



Institute for  
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## Final Report

### Interval between Changes of the OptiFlo72® Closed Suction System from Dahlhausen – (24 vs. 72 hours)

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## Background

A longer interval between changes (e.g. 72 hours) would be desirable for the OptiFlo72® closed suction system from P. J. Dahlhausen & Co. GmbH, Cologne. This would be not only be advantageous on cost and environmental grounds; it is possible that manipulating the suction system less frequently may have a positive (reducing) effect on the incidence of hospital-acquired pneumonia. Similar benefits can be seen, for example, from the positive experiences gained from increasing the interval between changes of ventilator tubes (Mattner, 2005).

## Project details

The purpose of this *experimental study* is to investigate whether there is any difference depending on time in the degree of microbial contamination of the OptiFlo72® suction catheter following artificial contamination.

## Study design

A total of eighty OptiFlo72® suction catheters (formerly: Free Trachea – LOT 07067776) were tested.

These were inserted to a depth of about 10 cm in a test tube containing a bacterial suspension with a defined microbial count (*Staphylococcus aureus* ATCC 29213,  $10^3$  CFU/ml; *Pseudomonas aeruginosa* ATCC 9027,  $10^3$  CFU/ml) in order to simulate airway bacterial colonisation.

For 40 of the catheters studied, 20 systems were contaminated with *S. aureus* (group A) and 20 with *P. aeruginosa* (group C); this procedure was repeated eight times every 45 minutes to 1 hour over a period of several hours: after the catheter had been inserted in the test tube, a 20 ml syringe was used to draw the bacterial suspension at least 20 cm along the tube (simulation of the suction procedure) and then to blow the suspension back out of the catheter. The catheter was then flushed via the irrigation port with sterile NaCl solution. These 40 catheters then underwent microbiological testing after 24 hours (see below).

These eight insertion, suction and flush cycles were repeated again with another 40 catheters on the following day and on day three (groups B and D). These latter 40 catheters also underwent microbiological testing after 72 hours.

### *Microbiological testing performed on the suction catheters:*

Each suction catheter was cut into sections of about 1 cm up to 20 cm along the catheter under sterile conditions using sterile scissors, placed in sterile saline solution (100 ml) and placed in an ultrasound bath for three minutes.

The saline solution was filtered through a sterile filter (0.45  $\mu\text{m}$ , Schleicher & Schuell) and the filter was then placed on Müller-Hinton agar.

After 48 hours of incubation, the microbial count was determined (CFU of *S. aureus*/catheter; CFU of *P. aeruginosa*/catheter).

The *Student's t-test for independent random samples* was used to test whether there is a statistically significant difference between the microbial counts obtained from the four groups of catheters.

Statistics software: SPSS 13.0 for Windows.

The null hypothesis ( $H_0$ ) was as follows: the number of suction cycles has no effect on the microbial count inside and on the catheter.

The alternate hypothesis ( $H_1$ ) was as follows: the number of suction cycles has an effect on (i.e. increases or lowers) the microbial count inside and on the catheter.

## **Results**

The results are summarised in Table 1.

S = standard deviation.

**Table 1: Results from microbiological testing (1 vs. 3 days)**

Catheter No. in Group	<i>S. aureus</i> ATCC 29213		<i>P. aeruginosa</i> ATCC 9027	
	Microbial Count after 1 Day [CFU/Catheter] Group A	Microbial Count after 3 Days [CFU/Catheter] Group B	Microbial Count after 1 Day [CFU/Catheter] Group C	Microbial Count after 3 Days [CFU/Catheter] Group D
1	2	0	0	6
2	4	6	0	8
3	0	8	0	2
4	2	2	0	4
5	68	0	0	0
6	0	6	4	2
7	6	2	0	0
8	4	2	0	0
9	4	0	0	2
10	50	0	0	4
11	2	4	0	4
12	12	2	0	2
13	0	32	28	24
14	0	8	38	2
15	24	12	36	12
16	2	10	0	10
17	8	2	0	32
18	0	6	0	0
19	0	18	0	48
20	0	4	0	2
Total	188	124	106	164
Mean ± S	9.4 ± 17.7	6.2 ± 7.4	5.3 ± 12.2	8.2 ± 12.2
Median	2	4	0	3
Seeding CFU/ml	Day 1 6600	Day 1 5920 Day 2 1800 Day 3 4000	Day 1 5100	Day 1 8200 Day 2 9100 Day 3 3300

The *mean* of the recovered microbes for *S. aureus* was 9.4 CFU/catheter after 8 suction cycles (= 1 day) and 6.2 CFU/catheter after 24 suction cycles (= 3 days).

The *mean* of the recovered microbes for *P. aeruginosa* was 5.3 CFU/catheter after 8 suction cycles (= 1 day) and 8.2 CFU/catheter after 24 suction cycles (= 3 days).

Comparison: one day vs. three days for *S. aureus*

According to the Student's t-test, the difference between the microbe counts recovered after 8 and 24 suction cycles is *not significant*

( $t = 0.728$ ;  $p = 0.474$ ).

Comparison: one day vs. three days for *P. aeruginosa*

According to the Student's t-test, the difference between the microbe counts recovered after 8 and 24 suction cycles is *not significant*

( $t = -0.733$ ;  $p = 0.468$ ).

## **Discussion of Results**

Closed suction systems are relatively advantageous for the pulmonary function of artificially ventilated patients compared with open suction (Cereda, 2001). Closed suction also has advantages in terms of the exposure of personnel to respiratory secretions (Maggiore, 2002). There is some controversy surrounding discussions regarding the effect of closed suction on the occurrence of hospital-acquired pneumonia associated with ventilation (ventilation-associated HAP). Some authors describe a reduction in the incidence of ventilation-associated HAP (Rabitsch, 2004), while other studies cannot confirm this (Zeitoun, 2003). It is conceivable that a reduction in the number of times the suction system is manipulated could have a positive effect on the incidence of ventilation-associated HAP. As a result, it is desirable to leave the suction system in place for as long as possible.

More recent studies and the results from a meta-analysis (Lorente 2006; Vonberg 2006) support the practice of not routinely changing a closed suction system, as is also advised in the 2004 CDC recommendations. The manufacturers of closed suction systems frequently specify one day as the interval between changes for their systems. The purpose of this experimental study examining the OptiFlo72® suction system from Dahlhausen was to investigate whether using the catheter for three days results in a higher level of microbial contamination.

Our previous study, which examined the OptiFlow® catheter from Dahlhausen revealed a significant reduction in *P. aeruginosa* microbial counts after three days of use. We were not able to demonstrate this result with the OptiFlo72® catheter.

While the mean microbe count for *S. aureus* after 3 days was lower (6.2 versus 9.4 after one day), this was not the case for *P. aeruginosa* (8.2 versus 5.3 after one day).

At the same time, the major finding in terms of suction catheter microbial counts was that there was no significant difference between 8 and 24 suction cycles (i.e. three days), either for *S. aureus* or for *P. aeruginosa*.

Consequences for practice:

- Based on the study results, the routine interval between changes for the OptiFlo72® suction catheter from P. J. Dahlhausen & Co. GmbH, Cologne, can be extended to 72 hours.
- This is also supported by clinical studies investigating *ventilation associated pneumonia*.

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