UV ANGEL LAB TEST: INACTIVATION OF BACTERIAL PATHOGENS: EXTERNAL KEYBOARD

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Introduction

UV Angel is an automated anti-microbial device that effectively disinfects targeted surfaces, areas highly trafficked with human interaction, shared public surfaces (e.g. computer technology, medical devices, kiosks, atm, point of sale devices, communication devices, etc…) by way of a low-intensity UV-C bulb and software. The device emits low intensity Ultra Violet C light that has the capability to kill bacterial pathogens present on surfaces. The purpose of the current pilot study was to evaluate the ability of UV Angel to kill bacteria that have been inoculated onto the surface of the keys on an external keyboard. Organisms evaluated included Staphylococcus aureus (MRSA), Klebsiella pneumoniae (KPC-2), and Enterococcus faecalis (VRE).

Materials & Methods

Device: A UV Angel device, external keyboard, stand, and appropriate software were supplied by UV Angel.

Organisms: Micromyx provided methicillin-resistant S. aureus ATCC 33591 (MRSA; MMX 2001), K. pneumoniae (KPC-2; MMX 4683), and E. faecalis (VRE; MMX 486)

Protocol: ***Preparation of inoculum***: All organisms were grown overnight on a Blood Agar Plate (Remel; Lot No. 519430) at 35°C. For each organism tested, colonies were removed from the plate and used to prepare an inoculum in sterile saline (Nerl Blood Bank Saline; Lot No. 227765) equivalent to approximately 108-109 CFU/mL. Each inoculum was quantitated by serial dilution plating to determine the starting point for the assay.

Sterilization of keys: Keys were removed from the keyboard, immersed in 100% ethanol for 30 min, rinsed with sterile water, and were dried in sterile petri dishes in a BioSafety cabinet. Sampling of decontaminated keys failed to show bacterial growth, thereby validating the sterilization method (data not shown).

Inoculation and UV Angel treatment of keys: Ten µL of an inoculum was applied to a total of 21 keys, spreading a thin layer over the surface with a sterile pipet tip. As the keys were drying, the "bed" of the keyboard (empty positions where keys were placed) was exposed to UV Angel for 10 min to decontaminate the area. Three keys served as a "Zero" time point for the assay. Three different keys were then placed back into the top "letter" row on the keyboard and exposed to the UV Angel light source for 2 min. These keys were removed for processing (see below), and the process was repeated with three keys each for 5 min and 10 min exposures. For each time point, 3 keys remained in a covered sterile petri dish exposed to ambient light only approximately 3 feet away from UV Angel.

Enumeration of bacteria from the keys: Each key was placed into a separate sterile 50 mL conical tube (Corning; Cat No. 430290) containing 10 mL of sterile saline, rotated in an incubator shaker at 190 rpm/37°C for 10 min, and vortexed vigorously for 30 sec to remove the organisms. Serial 10-fold dilutions were made with sterile saline. Duplicate blood agar plates were inoculated with 0.1 mL of the dilutions and the plates were incubated for 18-20 hr at 35°C for aerobic organisms. After incubation, the colonies were counted and calculations were conducted to determine the time-kill kinetic for each isolate tested.

Figure 1. Time-kill Kinetic of *Staphylococcus aureus* ATCC 33591 (MRSA) on External Keyboard Keys

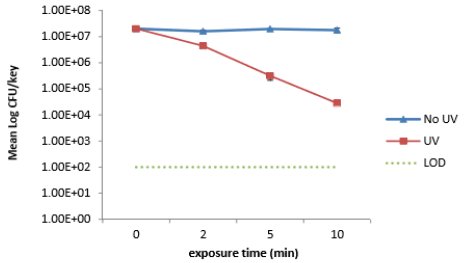


Figure 2. Time-kill Kinetic of *Enterococcus faecalis* MMX486 (VRE) on External Keyboard Keys

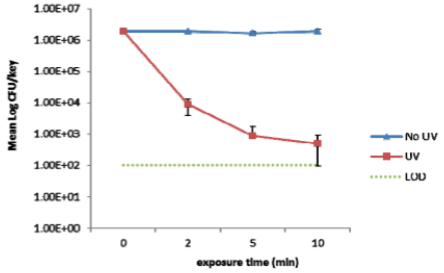
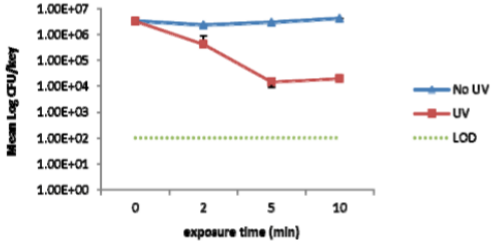


Figure 3. Time-kill Kinetic of *Klebsiella pneumoniae* MMX4683 (KPC-2) on External Keyboard Keys



Results & Discussion

The goal of the study was to evaluate the ability of UV Angel to kill bacterial pathogens that had been inoculated onto the surface of keys from an external computer. The inoculum was applied with organisms resuspended in sterile saline, followed by drying in ambient air. With the exception of the presence of saline, drying of the inoculum would mimic contamination of keys by human contact. Keys that were exposed to ambient light would provide data for survival of individual organisms under normal conditions, whereas treatment with UV Angel would reveal the ability of the instrument to kill organisms. Methodology was developed to sterilize keys, inoculate known amounts of pathogens onto the keys, and achieve good recovery of bacteria from the keys for enumeration. Three aerobic pathogens were evaluated as shown to the left.

In conclusion, UV Angel treatment of S. aureus MRSA, E. faecalis VRE, and K. pneumoniae (KPC-2) cells which had been dried onto the surface of the keys of an external keyboard resulted in dramatic killing after only 2 minutes of exposure. For each of these organisms, five minutes of UV Angel exposure resulted in >98% cell killing.