

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 cleaning³
- Not only are bacteria acquiring resistance to antibiotics, they are also developing chemical resistance to detergents and disinfectants⁴

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 48 h 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 ~45 min.

Measurements were repeated on each surface post-UVC and compared to baseline.

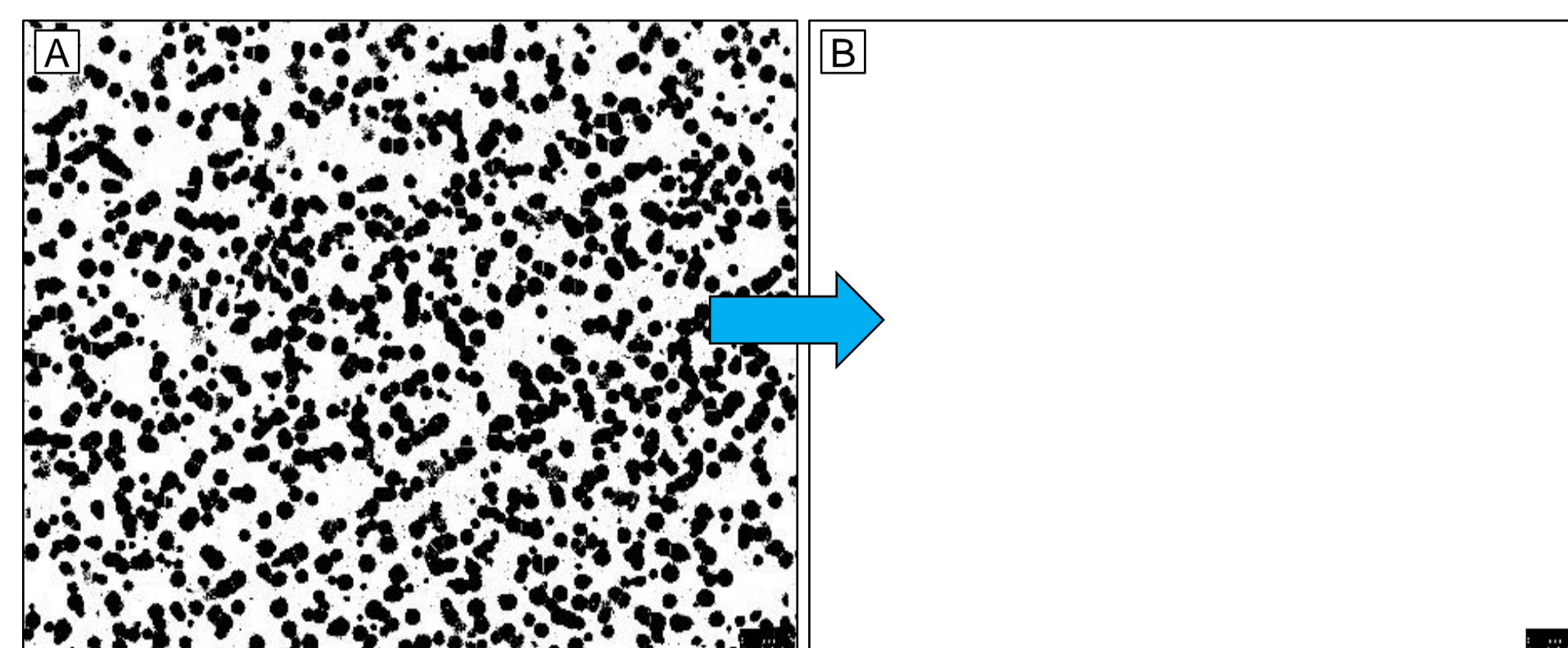
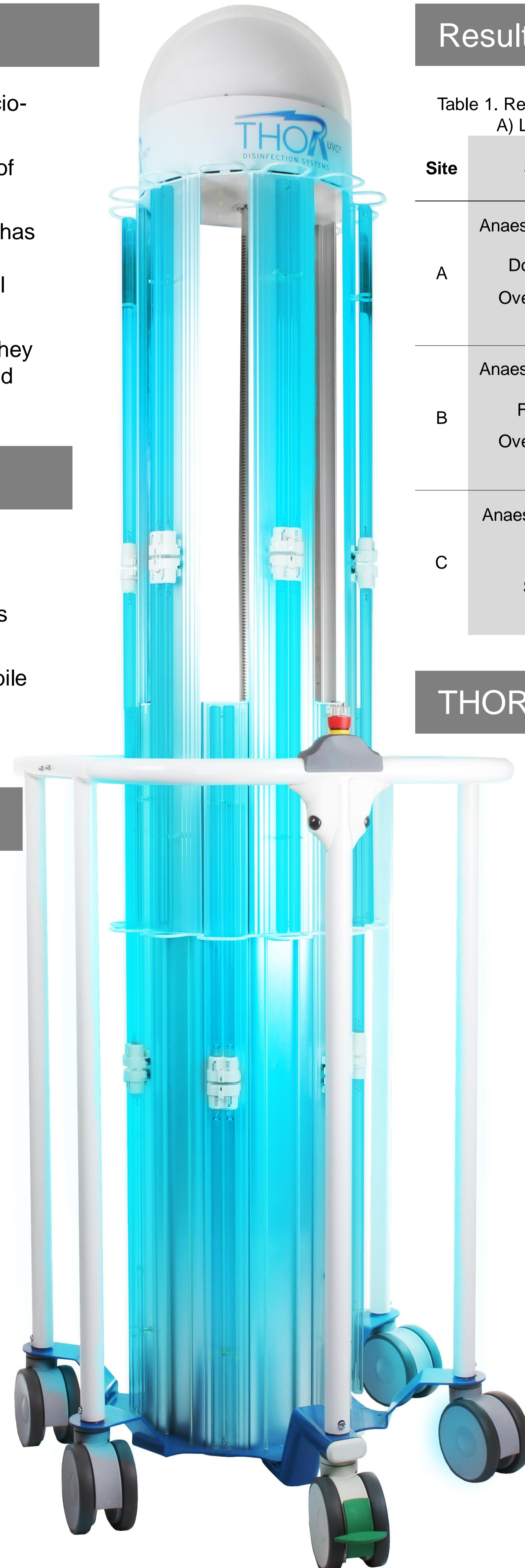


