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Research Article

The Importance of the Washing Evaluation of Flusher Disinfector in the Medical Site: Visual Evaluation with the ISO Standardized Test Soil and Adenosine Triphosphate Level

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ABSTRACT

Background: The Flasher Disinfector (FD) is designed to help reusable urinals and bedpans to be emptied, cleaned, and disinfected. Since FD may be used for bedpans exposed to heat-resistant bacteria such as *Clostridioides difficile* and *Enterococci*, ensuring washing of the human waste container is an important factor in preventing Hospital Associated Infections.

Objective: To examine washing evaluation method of FD installed in the medical site by visual evaluation with ISO test soil and Adenosine Triphosphate (ATP) measurement.

Methods: The test soil shown in ISO15883-5 was applied to the bedpan by two methods and then visually evaluated on a four-step scale. The ATP value on the surface of the bedpan corresponding to each scale was measured, and the correlation with the visual scale was confirmed. In addition, a visual evaluation was performed using a different FD and bedpan.

Results: In the visual evaluation, when the test soil was applied to the entire surface of the bedpan, it remained in the parts where the water flow was hard to hit. When the test soil was applied to the surface of the bedpan except the lid, there was no remaining. The 4-step visual evaluation scale and the logarithm of ATP value showed a positive correlation (correlation coefficient=0.86). Visual evaluation with different FD and bedpan combinations, the residual parts of the test soil tended to be different.

Conclusion: It was suggested that poor cleaning of FD may occur when the amount of water was insufficient, or the bedpan is significantly contaminated. It was considered important to carry out FD washing evaluation at medical sites in order to evaluate the function of FD, select an appropriate program, and utilize it for staff education for appropriate management. Since FDs and bedpans are diverse, it is recommended to carry out FD cleaning evaluation at each facility.

Keywords: Flasher disinfector; Bedpan washer; Washing evaluation; Adenosine Triphosphate (ATP)

INTRODUCTION

The Flasher Disinfector (FD) is designed to help reusable urinals and bedpans to be emptied, cleaned, and disinfected [1]. The advantages of FD include "no manual cleaning is required, no disposable equipment is required, and fewer chemical disinfectants are used" [1]. FD may be used for bedpans exposed to heat-resistant bacteria such as *Clostridioides difficile* and *Enterococci*. However, there are reports that bacterial spores cannot be inactivated by disinfection with FD [2], and that *Enterococci*, which have strong heat resistance, are difficult to be inactivated due to the presence of organic matter [3]. However, there are reports that FD is effective in decontaminating and disinfecting *Enterococci* [4], and that *C. difficile* spores can be removed by combining FD and an alkaline cleaning agent [5,6]. Therefore, to reduce the risk of infection by the human waste container, it is important to ensure that organic matter is removed from those. The washing and disinfecting function of FD is standardized by the European International Organization for Standardization (ISO) [7,8]. On the other hand, there is no clear standard for the evaluation of washing of human waste containers. This time we visually evaluated the washing effect of FD using the test soil and examined the quantification by measuring the relative emission amount (Relative Light Unit,

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hereinafter RLU) of Adenosine Triphosphate (ATP). Along with the results, we report on the importance of washing evaluation of human waste containers in medical sites.

MATERIALS AND METHODS

Visual evaluation with test soil

Material: Among the test soils shown in ISO15883-5-3, Annex C[8], which has a relatively high load due to its high viscosity and does not contain infectious substances, was selected. The FD selected was Ninjo-1600® (Arjo Japan co.ltd.), which has the least number of operations among the FDs installed in Hospital A (4 years after installation, average number of operations 3 times a day) and has been maintained every year. The cleaning agent (pH:12.9) and rinsing agent are those specified by the manufacturer. As the object , a newly purchased bedpan (SPN / 8-5405-01®) made of polypropylene were used. The test soil was applied to the bedpans in two ways and the results were compared.

Method 1: All steps were performed according to ISO15883-5 Annex C [8].The test soil was applied 200g to the inner of bedpan. Then it was applied with a thickness of about 2 mm to the outer side where the patient's skin contacts, and with a thickness of about 1 mm to other parts of outside including the handle. The bedpan was left to be dried at room temperature of 15 to 25°C. for 10 minutes. After that, it was washed with two kinds of program P2 and P5 (Table 1). set for bedpan washing (n=10). The bedpan was divided into 9 areas (Figure 1).And the inside of the FD was divided into 6 areas (Figure 2).And the degree of residual test soil after washing was evaluated using a 4-step washing evaluation scale (Table 2).

