UVD ROBOTS®

CLINICAL STUDIES

Candida auris

report id: uvdr-ict/ca

EVALUATION OF THE EFFICACY OF THE UVD ROBOT TO REDUCE NUMBERS OF *CANDIDA AURIS* AT SHORT TIME PERIODS

SUMMARY

Stainless steel coupons containing approximately 10^5 colony forming units (cfu/ml) of *Candida auris* DSM 21092 (dried) were placed on a surface. They were exposed to UV-C emitted by a UVD Robot for different time periods ranging from 10 minutes to 30 minutes. The numbers of organisms remaining were calculated compared to control coupons which were placed in exactly the same positions but were shielded from the UV by tin foil. The numbers of organisms remaining after the test period were counted and compared to the control and log reduction calculated.

The UVD Robot caused a > than 3 log reduction at the minimum time period tested of 10 minutes.

1.0 INTRODUCTION

Candida auris was first reported as an emerging pathogen as early as 2009, when it was isolated from an ear canal. It easily forms biofilms (a community of microorganisms adhering to a surface and covered in a polymeric matrix) which is resistant to a variety of disinfectants and antimicrobial agents. Levels required to kill the fungus within the biofilm can be 1000 times higher than in the non-biofilm state. Globally there is a threat to society in the form of multiple antimicrobial resistant (AMR) microorganisms[1] and *Candida auris* is on this list. It has been isolated from patients in hospitals in all continents and primarily it causes infections in the immunocompromised patients.

In healthcare environments, these organisms can survive on and be cultured from surfaces, both moist and dry, for at least 14 days and is resistant to many disinfectants. If a patient is infected with *Candida auris* infection is difficult to treat because it is resistant to many of the commonly used systemic antifungal agents. UV-C can be used as a final disinfection process post cleaning and this could reduce the risk of acquiring healthcare associated infections and hopefully reduce the need for antibiotics.

UVD Robots use 8 UV-C emitting lamps placed vertically on top of a robotic platform which moves either autonomously or can be controlled either by a phone or tablet from outside the area being disinfected. 8 x Philips UVC lamps (wavelength 254nm) gives 360 degree coverage. The lamps generate 5 joules of UV-C energy per lamp and there is always a minimum of 4 lamps facing any given surface a 1 m distance. The speed of the robot in disinfection mode is 10 cm per second. This delivers an intensity of 20 joules per m^2 per second.

Typically, a UVD Robot will take approximately 10-15 minutes to disinfect a single occupancy patient room. Following disinfection, the robot will return to its' station until it is called upon again.

2.0 METHOD

2.1 Preparation of the inoculum on stainless steel coupons

Candida auris DSM 21092 was used to prepare the inoculum in-Maximum Recovery Diluent (MRD) (Lab M Ltd, LAB103) using log phase cultures (approximately 105 cfu/ml). As per EN 14561, 1 ml of interfering substance (BSA - 3g/l)) and 9 ml of test organism was mixed to simulate light soil. Accurate viable counts were undertaken using a standard dilution method at the various time periods.

Stainless steel coupons (of the type and grade specified in BS EN 13697 – namely 1.5mm depth / 20 mm diameter stainless steel, manufacturer code 304 2B) were inoculated with 50µl of the inoculum and dried for approximately 40 minutes at 36°C. All log reductions were calculated against their own controls at the same time period.

Dried suspensions of each organism on stainless steel coupons (held at a 70 degree angle); test coupons (n=3) and unexposed control coupons (n=3) were placed at the same locations. The unexposed control was prepared by wrapping with 3 layers of aluminium foil (to shield from UV-irradiation) around the petri dish containing the coupons.

2.2. Exposure to the UVD robot

The UVD Robot was allowed to 'warm up' for 3 min behind a screen and the robot was moved to within 1 metre of the samples without stopping (drive by). This was repeated moving the robot to a 1 metre distance and allowing the robot to remain stationary for different time periods namely 10 minutes, 20 minutes and 30 minutes. The exposure was carried out three times.

2.3 Processing the coupons
On completion of each UV-disinfection cycle, the coupons were processed within the laboratory. Each coupon was aseptically transferred to 2 ml sterile Maximum Recovery Diluent (MRD) in a sterile bottle containing sterile glass beads. The MRD was vortexed mixed at full power for 30 seconds.

1 ml was transferred to 9 ml MRD, mixed and a ten-fold dilution series undertaken to determine an accurate viable count. 1 ml of each dilution was added to 12 ml molten Sabouraud Agar (Lab M Ltd, LAB009) as a pour plate and allowed to set. All plates were transferred to the relevant incubation conditions (30°C in air for 48 hrs).

Following 48 hrs incubation, all colonies were counted and recorded. All testing was done in triplicate and the log reductions were calculated by comparison of the test mean log viable count and the control mean log viable count.

3.0 RESULTS

3.1 Antimicrobial effect of UV-C
The starting viable count on the stainless steel coupons was approximately 1 x 10^5 cfu/ml (mean 5 log). There was a **3.07 log** reduction seen at the 10 minutes which remained at similar levels though to 30 minutes. The log reduction at each time point is shown in Table 1

Table 1; Log reduction at different time intervals.

Mean Log reduction	10 MINUTES	20 MINUTES	30 MINUTES
	3.07	>3.04*	>2.55*

Key: * limit of detection
Note: The organisms die very quickly on the coupons and after 30 minutes there are less viable organisms on the control coupon making it difficult to assess accurate log reduction) No growth was detected on the coupon exposed to UV-C after 30 minutes.

