Introduction

The objective of this study is to evaluate and compare multiple disinfectants for their immediate efficacy and the duration of their residual effect on the surfaces of facilities in which surgical surgeries are performed. Little information is available regarding standard disinfection protocols for biomedical research operating rooms and procedure areas. The ultimate goal is to establish an experimentally based, standardized protocol for effective sanitation of surgical areas commonly found in research settings. The first phase of the study seeks to determine the efficacy of multiple disinfectants. Samples to evaluate microbial growth will be taken from surgical procedure facilities prior to and after application of a treatment. The facilities will receive either control agents or one treatment chemical and will be retested for the presence of microbes. To assess the duration of residual antimicrobial properties of the agents, RODAC plates will be used weekly for four weeks. We expect high-level disinfectants to be more efficacious and possess a longer duration of sustained antimicrobial activity.

Materials and methods

Treatments include sterile water on the control, Nolvasan®, Roccal-D®, 200ppm bleach solution and 70% Isopropyl Alcohol. All chemical solutions were prepared according to manufacturers instructions and used within 24 hrs. Areas were first treated then thoroughly treated with the randomly assigned treatment After being allowed to set for ten minutes, the surface was wiped dry with sterile gauze then retested.

Samples were collected using both RODAC plates and the Chalmers Luminometric RODAC plates allowed the quantification of Colony Forming Units (CFU) and 4824 hrs after collection. Colonies were identified morphologically. The luminometer provides results within 5 sec by measuring changes released by enzymatic activity of bacteria on the ATP produced by bacteria on the testing surface. Presence of ATP is proportional to the amount of light released which can be indicative of amount of bacteria present.

Results-Immediate Efficacy

Immediate Efficacy was tested in relevant surgical procedure areas. The luminometer measures photon production in Relative Light Units (RLU). Samples revealed wide variance in pre-treatment luminometer measurements, ranging from two to thousand to 2.5 million RLU. This is partially due to time elapsed since last procedure performed and whether the surface was cleaned after the last procedure or is only disinfected prior to the next procedure.

For each testing location, the difference between the pre- and post-treatment RLU readings was calculated to indicate immediate efficacy in reduction of bacterial load. The difference was converted into percent in order to normalize the wide variation between locations. The percent reductions within each group were then averaged to provide an overall measurement of efficacy for each treatment.

Discussion

Experimental design dictated that products sit in contact with surfaces for ten minutes. The RODAC plate requirements necessitated that the testing surface be wiped dry. Sterile water was chosen for the control because the mechanical action of wiping a surface for ten minutes and wiping it dry it would be responsible for removal of some base level of bacterial removal.

The Chalmers Luminometer measures ATP, which is present in both living organisms and organic material, thus it is possible to detect ATP that is not the result of viable bacterial organisms and can impact the overall score.

Data collection for the Immediate Efficacy phase has not yet been completed. The end result will be ten testing sites for each of the treatments and the control. We considered Roccal-D® and Nolvasan to be high level disinfectants, bleach and isopropyl alcohol to be low level disinfectants and sterile water as the control. In support of our hypothesis, preliminary data has indicated that a high level disinfectant, Roccal-D®, provides the most complete killing of bacterial populations, and that sterile water performed the worst, with disinfectant added to physical removal. We were surprised, however, to discover that Nolvasan did not surpass the disinfection capacity of 70% Isopropyl Alcohol and it was similarly unexpected to discover that a Bleach dilution of 200ppm appears to be a better disinfectant than Nolvasan.

Data collection for the Residual Effects phase is also incomplete. At this stage, CFU's have shown gradual increase as expected, however, the reproducibility of one treatment's sustained ability to maintain low bacterial counts over that of another remains inconsistent. These data could have been complicated by non-uniform contamination of specific testing surfaces in the large animal operating room in association with use for scheduled surgeries.

It was significant that a large portion (33%) of bacterial colonies isolated are Gram-negative bacilli due to their pathogenic propensity in veterinary medicine.

Efficacy, Duration and Residual Effects of Antimicrobials in Biomedical Research Surgical Facilities

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Further Investigations:

Statistical analysis was unfavorable at the time of printing. However, all data will be evaluated for statistical significance upon completion of data collection.

The data from the Immediate Efficacy Phase collected on RODAC plates was not included in this presentation but revealed results similar to that of the luminometer regarding the disinfection capacity of the treatments. Results from both RODAC and the luminometer will be evaluated for correlation.

We will look at the different morphologically-identified groups of bacteria to determine if relative susceptibility of groups can be established.