Standardised test of the disinfection efficiency of room disinfection with ozone under complex room conditions

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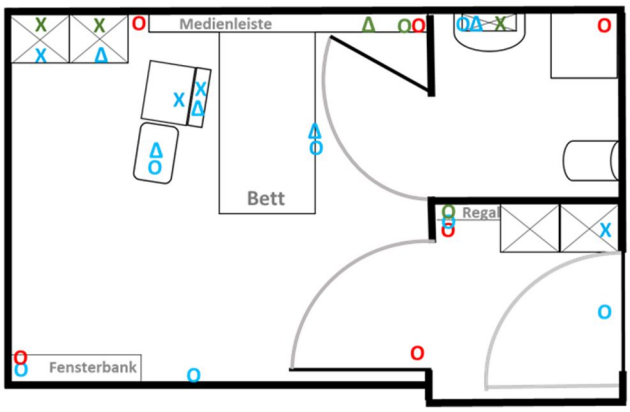
Conflicts of interests: For the examinations, the STERISAFE™-Pro robot was made available free of charge by Infuser Deutschland GmbH, Mannheim, Germany.

Background: For testing the disinfection efficiency of devices used for whole room disinfection, the French NF T 72-281 standard is applied. This standard relates to the test of disinfection efficiency in an unfurnished room. In the course of the study, the function of a room disinfection device in the complex situation of a furnished patient room with integrated bathroom and vestibule was examined in order to test the disinfection efficiency also in difficult-to-reach places.

Methods: The room used for the test included a fully furnished patient room (31.89m³) with integrated bathroom (6.63m³) and a vestibule (7.11m³) which can be used as an air lock. The test surfaces (5x5 cm tiles, (#3709PN00, made by Villeroy & Boch, Mettlach, Germany) were prepared as highly contaminated surfaces by the application of 20 µl of a suspension (McFarland=1.0) containing *E. faecium* ATCC 6057. Via a touch transfer process (Knobloch, et al, PLOSone, 2017) with the test pathogen, secondarily contaminated surfaces with low contamination and organic pollution were generated. In 22 defined positions of various height levels, horizontally or vertically highly contaminated test surfaces were placed (surfaces close to the patient [n=4], surfaces at a distance from the patient [n=10], bathroom [n=3], vestibule [n=5]). Five of the surfaces with a low contamination level were placed in the area close to the patient (n=4) and in the bathroom. In five separate cycles with identical position of the test surfaces, the room was disinfected using the ozone-generating STERISAFE™-Pro robot (Infuser Deutschland GmbH, Mannheim, Germany) with an exposure time of 60 minutes each and an ozone concentration of 80 ppm. Quantitative cultures with replicate samples were performed (threshold value: 5 CFU/25 cm²) with all treated surfaces and untreated control surfaces.

Results: The average contamination of the highly contaminated surfaces was found to be 6.4×10^5 CFU/25 cm². The surfaces contaminated by a touch transfer process exhibited an average test organism contamination of 2.9×10^3 CFU/25 cm². The disinfection process with a dwell time of one hour and an ozone concentration of 80 ppm took a total time of about 150 minutes with the STERISAFE™-Pro robot. 108 out of 110 highly contaminated test surfaces placed showed no growth of the test organism while 5 CFU/25 cm² were found on each of the two remaining test surfaces. All test surfaces examined after the touch transfer (n=25) showed no growth of the test organism. Consequently, a reduction of the test organism by at least 5.1 log could be achieved irrespective of the position of the test surface (including open cabinets, drawers and adjacent rooms).

Conclusion: The room disinfection with an ozone concentration of 80 ppm and a dwell time of one hour achieves a significant reduction of the test organism *E. faecium* ATCC 6057 even in difficult-to-reach places. Further examinations with clinical isolates should be done in complex room conditions in order to prove the efficiency of the disinfection under realistic conditions. As regards further developments, shorter total cycle times are desirable in order to facilitate the integration of room disinfection in routine processes.



X inside furniture

O openly accessible

Δ secondary contaminated surfaces

Floor level

Medium level

High level

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