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Hygiene Expert Opinion to the Medigenic™ Infection Control Keyboard-Mouse Combination of Esterline Advanced Input Systems, Coeur d´Alene, Idaho, USA

We were asked to clarify, whether the Medigenic keyboard-mouse system for medical environments fits the hygienic requirements to be used in hygienic critical areas, as in intensive-care units or in operating rooms or in laboratories. A safe disinfection of all surface areas must be carried out in these facilities due to the distinct infectious risks of patients. Any feasible risk of a patient outgoing from the device has to be excluded. The potentiality of a reliable disinfection of the Medigenic system should be checked on the basis of the guideline for "the test and assessment of chemical disinfection methods" of the German Society for Hygiene and Microbiology (DGHM). The examinations were carried out with regard to the test organisms in analogy and in accordance with the specifications of the German society for hygiene and microbiology (*Deutsche Gesellschaft fuer Hygiene und Mikrobiologie,* DGHM) and the German society for applied hygiene (*Vereinigung fuer angewandte Hygiene*, VAH) for disinfection methods in a microbiological burden test under practical conditions.

1 Test Object

For the examinations Medigenic infection control keyboards and optical mice made of pliant silicone-based material providing a smooth latex-free surface were provided for the disinfection tests. Typical healthcare keyboards have many users, so the spread of hospital-acquired infections (HAIs) through cross-contamination from and to patients by healthcare workers can result in fatal consequences particularly if transient bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) exist. The Medigenic input System offers infection-control medical keyboards that feature a flat design that can be quickly cleaned in place with hospital-grade disinfectants to combat cross-contamination. Two types are available, The *Essential* medical keyboard as an alternative to conventional keyboards and covers and the *Compliance* medical keyboard which adds an alert system by a LED that reminds users to clean the keyboard at regular intervals.

2 Detailed Study

The object was contaminated with the test microorganisms on appropriate and crucial to be disinfected areas. To this, 1 ml of the respective solution of microorganisms was brought up to the selected localizations. Each test organism was placed on ten different positions on the upper side and the bottom of the keyboard. In case of *Aspergillus niger* 5 different positions were selected. So, 75 contamination points were set. The tests were conducted fivefold. After drying of the solution, disinfection was carried out with Terralin liquid®, an alcohol-based disinfectant for rapid disinfection. In a second, following examination the tests were done with Terralin protect®, a disinfectant for surfaces using a concentration of 0.5% and an application time of 1 hour. Both products are listed by the VAH for floor disinfection. A quantitative and qualitative microbiological examination was carried out subsequently.
A similar examination was done in an identical way with the mouse but only two contamination points were used with each test organism.

3 Test Organisms

Staphylococcus aureus, Enterococcus faecium and *Enterococcus hirae* were used as representatives for Gram-positive pathogens. *Staphylococcus aureus* is a typical pathogen in wound infections, *Enterococcus faecium* is taken as an indicator for faecal pollutions, Enterococcus hirae is a difficult to disinfect. *Escherichia coli, Pseudomonas aeruginosa* and *Proteus mirabilis* were checked as representatives of hospital relevant Gram-negative microorganisms. The yeast *Candida albicans* was included in the examination to check the diminution of yeasts and *Aspergillus niger* is a representative of pathogenic molds. The assortment of microorganisms was defined by the DGHM for tests of the germicidal and fungicidal effect of disinfectants.

Staphylococcus aureus	ATCC 6538
Enterococcus faecium	ATCC 6057
Enterococcus hirae	ATCC 10541
Escherichia coli K12	NCTC 10538
Pseudomonas aeruginosa	ATCC 15442
Proteus mirabilis	ATCC 14153
Candida albicans	ATCC 10231
Aspergillus niger	ATCC 16404

4 Concentrations of Microorganisms

Staphylococcus aureus	ATCC 6538	1.0×10^6 cfu/ml
Enterococcus faecium	ATCC 6057	0.8×10^6 cfu/ml
Enterococcus hirae	ATCC 10541	0.4×10^6 cfu/ml
Escherichia coli	NCTC 10538	1.0×10^6 cfu/ml
Pseudomonas aeruginosa	ATCC 15442	1.0×10^6 cfu/ml

Proteus mirabilis	ATCC 14153	1.0 x 10^6 cfu/ml
Candida albicans	ATCC 10231	2.0 x 10^6 cfu/ml
Aspergillus niger	ATCC 16404	4.0 x 10^6 cfu/ml

5 Keyboard Results

With each bacterial microorganism ten different areas and with Aspergillus niger five areas were contaminated so that overall 75 contamination points covering all possible areas of the object arose. Every test was repeated five times.

