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Effect of Dentacide™ on Dental Unit Water-Circulating Components

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Objective: Disinfecting agents used to control microbial contamination in dental unit waterlines can compromise the integrity of component parts. This study evaluated a microbicidal anti-biofilm treatment, Dentacide™, for its potential to adversely affect the plastic, rubber, and metal components in a dental unit.

Methods: Representative components of typical dental units (A-dec™) were exposed to three test solutions: tap water (normal usage), Dentacide™ at its recommended concentration (1x), and ten times recommended concentration (10x). Continuous exposure and 10x were used to accelerate environmental conditions. The viscoelastic properties of non-metal components were evaluated for changes as a function of exposure time and solution environment. Several sizes of polyurethane (PU) and PVC dental unit tubing were each cut into five 50 cm samples and placed in a test solution.

After zero, 2, 4, and 6 mo, 5 cm specimens were cut from each sample and stressed in tension (ASTM D638-91), and then evaluated using a universal mechanical tester (Instron Model 1125). Similarly, individual PU gaskets were tested in tension and polyethylene-propylene 'O' rings were tested in compression. One way ANOVA was used to determine differences within each component group ($n=5$, $p \leq 0.05$) due to environment, Dentacide™ concentration, exposure time and the interaction of concentration x time. Pairwise comparisons were made within groups having significant differences using the Student-Newman-Keuls method. Analyses were carried out using SigmaStat™ version 1.01, statistical software (Jandel).

A separate test to assess corrosion resistance of metal components was also performed. A new routing manifold block was installed in each of two dental units and treated daily with Dentacide™ or with NaOCl bleach through a combination of weekly and continuous treatments. After 6 mo, the blocks were removed, disassembled, and inspected under low power magnification (10 to 20x) for corrosion. An unexposed manifold block was used as a control.

Results: In tap water, modulus (relative stiffness) tended to decrease slightly for all materials except for the flexible PVC syringe tubing. This was likely due to water absorption and softening. A decrease in modulus was always accompanied by reduced stress at yield and at break, and increased elongation; thus indicating that the materials became somewhat more elastic. For several materials, most notably the clear PU supply tubing, these changes either ceased or reversed after 4 - 6 mo. Such behavior is often caused by the absorption of water by a plasticized material that is followed by gradual extraction of the plasticizer. For the PVC syringe tubing, modulus *increased* slightly during the first four months and then remained approximately constant, with accompanying *increases* in stress at yield and at break, and *reduced* elongation. This syringe tubing is a highly plasticized PVC. Thus, increased modulus indicates that plasticizer extraction dominates water softening. In the presence of Dentacide™, effects similar to those in water were seen. Some property changes were somewhat exaggerated compared to water, while others were reduced depending on the component's composition. In general, changes in modulus, stress to yield, *etc*. are dependent on exposure time, Dentacide™ concentration and concentration x time. However, all of these changes are small and most are significant only at 10x Dentacide™ concentration after the longest exposure time (6 mo). In the corrosion resistance study, some corrosion was observed in both treatments. However, the sample treated with bleach experienced more severe crevice attack than the sample treated with Dentacide™.

Conclusion: Given the accelerated exposure conditions, the observed changes are small and we conclude that no practical adverse effects due to Dentacide™ treatment should be expected over the normal, approximately 5 year, lifetime of these rubber and plastic components. Similarly, Dentacide™ is not expected to adversely affect metal components in the water circulating system of dental units and should be less corrosive than bleach.

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