Table 1: Cleaning programs of FD.

	P2	P3	P4	P5
Disinfection	91℃ 1 min			
Detergent	Approximately 12 mL			
Water consumption(L)	19 ± 1	26 ± 1	30.5 ± 2	43 ± 2
Duration	8 min.41 sec.	9 min.6 sec.	9 min.30 sec.	10 min.40 sec.

There are five stages of cleaning programs installed in the FD, P1 is for urine bottles, and P2 to P5 are programs for bedpans.

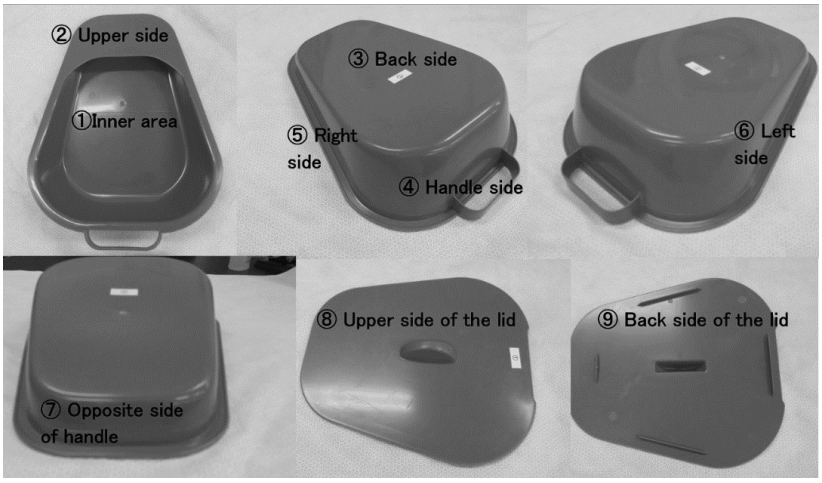


Figure 1: Division of evaluation area (Bedpan).

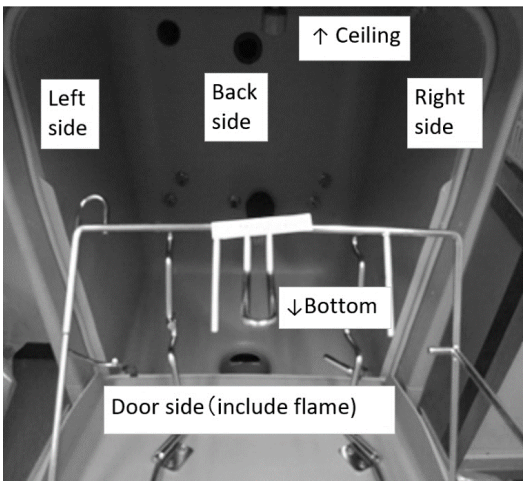
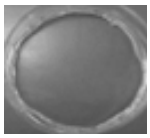
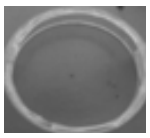
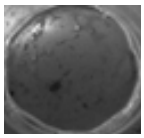
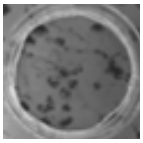


Figure 2: Division of evaluation area (FD).

Table 2: Visal evaluation scale.

Scale	0	1	2	3
Degree of the residual	Nothing	Slight coloration or residualspot<10	Risidualspot ≧ 20 or lumps more than thickness 1mm<10	Lumps more than thickness 1mm ≧ 10
Example				

Method 2: The test soil was applied to the inside of the bedpan and the surface except on the lid.200 g of test soil was applied to the inside of the bedpan. Then, it was applied to the surface excluding the lid with a thickness of about 1 mm. After drying in the same procedure as method 1, washing with the most powerful program P5, visual evaluation was performed (n=10).

Evaluation with ATP value

Materials and method: The ATP measuring instrument used was Lumitester PD-30® (JAN:4549160985100), and the measuring kit used was Lucipack Pen® (JAN:4549160985049). On the surface of the bedpan after visual evaluation with the test soil, the ATP value of each part corresponding to scales 0 to 3 was measured (n=12 to 20). After washing, the bedpan was placed in an area covered with a clean sheet, and gloves were changed each time for measurement. The measurement area was kept constant by using a circular mold with a diameter of 3.5 cm.

