Evaluation of an automated UVC device (THOR) for enhanced disinfection of patient environment

June 2017
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Device: Telescopic High-Output Rapid UVC disinfection robot from Finsen Technologies (THOR)
Hospital: Dutch Burn Center Beverwijk

Background

Recent studies show that enhanced terminal room disinfection decreases risk of contaminated health-care environment as an important source for acquisition of pathogens (Lancet 2017 jan 16).
Room decontamination that continuously reduces microbial reduction is believed to be effective to prevent HAI's associated with the environment.

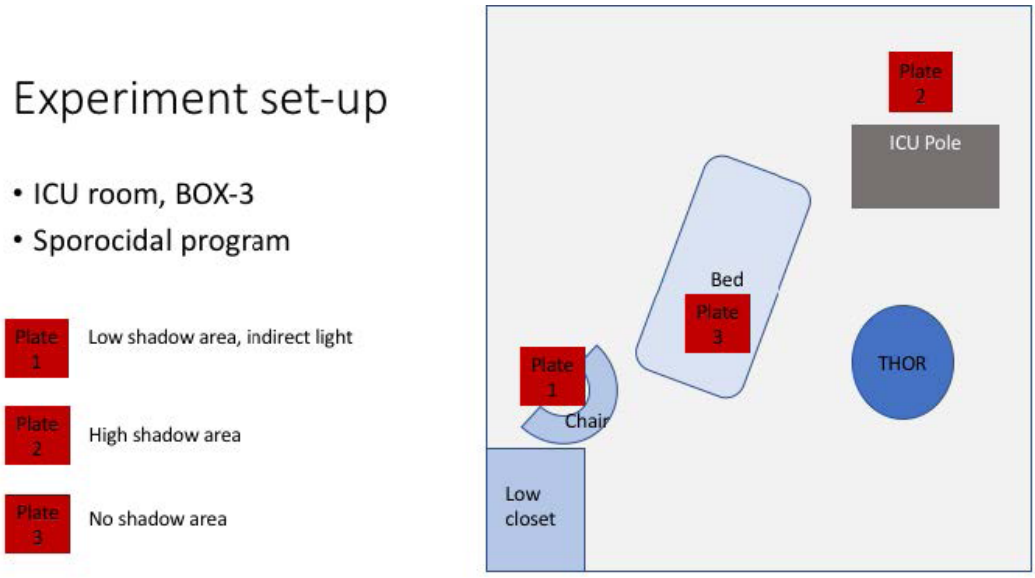
At the Burn Wound centre in Beverwijk, hydrogen peroxide vapour (HPV) is used for terminal room disinfection. However, HPV disinfection is labour intensive, time-consuming and can only be performed by specifically trained personnel. This pilot study intended to evaluate the feasibility to apply THOR for regular room decontamination to achieve continuous microbial reduction.

Methods

ICU rooms at the burn wound centre were used to determine optimal robot placement, cycle time for UVC disinfection. Floorplans of targeted areas, THOR's Intelligent placement system and room mapping technology were used to determine optimal placements, number of cycles and operating times of the UVC robot.
Blood-agar plates inoculated with 0.5 McFarland bacteria strains were placed in different position before each UVC cycle to monitor the microbiological efficacy for each protocol (Figure 1).

The overall operational impact of UVC disinfection was evaluated and included estimated cost of ownership, time of engagement (including time for preparation before and after use), safety and environment friendliness, operator requirements (e.g. skills and training requirements).

Figure 1: relative position of THOR to ICU room furniture and blood agar plates

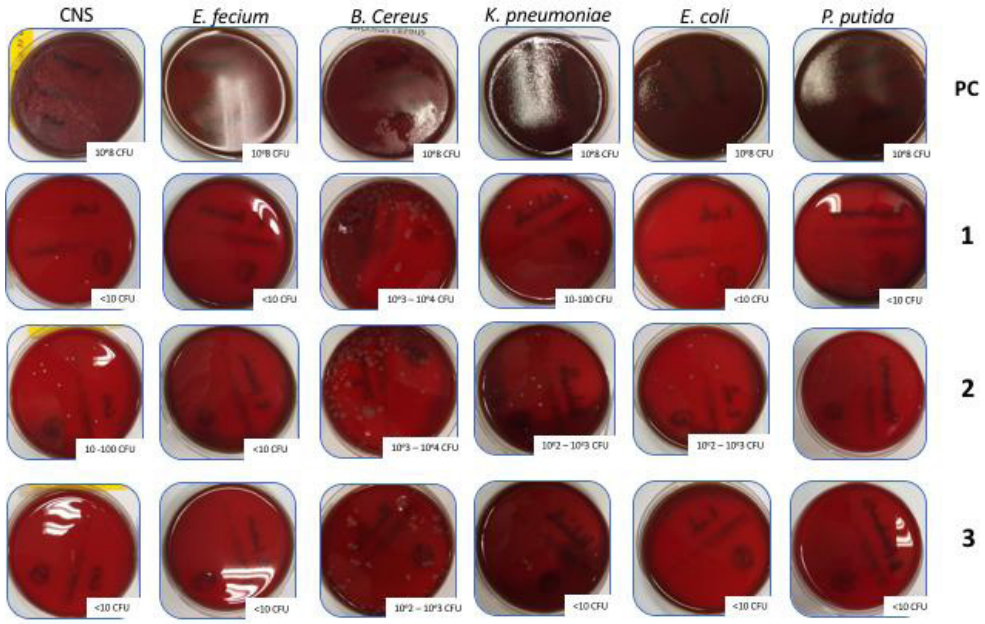


Results

The overall operational impact of UVC disinfection was favourable for the requirement of regular room decontamination. Flexible deployment at any time of the day and by almost any employee (ward nurse, infection-control nurse, facilities and cleaning service employee) provides the flexibility required for regular disinfection at reasonable costs.

Microbiological efficacy testing showed significant bacterial load reduction with the sporicidal and germicidal program for: coagulase negative staphylococci, E. faecium, B. cereus, K. pneumoniae, E. coli, P. putida. Bacterial load reduction in direct line of light was highly significant, even for the hardy spore forming bacteria B. cereus. In shadowed area, bacterial load reduction was less for most bacteria, yet still substantial (Figure 2).

Figure 2: Blood-agar plates were inoculated with 0.5 McFarland suspension of various bacterial strains and placed in 3 different position (1-3, as depicted in figure 1), with the lid removed. After completion of the UVC disinfection cycle, agar plates were incubated for 24 hrs at 35°C. 1 set of agar plates were not subjected to UVC radiation (PC).



Conclusions

Data from this pilot study suggest flexible operational characteristics and significant microbial load reduction with various disinfection protocols (including robot placement, cycle times and number of cycles per room). We estimate that these properties are beneficial for regular room disinfection protocols aiming to achieve continuous microbial reduction.

Further Studies

Follow-up studies will be aimed at designing standard procedures and protocol for regular disinfection of patient rooms. Further studies will also be performed to evaluate the effect of continuous microbial reduction using UVC on burn wound colonization and infections.

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