4.0 DISCUSSION

This was a snap shot study undertaken to determine whether an effective log reduction could be attained at a low time period. *Candida auris* was chosen because it was a multidrug resistant strain and seen in a variety of healthcare associated infections across the globe. The UVD Robot rapidly reduced organism numbers in light soil by 3 log, as the robot remained within a 1 meter vicinity. This reduction remained at similar levels through to 30 minutes. Shading was not an issue because the robot could move between positions and position itself so that sufficient UV-C was emitted.

5.0 REFERENCES

1. WHO Global list of antibiotic resistant bacteria
https://www.who.int/medicines/publications/WHO-PPL-Short_Summary_25Feb-ET_NM_WHO.pdf?ua=1

2. Anna Jeffery-Smith, Surabhi K. Taori, Silke Schelenz, Katie Jeffery, Elizabeth M. Johnson, Andrew Borman, Candida auris Incident Management Team, Rohini Manuel, Colin S. Brown Candida auris: a Review of the Literature. Clinical Microbiology Reviews 2018; 31; 1-18.

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Dated: 19th June 2020

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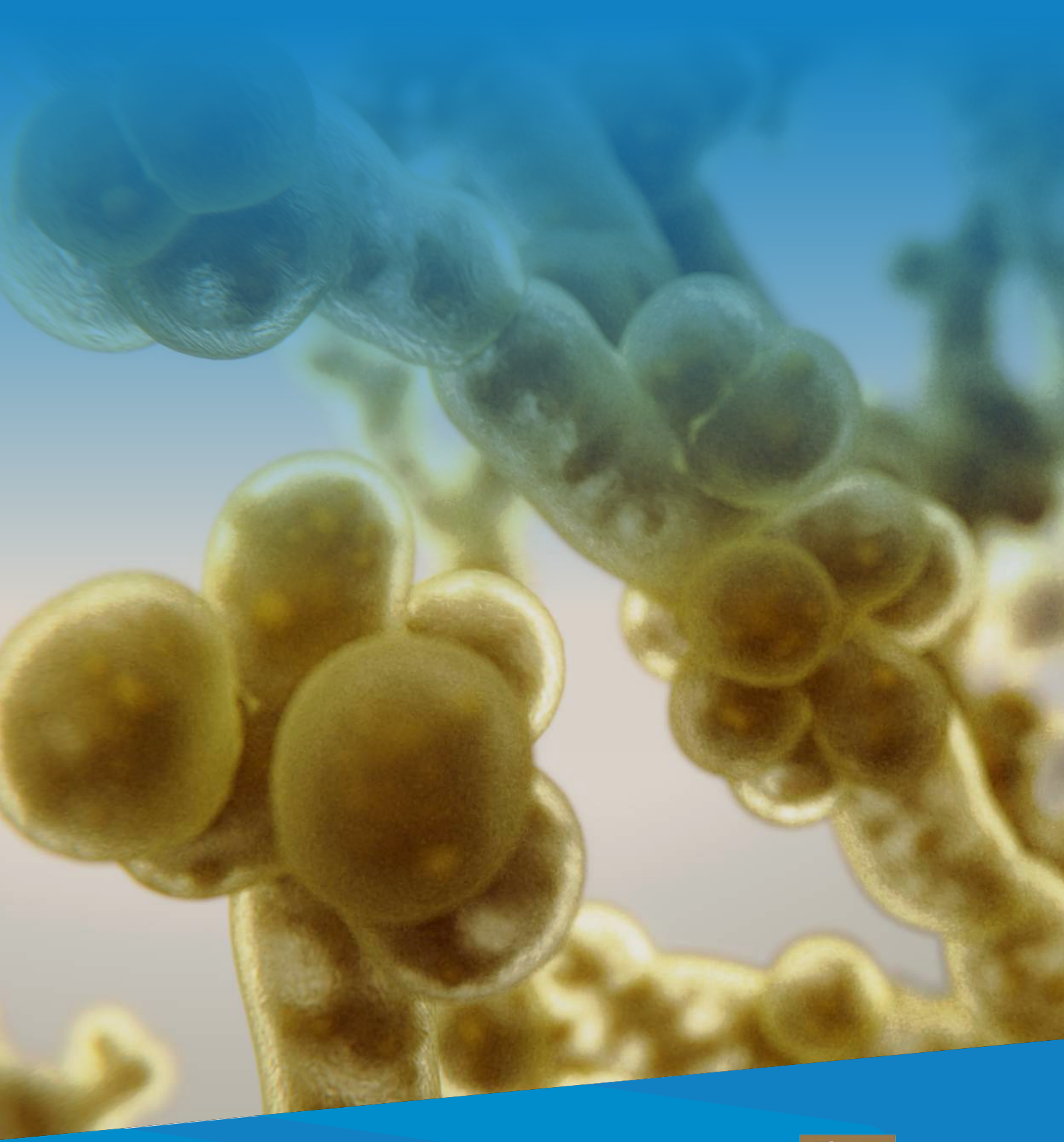

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The UVD Robot is highly effective in the inactivation of harmful microorganisms and it is deployed by hospitals all over the world to protect vulnerable patients from hospital acquired infections. The clinical efficacy of the UVD Robot has been independently tested and validated at the following institutes:

Melbec Microbiology

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