Staphylococcus aureus ATCC 6538, concentration 1.0 x 10^6 cfu/ml

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
1	6.0	6.0
2	6.0	6.0
3	6.0	6.0
4	6.0	6.0
5	6.0	6.0
6	6.0	6.0
7	6.0	6.0
8	6.0	6.0
9	6.0	6.0
10	6.0	6.0
Total reduction	**5.91**	**6.00**

Enterococcus faecium ATCC 6057, concentration 0.8 x 10^6 cfu/ml

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
1	6.0	6.0
2	6.0	6.0
3	6.0	6.0
4	6.0	6.0
5	6.0	6.0
6	6.0	6.0
7	6.0	6.0
8	6.0	6.0
9	6.0	6.0
10	6.0	6.0
Total reduction	**6.00**	**6.00**

Enterococcus hirae **ATCC 10541, concentration 0.4 x 10^6 cfu/ml**

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
1	6.0	6.0
2	6.0	6.0
3	6.0	6.0
4	6.0	6.0
5	6.0	6.0
6	6.0	6.0
7	6.0	6.0
8	6.0	6.0
9	6.0	6.0
10	6.0	6.0
Total reduction	**6.00**	**6.00**

Escherichia coli **NCTC 10538, concentration 1.0 x 10^6 cfu/ml**

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
1	6.0	6.0
2	6.0	6.0
3	6.0	6.0
4	6.0	6.0
5	6.0	6.0
6	6.0	6.0
7	6.0	6.0
8	6.0	6.0
9	6.0	6.0
10	6.0	6.0
Total reduction	**6.00**	**6.00**

***Pseudomonas aeruginosa* ATCC 15442, concentration 1.0 x 10^6 cfu/ml**

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
1	6.0	6.0
2	6.0	6.0
3	6.0	6.0
4	6.0	6.0
5	6.0	6.0
6	6.0	6.0
7	6.0	6.0
8	6.0	6.0
9	6.0	6.0
10	6.0	6.0
Total reduction	**6.00**	**6.00**

***Proteus mirabilis* ATCC 14153, concentration 1.0 x 10^6 cfu/ml**

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
1	6.0	6.0
2	6.0	6.0
3	6.0	6.0
4	6.0	6.0
5	6.0	6.0
6	6.0	6.0
7	6.0	6.0
8	6.0	6.0
9	6.0	6.0
10	6.0	6.0
Total reduction	**6.00**	**6.00**

***Candida albicans* ATCC 10231, concentration 2.0 x 10^6 cfu/ml**

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
1	5.70	5,.0
2	3.53	6.0
3	3.61	6.0
4	3.70	6.0
5	3.53	6.0
6	6.0	4.10
7	6.0	6.0
8	6.0	6.0
9	6.0	6.0
10	6.0	6.0
Total reduction	**5.00**	**5.61**

***Aspergillus niger* ATCC 16404, concentration 4.0 x 10^6 cfu/ml**

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
1	6.0	6.0
2	6.0	6.0
3	6.0	5.6
4	6.0	6.0
5	6.0	6.0
Total reduction	**6.00**	**5.92**

6 Mouse results

With each microorganism two different areas were contaminated so that overall 16 contamination points covering all possible areas of the object arose. Every test was repeated five times.

	Terralin liquid 1min (Reduction rate Log_{10})	Terralin protect 0.5%/1h (Reduction rate Log_{10})
S. aureus	6.00	6.00
E. faecium	6.00	6.00
E. hirae	6.00	6.00
E. coli	6.00	6.00
P. mirabilis	6.00	6.00
P. aeruginosa	6.00	6.00
C. albicans	6.00	6.00
A. niger	6.00	4.90

7 Advisory Opinion

The hygienic examination of the Medigenic Infection Control keyboard-mouse system for use in medically sensitive areas yielded a high reduction of the test organisms by disinfection with products of the German VAH disinfectant list. Mostly a reduction rate of 6.0 (log_{10}) was determined which is in accordance with the recommendations and demands of the German societies for hygiene (VAH and DGHM). The results additionally showed that disinfection of the bottom of the keyboard and mouse should be done extra careful because the bottoms proved to be the most difficult to disinfect parts. The results also showed that thorough and rigorous spray disinfection with subsequent dispensation by wipe is effective and safe.

On the basis of the test results the Medigenic Infection Control keyboard-mouse system can be used without risk in hygienic sensible areas of hospitals if disinfection is carried out correctly with preparations and application times in accordance with the VAH list.

The hygiene standard of the ViewMedic Vario system is classified as very high. The use of the system in hygienic sensitive areas as in operation rooms, intensive-care units and also in laboratories is recommended.

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