfection.

The unit produces super-oxidised hypochlorous acid using just salt and water. Hypochlorous acid is found naturally in white blood cells of mammals, including the human body. It is non-toxic and has been used as a safe wound care solution for many years.

Hypochlorous acid is known to be an effective disinfectant, up to 100 times more effective than chlorine and is recommended as an ideal cleaning and disinfecting agent, as outlined in the *Journal of Oral and Maxillofacial Surgery*, 'Hypochlorous acid: a review' (Block and Rowan, 2020).

Hypochlorous acid has been identified by the US Environmental Protection Agency as effective against COVID-19. The mechanism of disinfection involves the destroying of the cell wall of microbes or viruses, allowing the disinfectant to destroy or inactivate them (Block and Rowan, 2020).

## Testing challenge

Testing was designed to challenge Dentaqua on both surface and dental unit waterline disinfection. The procedures used were designed to accurately replicate how Dentaqua solutions are typically used in a dental practice.

Sampling and sample analysis were performed according to best practice. Equipment and test kits were, as far as practicably possible, compliant with relevant industry standards.

## Surface disinfection

The AOAC and Microval ISO EN16149 and ISO 21527 accredited Compact Dry Total count test method were used in this study. These were obtained from Nissui Pharmaceutical Ltd.

Following treatment, swab samples were taken from three locations on the chair (Figure 2): arm rest, touchscreen, and the chair horizontal surface adjacent to the spittoon.

These locations were then disinfected using the Dentaqua solution and compostable paper towel.

Cleaning and disinfection was executed by spraying all surfaces, allowing one-minute contact time. The surfaces were then wiped down using a paper towel folded into six-inch square pads that were sprayed with Dentaqua disinfectant until damp.

Test number	Location	Total count before cleaning 25/01/21	Total count post disinfection 25/01/21	Total count before cleaning 15/02/21	Total count post disinfection 15/02/21
1	Dental chair arm	43	0	57	0
2	Dental chair touchscreen	66	0	5	0
3	Chair horizontal surface (beside spittoon)	298	0	82	0

Table 1: Results of the surface disinfection challenge

Clinic	Instrument	Results	Centre for disease (CFU/ml)	
1	High-speed	170	500	Pass
1	Three-in-one	350	500	Pass
2	High-speed	54	500	Pass
2	Three-in-one	37	500	Pass
3	High-speed	250	500	Pass
3	Three-in-one	1,100	500	Fail

Table 2: Results of the DUWL challenge



Figure 1: Dentaqua device



Figure 2: Swabbing near the spittoon

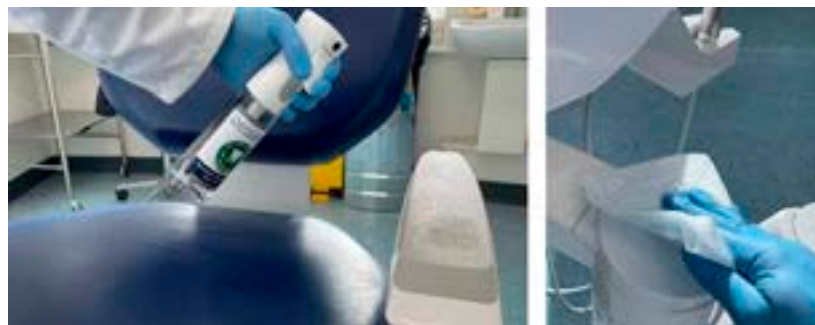


Figure 3: Disinfection of the dental chair using Dentaqua solution and paper towels

## Dental unit waterline testing

Two water samples were taken from each dental chair, one from the three-in-one and one from the high-speed tools.

The dental unit water bottles were filled at the start of each day from the Dentaqua device. Dentaqua water contains a small amount of super-oxidised hypochlorous acid and provides residual disinfection to remove biofilm and other harmful microbes from the waterlines. This ensures the aerosols produced by the tools are safe for patients and staff.

The installation of the Dentaqua system has kept Mullingar Dental Clinic's waterlines safe for more than a year. Implementing the Dentaqua dental unit waterline disinfection system eliminates the requirement for weekly shock-dosing, giving staff one less task to worry about each week.

There are three dental chairs in Mullingar Dental Centre and samples were taken from the three-in-one and high-speed tools in each. The samples were taken in a sterile bottle with sodium-thiosulphate (Figure 4) used to neutralise the residual disinfectant. The neutralisation of the disinfectant prevents any residual disinfectant affecting the test results from the time of testing to delivery to the microbiology laboratory.

The water samples were tested using heterotrophic plate count in waters with 10-day incubation at 20°C on R2A media (O'Donnell et al, 2009). This method facilitates the recovery of significantly more microbes than more traditional water test methods, and is regarded as the only appropriate method for accurate dental or medical-use water analysis.

