# Microbial Contamination of Dental Operatory Water Bottles for DUWLs

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## ABSTRACT

**Objectives:** 1) To evaluate microbial contamination of distilled water in the self-contained water bottle (SCWB) of the dental operatory and its source water; and 2) to determine effective measures for eliminating the contamination. **Methods:** Fifty SCWBs (A-DEC, Inc., Newberg, OR) and 49 (10 unopened and 39 opened, half full) Arrowhead distilled water (San Bernardino, CA) samples from original containers were examined. In addition, two methods, cleaning of SCWB using a glassware washer or adding a BioRx tablet (Sterisil, Castle Rock, CO) to SCWB water (10/group), were evaluated. Water samples were taken at the baseline, after cleaning, and two weeks later. All samples were collected in sterile vials and processed immediately. Each sample was diluted, filtered and then the filter was placed on R2A agar plates. The plates were incubated at room temperature and the colonies were counted on the 7th day. **Results:** Ten samples collected from the unopened distilled water containers were free of microorganisms. Among the 39 samples from the opened, half-full containers, 61.5% had no colonies; 23.1% showed acceptable level (<200 CFU/ml), and 15.4% had CFU ranging from 5,520 to 42,240 per mL. Among the 50 SCWB samples, 84% were contaminated with an average of $8.1X10^4$ CFU/ml. Both the washing of SCWB and adding BioRx tablet to water were effective in reducing the microbial contamination ($p<0.001$). After two weeks, 50% of the BioRx group maintained <200 CFU/ml; however it was only 10% for the glassware washer group. **Conclusions:** Distilled water from opened containers may be contaminated with microbes. Significant microbial contamination may exist in the SCWBs that are not routinely cleaned and sanitized, and it can be a source of microbial contamination of dental unit waterlines (DUWLs). Compared to washing, the use of BioRx tablet is an effective and simple measure to control the water contamination in the SCWBs.

## INTRODUCTION

Microbial contamination of dental unit waterlines was recognized more than three decades ago. Due to an increased awareness of potential occupational hazards and concerns with immunocompromised patients, the problem has resurfaced in recent years. Following the ADA's statement issued in 1996, more dentists are using treated water and have equipped their dental operatory with a self-contained water bottle (SCWB) to control microbial contamination of dental unit waterlines. So far, however, little information is available on the effectiveness of the SCWB.

## PURPOSES

1) To examine the level of microbial contamination of the source water for the SCWB.
2) To evaluate the level of microbial contamination of the water in the SCWB of the dental operatory.
3) To determine the effectiveness of two measures for controlling the microbial contamination of the SCWB.

## MATERIALS AND METHODS

- **Dental operatories:**
  - 50 A-DEC operatories with SCWB
- **Source water:**
  - Arrowhead Distilled Water
    - 10 unopened containers
    - 39 opened, half-full containers
- **SCWB Water Samples:**
  - Prior to scheduled weekly Bio2000 cleaning (7th Day)
- **SCWB clean methods:**
  1. Large-Capacity Glassware Washer (N=10)
  2. Sterisil BioRx Tablets (N=10)
  3. Sampling time: Baseline, 3-day and 14-day
- **Procedures:**
  1. Samples collected with sterile vials and processed immediately
  2. Each sample diluted and filtered through a 0.2 µm membrane filter (Pall Medical, Ann Arbor, MI)
  3. Filters placed on R2A agar plates aseptically
  4. Plates incubated at room temperature
  5. Colonies counted on the 7th day

## RESULTS

**Table 1. Evaluation of Microbial Contamination of Source Water—(Arrowhead Distilled Water)**

| Distilled Water | CFU/mL * | % | Sample | CFU/mL | |
|---|---|---|---|---|---|
| | | | | Range | Mean ± SD |
| Unopened containers (10) | None | 100.0 | 10 | 0 | 0 ± 0 |
| Half-full containers (39) | None | 61.5 | 24 | 0 | 0 ± 0 |
| | <200 | 23.1 | 9 | 1 - 134 | 31 ± 47 |
| | >200 | 15.4 | 6 | 5,520 - 42,240 | 19,980 ± 13,555 |

*ADA limit at <200 CFU/mL.

**Table 2. Microbial Contamination of Water Samples from Self-Contained Water Bottles of Dental Operatory**

| ADA Recommendation | % | Units | CFU/mL | |
|---|---|---|---|---|
| | | | Ranges | Mean ± SD |
| Pass (<200 CFU/mL) | 16% | 8 | 5 -160 | 81 ± 61 |
| Fail (>200 CFU/mL) | 84% | 42 | 210 - 558,000 | 80,616 ± 141,758 |

**Figure 1. Dental Operatory with a Self-Contained Water Bottle (SCWB)**


**Figure 2. Illustration of Microbes in Water Samples From Self-Contained Water Bottles**

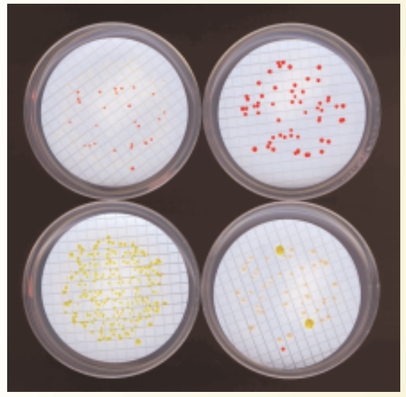


**Figure 3. Evaluation of Colony Forming Units (CFUs) of Water Samples from Self-Contained Water Bottles**

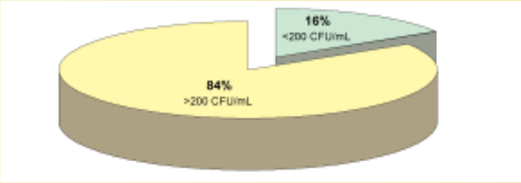
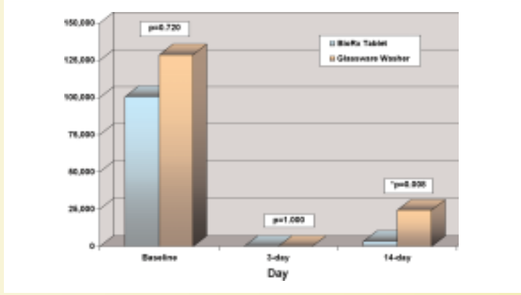



**Figure 4. Comparison of Clean Methods: Sterisil BioRx Tablets Vs Glassware Washer**




* There is a statistically significant different of 14-day, (p=0.008)

## CONCLUSIONS

- Distilled water from opened containers may be contaminated with microbes.
- Significant microbial contamination may exist in the SCWBs that are not routinely cleaned and sanitized, and it can be a source of microbial contamination of dental waterlines (DUWL).
- Compared to washing, the use of the BioRx tablet is an effective and simple measure to control the water contamination in the SCWB.