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A NOVEL DISINFECTION STRATEGY TO PREVENT SURGICAL SITE INFECTION

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BACKGROUND

- Surgical site infections (SSI) encompass a significant socio-economic burden
- Contaminated surfaces play a critical role in the etiology of SSI's[1,2]
- Recent attention to the quality of environmental cleaning has demonstrated that manual cleaning efforts are often insufficient; indicating persistent contamination of hospital surfaces after manual cleaning[3]
- Not only are bacteria acquiring resistance to antibiotics, they are also developing chemical resistance to detergents and disinfectants[4]

RATIONALE

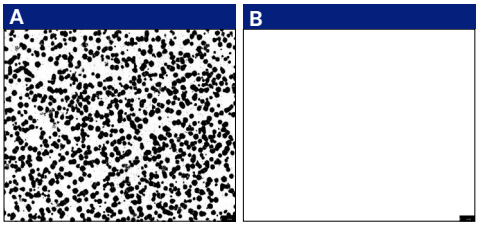
- There is an unmet medical need to decrease the environmental bioburden in operating theatres
- Thus, reducing the transmission of pathogenic organisms that may result in SSI
- The aim of this study was to assess the efficacy of a mobile UVC-disinfection robot to reduce the environmental bioburden in operating theatres

METHODS

Pre-cleaned operating theatre surfaces were swabbed prior to the surgical day.

- Microbiological samples were inoculated on TSA plates and incubated aerobically at 37°C. After 48h the numbers of colony forming units (CFU) were enumerated
- The BSMA was used to rapidly quantify the light-producing reaction between luciferase and bacterial-ATP, recorded in relative light units (RLU)

THOR-UVC was then used to irradiate the operating theatre for ~[4]5 min. Measurements were repeated on each surface post-UVC and compared to baseline.



Figure[1]. Light microscopy images of Staphylococcus aureus inoculated TSA plates following 24 h incubation.
A) control, B) THOR-UVC treatment.

RESULTS

Table 1. Reduction in bioburden on commonly contaminated operating theatre surfaces after UVC-disinfection
A) Large animal operating facility, B) Small animal veterinary clinic, C) Specialist equine centre.

		RLU			CFU		
	Surface	Pre-UVC	Post-UVC	Reduction (%)	Pre-UVC	Post-UVC	Reduction (%)
A	Anaesthesia Station	102	15	85	33	6	82
	Door Handle	4	0	100	3	0	100
	Overhead Light	433	39	91	58	10	83
	Floor	2082	111	95	28	3	89
B	Anaesthesia Station	724	15	98	1	0	100
	Foot Stool	281	8	97	6	0	100
	Overhead Light	13	0	100	1	0	100
	Floor	955	93	90	1	0	100
C	Anaesthesia Station	30	1	97	3	0	100
	Bench	474	13	97	1	0	100
	Speaker	405	30	93	1	0	100
	Floor	71	5	93	1	0	100

THOR-UVC

- UVC is a high-energy, small-wavelength photon that is absorbed by DNA and RNA
- This photochemical reaction results in molecular lesions and the formation of covalent bonds between adjacent pyrimidine bases
- These pyrimidine dimers disrupt nucleic acid transcription and translation, leading to arrested replication

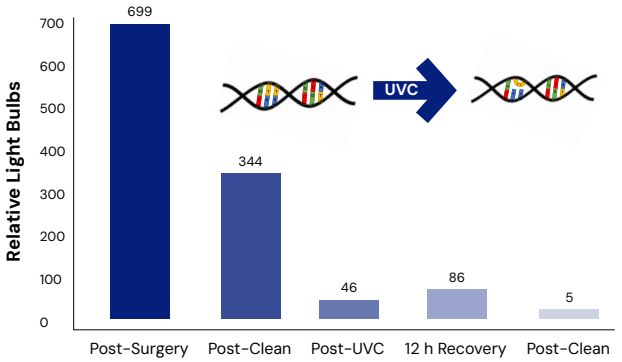


Figure 2. Relative lights units of an anaesthesia bench at various stages of disinfection

POINTS OF INTERESTS

Both the BSMA and microbiological culture samples demonstrated a persistent microbial population after manual cleaning (Table [1]).

After UVC-disinfection, both testing methods displayed a reduction in this microbial population (Table [1]).

The BSMA addressed many of the drawbacks of conventional agar culture including:
- Sensitivity
- Result turnaround time

Across the [3] sites, compared to manual cleaning, the average reduction after
- 1 THOR cycle = 95% (Table [1])
- 2 THOR cycles = 99% (Figure [2])

UVC has been used as a germicide for 100+ years with no documented resistance.

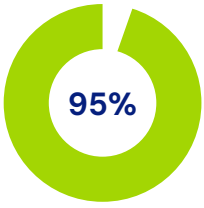
Pathogen concentration does not impact the killing efficacy of UVC (Figure [1]).

Previous studies have demonstrated that decreased environmental bioburden directly correlates with a reduction in hospital acquired infections[5]

CONCLUSIONS

- THOR-UVC disinfection technology successfully reduced the environmental bioburden orthopaedic operating theatres.

- As contaminated surfaces facilitate the transmission of pathogens, it is essential to consider UVC as an adjunct cleaning strategy for the prevention of SSI's



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