## Results

Many studies have shown that dental chair output water is frequently contaminated by large numbers of various microorganisms (bacteria, fungi, protozoa, viruses). This contamination results from the growth of microbial biofilms on the internal surfaces of dental waterlines.

Microbial contamination in DUWLs may originate from the mains water piped into the dental unit, the failure of anti-retraction valves, and contamination from bottled water systems. Total bacteria counts as high as 1,000,000CFU/ml have been recorded and figures of 50,000CFU/ml are a worrying yet very regular occurrence.

As can be seen from the results, all DUWL figures in Mullingar Dental Centre are below 350CFU/ml, except for one sample from the three-in-one in clinic three, which was 1,100CFU/ml. While this figure is relatively low, it is above the guidelines for dental unit water.

On investigation, it was discovered the chair in clinic three had two three-in-one lines (left and right). This chair is primarily used by a dental hygienist, who would not have an assistant, and hence the three-in-one on the assistant's side is not used regularly. The water sample taken from this chair was taken from a three-in-one on the assistant side, which often lies stagnant for long periods.

Following the test result, we decided to remove the second three-in-one from this chair rather than implementing a regular flushing routine for both. The slightly higher result in the three-in-one from clinic three, prior to its removal, demonstrates the importance of proper dental waterline disinfection and management.



Figure 4: Water sample retrieval

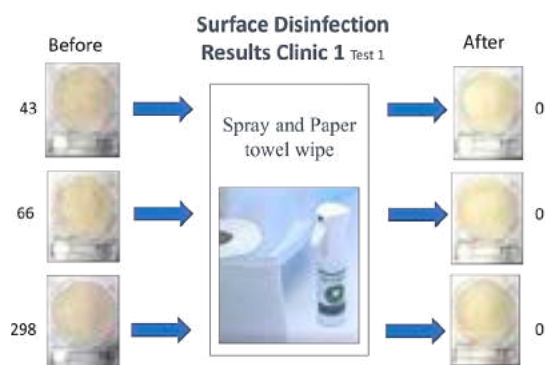


Figure 5: Test one - total count swabs taken on 25/01/21

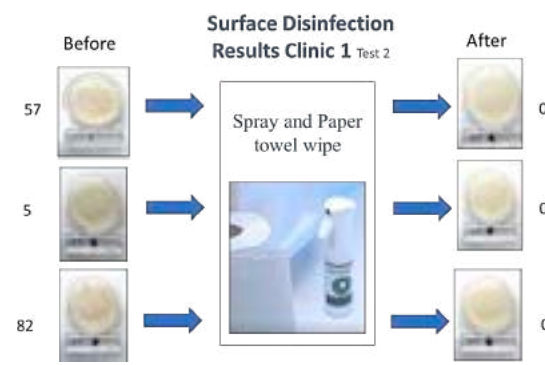


Figure 6: Test two - total count swabs taken on 15/02/21

## Discussion

The results demonstrate that Dentaqua is an effective disinfection solution for any modern dental clinic. The effectiveness of super-oxidised hypochlorous acid for surface and waterline disinfection has been proven extensively in many peer-reviewed papers and this real-world clinical study has demonstrated the same.



Figure 7a: Bottled commercially available HOCL. Visible salt crystals



Figure 7b: Dentaqua (no salt crystals)

It is reassuring to have real in-clinic results to validate our processes and this has provided us with the assurance that our protocols are effective, ensuring patient safety.

Hypochlorous acid is now widely used in the dental industry. However, not all hypochlorous acid solutions are the same; some are known to be corrosive due to inefficient generation.

To demonstrate the difference, we evaporated equal amounts of Dentaqua solution and a commercially available bottled hypochlorous acid. It was clear there is no residue of salt crystals in the Dentaqua solution (Figures 7a and 7b). The residual salt in the bottled solutions will cause corrosion of dental chair and tools.

Dentaqua's patented technology was designed specifically for dentistry. It has been evaluated in long-term clinical studies and is proven compatible with dental equipment.

From a cost reduction point of view, Dentaqua is saving Mullingar Dental Centre approximately €3,500

per year, with reduced purchasing costs for disinfection wipes, chemicals, and reduced labour.

The staff enjoy the fact that the system is easy to use and produces fresh disinfectant every morning. There are no containers to store or to dispose of, which makes for easier practice of stock control.

There is reduced ordering and management of supplies. Previously, our practice had to order wipes, spray disinfectant, impression disinfectant, waterline tablets and had to ensure that adequate supplies of all were in stock at all times.

Now, we produce our disinfectant requirement on-site, at the touch of a button with no stock management issues.

The big bonus is the eco-friendly aspect, eliminating single-use wipes, harmful chemicals and all of the associated plastic packing.

I have no problem recommending the system to any other dental clinic. **D**

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