Additional test

Visual evaluation using bedpan with different design: Using the same FD (Ninjo FD-1600®, hereinafter FD-A) as described above, a visual evaluation of a different bedpan (JAN: 4905203 103458, hereinafter bedpan-B) was carried out (N=3) by the method shown in 1)-(2) Method1.

Visual evaluation using different model FD: The FD (ROMEO S-560®, NITI-ON co. ltd., hereinafter FD-B) newly installed in Hospital A was used. Two types of bedpans (SPN/ 8-5405-01, hereinafter bedpan-A) and bedpan-B were visually evaluated by the method shown in 1)-(2) Method1.

RESULTS AND DISCUSSION

Visual evaluation

As shown in Table 3, when the test soil was applied to the entire surface of the bedpan by Method 1, residual test soil was observed in all the tests. Program P2, which has a relatively small amount of water, had more residue, and residue was also found inside the FD. The parts corresponding to scale 3 with the largest amount of residue were mainly handle part of the main body, both side of the lid, and right side of the main body. No test soil remained inside the bedpan in any of the washing programs. When the test soil was applied by Method 2 and washed by program P5, no residual test soil was observed.

Evaluation with ATP value

The ATP value (RLU logarithmic value) of the part corresponding to each scale showed a positive correlation with the scale, and the correlation coefficient r2 was 0.86 (Figure 3). The ATP value of scale 0, which is the acceptance criterion, was 0.6 to 2.3 (RLU, measured value 4 to 221), and the mean +2SD was 2.2 (n=12).

Additional test

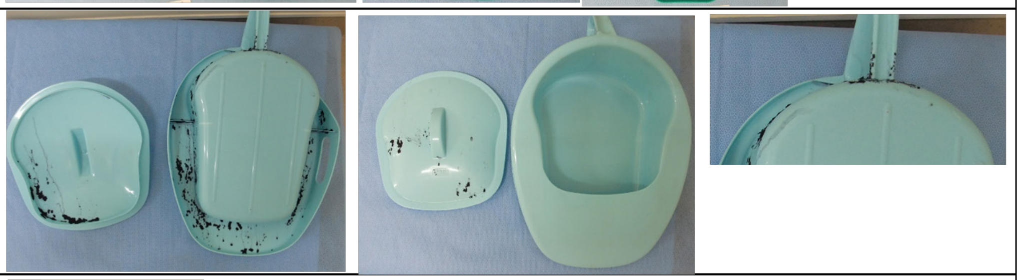
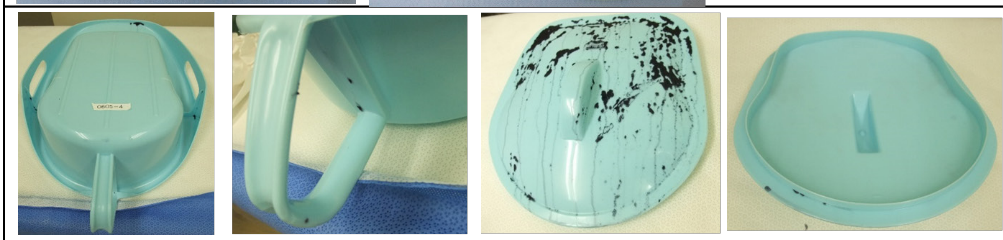
As shown in Table 4, in the test with FD-A and bedpan-B, the test soil remained on the handle part, the front and back sides of the lid, and the bottom surface. In the test with FD-B and bedpan-A, the test soil remained on the handle part, the front and back sides of the lid, and the inside and bottom of the bedpan. In the test with FD-B and bedpan-B, the test soil remained on the handle part, the front and back sides of the lid, and the bottom surface.

Table 3: Visual evaluation; the residual degree of test soil in each area shown in Figures 1 and 2 is shown on a scale.

