Shining New Light on Physical Therapy Equipment: Effectiveness of UV Light in Comparison to Detergent in the Reduction of Bacteria

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Background

Using proper disinfecting techniques in the healthcare field is important in preventing nosocomial infections. Considering that physical therapy equipment is used for multiple patients, disinfection between patients is of critical importance. Articles exist in the literature relating to the effects of various detergents on the reduction of bacteria, but there is limited data concerning treatments other than those used as standard protocols in acute rehabilitation facilities. Studies have shown that UV-C light is bactericidal and can damage bacterial DNA, thus inhibiting replication. UV-C radiation is effective in disinfecting liquids, surfaces, and foods. Previous studies have shown the germicidal effects of UV-C lamps on contaminated surfaces. In this study, we investigated the germicidal effects of UV-C light on various contaminated surfaces using a hand-held UV-C wand. The utilization of detergent in the healthcare field is a common practice, but we have found no literature on the use of hand-held UV-C wands for decontamination purposes in physical therapy clinics.

Methods

Gait belts and wheelchair seats were intentionally contaminated with both Staphylococcus aureus and Escherichia coli and allowed to incubate for 24 hours in a controlled environment with an average temperature of 30°C (84°F). Afterward, the equipment was uniformly transported via elevator to an isolated treatment room with an average temperature of 18.5°C (65.3°F). To collect samples, six apertures were demarcated on a premeasured grid (Figure 1) to standardize the areas where initial and final samples would be collected in UV-C- and detergent-treated areas. Following the product protocol, a UV-C wand and a quaternary ammonium compound (QAC) detergent were used to treat adjacent areas (Figure 2 A). In order to eliminate the chances of disinfection overlap, the UV-C side received treatment prior to the detergent side, which was shielded with aluminum foil and 4x4 sterile gauze pads. Samples were collected (Figure 2 B) and labeled (Figure 2 C) before and after treatment application, and were delivered on the same day to the Alabama State University Microbiology lab (Figure 2 D) for plating, growth, and colony counts.

Results

The data did not appear to have a normal distribution; therefore, nonparametric statistical tests were used for analysis. The Wilcoxon Signed Rank Test (N=9, α=0.05) was used to establish whether there is a significant difference between the initial and final samples from the UV-C-treated and the detergent-treated areas. The Mann-Whitney Test (N=9, α=0.05) was used to establish whether there was a significant difference between the UV-C and detergent treatments. We found no significant difference between initial and final treatment methods in either detergent (R=11.5, W[0.05]=9, W[0.95]=38) or UV-C (R=20, W[0.05]=9, W[0.95]=36) treated areas of the gait belt. There was also no significant difference between use of UV-C or detergent on the gait belt (T=38, W[0.05]=22, W[0.95]=59). No significant difference was seen in the initial and final samples from the detergent-treated areas of the wheelchair seat. The Mann-Whitney Test (N=9, α=0.05) was used to establish whether there was a significant difference between the UV-C and detergent treatments. We found no significant difference between initial and final samples from UV-C-treated and the wheelchair seat (R=0, W[0.005]=2, W[0.995]=43). There was a significant difference between UV-C and detergent treatment on the wheelchair seat (T=62, W[0.05]=19, W[0.95]=62). (See Table 1)

Conclusions/Implications for Practice

Although this is a small study with a limited sample size, the hand-held UV-C wand appears to be as or more effective than a quaternary ammonium compound detergent when disinfecting non-porous material. Neither method consistently disinfects porous surfaces. For cleaning equipment with non-porous surfaces, the hand-held UV-C wand may be a better choice due to its ease of use, effectiveness and environmentally safe properties. The ease of use of hand-held UV-C wands would make it desirable for use not only in clinics but also for other healthcare settings inclusive of home health.

References