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Brief Report

Assessing the Feasibility of a Focused Multivector Ultraviolet System Between Surgery Cases with a Parallel Protocol for Enhanced Disinfection Capabilities

Donna Armellino RN, DNP^{a,*}, Thomas J. Walsh MD, PhD^b, Vidmantas Petraitis MD^b,
Wladyslaw Kowalski PhD^c

^a Infection Prevention, Northwell Health, Lake Success, NY

^b Infectious Diseases Translational Research Laboratory, Weill Cornell Medicine, Cornell University, New York, NY

^c Clinical and Research Programs, PurpleSun, New York, NY



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A focused multivector ultraviolet (FMUV) light system was used in a parallel process with manual chemical disinfection during operating room (OR) turnovers to assess the impact on cleaning time. The average time to disinfect an OR using only chemical wipes and mops was 19.0 minutes (n = 68); for the FMUV process, the average time was 18.8 minutes (n = 61). The mean cleaning times were equivalent within a 7% margin ($P < .17$), and total turnover time was not significantly affected.

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The focused multivector ultraviolet (FMUV) system (PurpleSun; New York, NY) disinfects equipment while allowing environmental services (EVS) staff to occupy the room during operation. This novel portable system encloses a target zone into which medical equipment can be placed and disinfected with a 90-second cycle of high-intensity ultraviolet light. It is ideally suited to disinfect equipment that is visibly clean; equipment that has visible soiling can be separately cleaned with liquid chemicals. The effectiveness of this system at reducing surface contamination has been previously demonstrated, but a critical question remained as to whether it could be deployed without impacting the between-case cleaning and total turnover time.¹

METHODS

This study is a field trial comparing the FMUV disinfection system with parallel manual cleaning to retrospective data for manual chemical cleaning and disinfection performed alone at an 827-bed New York metropolitan area teaching hospital with 25 operating rooms (ORs). An FMUV system was placed in each of 2 separate ORs, designated as OR A and OR B. Cleaning time, the focus of this study, is a portion of the total turnover time. Independent remote video auditing (RVA)² recorded the between-case cleaning time from “cleaners

in” to “cleaners out” with and without FMUV, and the turnover time was recorded from patient “wheels out” to when another patient entered (“wheels in”). Cleaning times were also recorded with a stopwatch to validate the data.

The FMUV system was stationed within the OR, and high-touch objects that were visibly clean were rolled in and disinfected inside the enclosed target zone of the FMUV system by EVS staff. High-touch objects disinfected by FMUV in this study included stainless steel equipment such as intravenous poles, mayo stands, ring stands, and back tables. Two FMUV systems were utilized, and EVS staff were trained in their operation and protocol for implementation. Each device was assigned to 1 of the 2 designated ORs, which were chosen because of their high volume of orthopedic procedures.

A parallel process procedure for the FMUV system using between-case cleaning and disinfection was provided to EVS staff and involved the following steps, in addition to the facility’s standard protocol:³

1. The target area for FMUV deployment was mopped.
2. The FMUV system was deployed in a rectangular configuration.
3. Stainless steel equipment was disinfected by FMUV.
4. A 90-second cycle was utilized.
5. During FMUV operation, EVS staff manually cleaned and disinfected other equipment.
6. Upon completion, objects were returned to normal positions.
7. The FMUV system was wiped down with disinfectant wipes and folded into a compact configuration.

* Address correspondence to Donna Armellino, Infection Prevention, Northwell Health, 1985 Marcus Ave, Suite LL106, Lake Success, NY 11042.

E-mail address: darmelli@northwell.edu (D. Armellino).

Conflicts of interest: None to report.

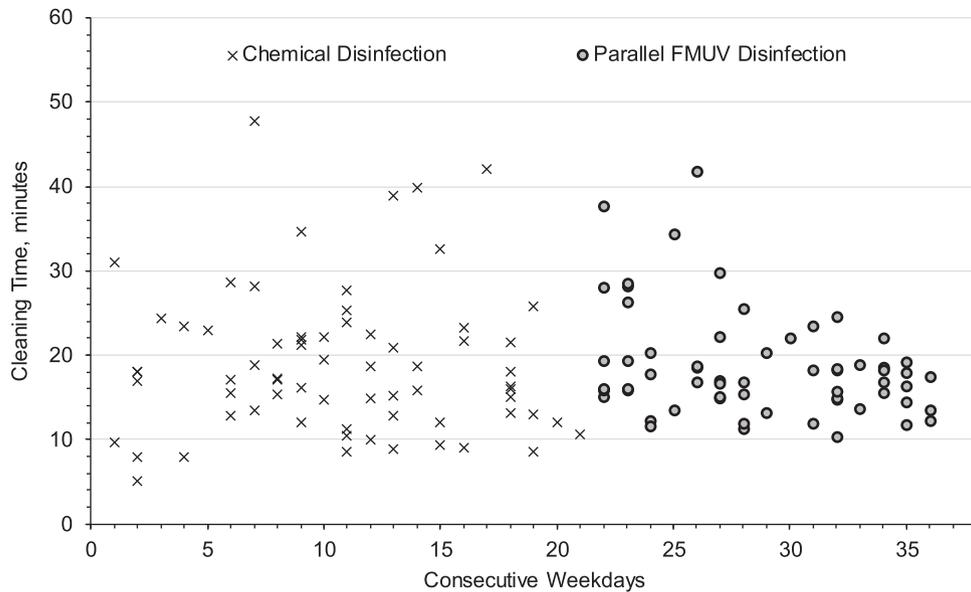


Fig 1. Scatterplot of cleaning time durations for 36 consecutive weekdays measured by remote video auditing data showing chemical disinfection (n = 68) on weekdays 1-21 and parallel focused multivector ultraviolet (FMUV)/chemical disinfection (n = 61) on weekdays 22-36. No outliers were excluded.