Figure 1. Light microscopy images of *Staphylococcus aureus* inoculated TSA plates following 24 h incubation. A) control, B) THOR-UVC treatment



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

Site	Surface	RLU			CFU		
		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
C	Floor	955	93	90	1	0	100
	Anaesthetic 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

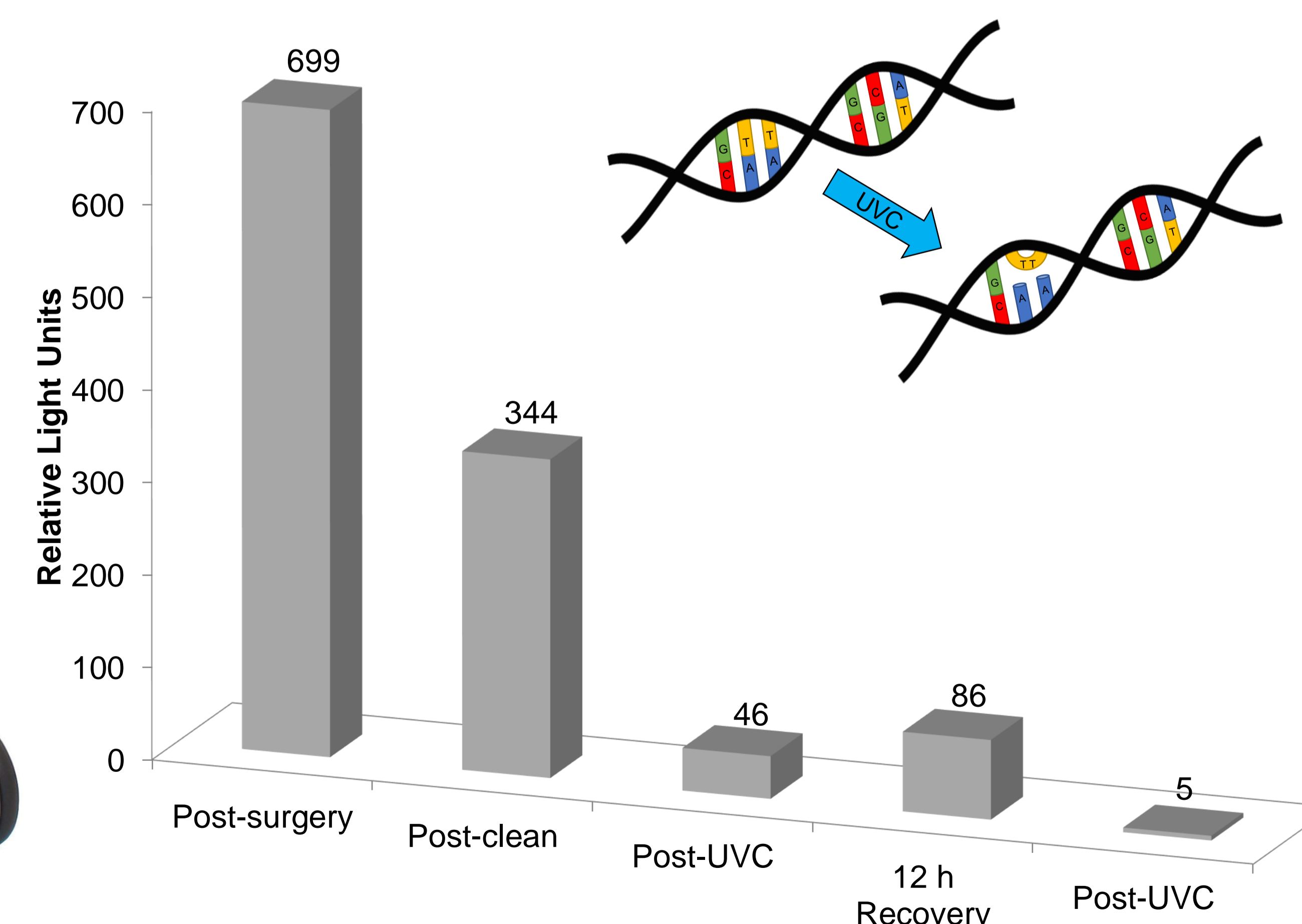


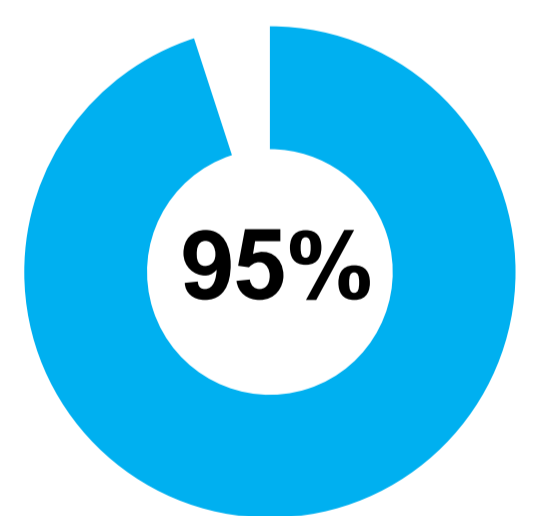
Figure 2. Relative lights units of an anaesthesia bench at various stages of disinfection

Points of Interest

- 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 infections⁵

Conclusion

- 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



References

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