Method (Program)	1	2	3	4	5	6	7	8	9	Inner side of FD					
										Door	Bottom	back	left	Celling	Right
Method-1 (P2)		1	2	3	3			3	2	2	2				
		1		3	3			3	3	2	1				
		1		2	3			3	3	2	2				
		1	1	2	3			3		2	2	1			
				3	3		1	3	2	3	2	1			
				3	3			3	3	3	2				
				3	3			3	3	2	2	2	1	1	
		1		2	3			3	1	2	2	1			
				3	3			3			2	1	1		
		1		3	3			3	3	1	2	1			

				3	3	2		1	
		1		3	3	3	3	2	
			2	3	3	3	1	1	
			3		3	1	1	1	
	1		3	1	3	2	1	2	1
Method-1 (P5)	1		2	2	3	2			
			1	2	3			1	
			1	3	3			1	
			3	3	3	2			
			1		3			1	
Method-2 (P5)									

Table 4: Residual test soil (Additional test).

<table>
<tr><th>FD</th><th>Bedpan</th><th>Result</th></tr>
<tr><td rowspan="2">FD-B</td><td>Bedpan-A</td><td>  </td></tr>
<tr><td rowspan="2">Bedpan-B</td><td>  </td></tr>
<tr><td>FD-A</td><td>  </td></tr>
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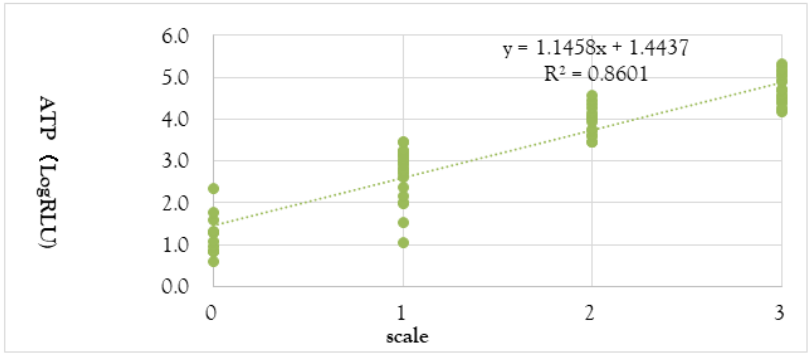

Figure 3: The correlation between ATP(Log RLU) and scale.

In the visual evaluation, the program with less water had more residual test soil. With the method of the test soil only applying to the part except on the lid, no residue was observed in the case of the program with a large amount of water. From the above, it was suggested that a program with enough water would provide an appropriate effect only in the absence of excessive contamination, but poor washing may occur when the amount of water was insufficient, or the bedpan was significantly contaminated. In the medical sites, the surface of the bedpans may be contaminated by the patient's condition or the contaminated gloves of the medical staff. In addition, if the bedpans were left until the start of washing because the FD is in operation, the attached organic matter may be dried and easily stuck. Bryce et al. mentioned the high contamination rate of bedpans after washing with FD, citing insufficient management such as leaving bedpan and misusing FD, and FD dysfunction such as blockage of the spray head [9]. In addition, there are reports that FD parts installation methods and piping connection mistakes were discovered during washing evaluation[2].Based on the above, it was considered important to carry out a washing evaluation of FD in the medical sites, to utilize it for staff education, select an effective washing program, and evaluate function of the FD.

In the visual evaluation, the parts where the residual test soil relatively concentrated were the part where the water flow was hard to hit when the bedpan was installed in the FD and the part where the water flow was hard to hit due to the design of the bedpan. In our past studies,visual evaluation was conducted single FD and bedpan[10]. This time, an additional tests with different FD and bedpan combinations, the residual parts of the test soil tended to be different. Since there are various FD models and bedpan designs, it is recommended to carry out FD washing evaluation at each

In the evaluation with ATP measurement, the visual evaluation scale and the corresponding ATP value on the bedpan surface showed a high correlation at the logarithmic level. The ATP value of scale 0, which is the acceptance standard, was within mean +2SD with 11 times out of 12, indicating little variation. This suggests that the measurement of ATP value can complement the washing evaluation of FD in the medical sites. However, the ATP value shows a high correlation between the object and the measured value with the same models [11,12], but there are differences depending on the model and measurement kit, and different benchmarks have been reported depending on the model [13,14]. Therefore, it is desirable to set a standard value at each facility when evaluating washing of FD by measuring ATP Value.

CONCLUSION

As the washing evaluation of FD in the medical sites, we examined the method that combines visual evaluation and ATP value measurement. Therefore, it is desirable to set a standard value at each facility when evaluating washing of FD by measuring ATP Value.

CONFLICT OF INTEREST SELF-REPORT

Nothing to declare.

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