The third-party auditing service used a checklist consistent with Association of periOperative Registered Nurses (AORN) recommendations that listed the tasks that EVS was to perform during the cleaning. The data collected for cleaning times, turnover times, and compliance were evaluated for equivalence with the Wilcoxon signed-rank sum test using the two one-sided tests approach. Data from the FMUV trial were assessed for a trend to decreasing cleaning times using the Aspin-Welch *t*-test.

RESULTS

Over the course of 3 weeks, data were collected from 61 turnovers employing FMUV and compared to data for the previous 68 turnovers in the same ORs during the previous month. The average cleaning time for chemical disinfection alone (n=68) was 19.0 minutes as recorded by RVA prior to implementation of the FMUV system. The average between-case time for the parallel process of chemical disinfection + FMUV disinfection was 18.8 minutes as recorded by RVA and 17.5 minutes as recorded by stopwatch. **Figure 1** shows a scatterplot of the timing data for both FMUV parallel process disinfection and standard chemical disinfection cleaning times. Both data sets show data for weekdays and exclude the last case of the day (ie, only “between” surgery cases were considered). A box and whisker plot of the 2 datasets (**Fig 2**) shows no significant difference between the mean cleaning times.

The mean cleaning time proved to be a fraction of the total turnover time (22%-23%). Evaluation of the total turnover times showed a mean time of 82.3 minutes for chemical disinfection and a mean time of 85.9 minutes for the FMUV parallel process, and these means were equivalent within a 7% margin (*P* < .11).

The RVA results indicated a compliance rate of 88.7% ± 1.0% (standard error of the mean [SEM]) for all items disinfected during the FMUV study period and a compliance rate of 90.3% ± 1.1% (SEM) for the same items during the prior retrospective period, and these results were statistically equivalent (*P* < .0001).

DISCUSSION

There was no significant difference in cleaning times between the current process of chemical disinfection and the parallel protocol

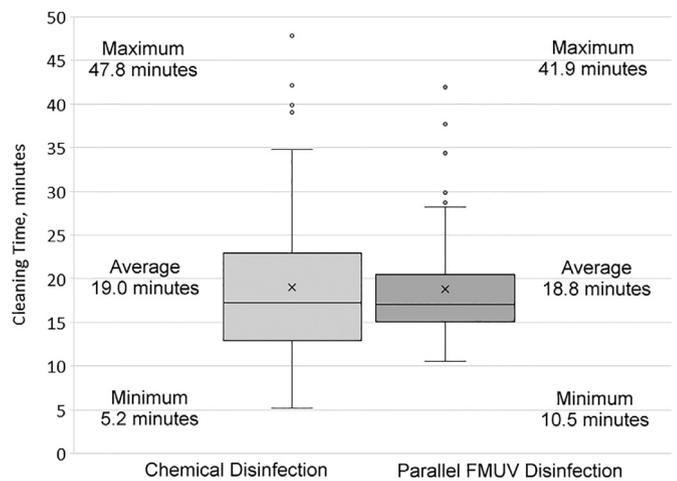


Fig 2. Box and whisker plot comparing chemical disinfection time (n = 68) with the parallel focused multivector ultraviolet (FMUV)/chemical disinfection time (n = 61). The mean cleaning times were equivalent within a 7% margin (*P* < .17).

employing FMUV with chemical disinfection. The mean cleaning times were equivalent within a 7% margin (*P* < .17) using the Wilcoxon signed-rank sum test. It can reasonably be concluded that use of the FMUV system in a parallel process with chemical disinfection did not increase cleaning times and will not increase total turnover time. Stopwatch data collected separately suggest that the historical data from RVA were conservative.

During the FMUV trial (see days 22-36 in **Fig 1**) a statistical trend toward decreased cleaning times was observed between the first 7 days of FMUV use and the last 8 days (*P* < .07), suggesting that EVS staff became more proficient as they gained experience at operating the system and implementing the parallel process protocol.

There was no reduction in quality of cleaning during the study period. The compliance rates in this study were higher than typical compliance rates reported for multiple health care settings elsewhere.^{4,5}

Disinfection with FMUV has been demonstrated to improve the quality of OR disinfection and may potentially result in reduced

surgical site infections;¹ however, further research is needed on the impact of FMUV disinfection on surgical site infection rates.

In conclusion, it has been demonstrated that use of the FMUV disinfection system in parallel with the normal manual cleaning procedures did not adversely affect the cleaning time and therefore can be used in ORs without affecting total turnover time.

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