

## INFLUENCE OF WEARING TIME ON EFFICACY OF DISPOSABLE SURGICAL MASKS AS MICROBIAL BARRIER

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### SHORT COMMUNICATION

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#### ABSTRACT

The present study evaluated the efficacy of disposable surgical masks as a microbial barrier with 95% of Bacteria Filtration Efficacy (BFE) according to the wearing time (1, 2, 4 and 6 hours). The masks showed a decrease in efficacy after a 4-hour wearing time.

**Key words:** surgical masks, hospital infection, microbial barrier

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Among the practices adopted for prevention and control of surgical site infection (SSI), the use of surgical masks during surgical procedures has been subject of debate in the last few years. Some authors, such as Orr (4) and Tunevall (5) showed that there is no increase of SSI when surgical masks are not worn during surgical procedures. This fact may frequently lead to conflicts and questions, hampering professionals' decision-making.

This study was carried out based on the hypothesis that the use of disposable surgical masks is an efficient microbial barrier for surgical patients, and that the filtration efficacy of these masks decreases according to the wearing time. The aim of this study was to evaluate the filtration efficacy of disposable surgical masks after 1, 2, 4 and 6 hours of wearing time.

The research design was characterized as an experimental laboratory study in which variables were controlled. The data were collected in the operating theatre unit of a private hospital in the city of São Paulo, which meets the necessary building requirements proposed by the Ministry of Health (5).

The temperature in the operation rooms (OR) ranged between 19 and 24°C and the relative air humidity between 45 and 60%. The ORs had controlled positive pressure.

Surgical masks used in the experiment, donated by Kimberly Clark®, were those which met the requirement of 95% BFE (Bacterial Filtration Efficiency). The experiments were conducted

with two groups of mask users: a control group that did not wear masks, and the experimental group that wore masks. A set of nine Petri dishes containing tryptone soy agar (TSA) medium was placed on the operating table. The set was replaced after 1, 2, 4, and 6 hours. Each group read a 250-word text in loud voice for approximately 2 minutes, repeating the reading every 15 minutes. To monitor the room contamination, two Petri dishes containing TSA were placed on the auxiliary table next to the OR air conditioner opening. A total of 64 experiments were performed, 32 in each group.

The plates were incubated at  $22.5 \pm 2.5^\circ\text{C}$  for 48 h and at  $32.5 \pm 2.5^\circ\text{C}$  for 72 h, and the number of colony-forming units (CPU) was determined.

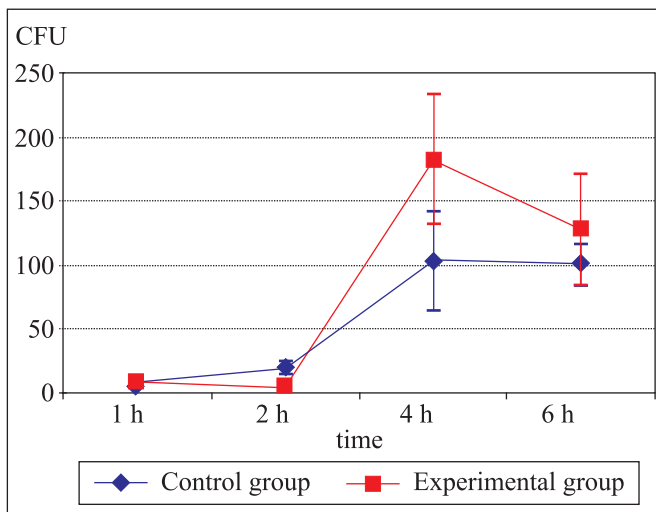
The data were processed using the software "Statistical Package for the Social Sciences" (SPSS) for Windows version 10.0. The Analysis of Variance – ANOVA and multiple linear regression were used.

A decrease in the counts was observed in the experimental group between one and two hours. However, between 4 and 6 hours, both groups – experimental and control – presented an increase in the counts, showing that the barrier efficiency decreased (Fig. 1).

We performed a multiple linear regression analysis of the variables involved in this study (experimental group, environment

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**Figure 1.** Counts of CFU on operation tables, after 1h, 2h, 4h and 6 h of exposition.

and time intervals) to estimate the contamination of the dishes on the operating table and the relevance of each variable considering the contamination of these dishes. The analysis confirmed that when the surgical mask was worn, the contamination of dishes on the operating table, decreased approximately 20 CFU (regression coefficient = -20.10) at every time interval studied. In relation to the wearing time of surgical masks, we verified that after 4 hours an increase in the contamination of the dishes on the operating table occurred, leading us to the conclusion that the microbial barrier of the surgical mask decreases with wearing time, confirming the previous hypothesis.

Tunevall and Jörber (6), Orr (4) and Tunevall (5) create controversy over the use of surgical masks for decreasing SSI. These authors only analyzed the final result (SSI), which depends on several variables, especially patient's immunological status and behavior of the surgical team in the operating field, by avoiding unnecessary conversation. The oral microbiota bioburden is undeniable, and speech droplets containing organisms, dispersed in the operating field are potential risks for the development of SSI. Other studies run by Mc Lure, Talboys, Yentis and Azadian's (3) and Letts and Doerner (2) corroborate the results of the present investigation, despite the differences in the methodologies adopted. We emphasize that in this research, all counts were lower than  $4 \times 10^2$  CFU, an amount

potentially able to trigger SSI in patients with poor immunity, or in cases of surgical wound complications such as ischemia and hematoma, as well as in surgeries with prosthesis implant.

This study was able to show that disposable surgical masks with 95% BFE are efficient microbial barriers up to wearing time and, therefore, they are indicated for every critical invasive procedure. However, another conclusion is that their bacterial filtration efficacy decreases significantly after 4 hours.

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## RESUMO

### Influência do tempo de utilização de máscaras cirúrgicas descartáveis na sua eficácia como barreira microbiana

Este estudo propôs analisar a eficácia de barreira microbiana das máscaras cirúrgicas descartáveis com 95% de Eficácia de Filtração Bacteriana (BFE), segundo seu tempo de uso (1, 2, 4 e 6 horas). As máscaras apresentaram diminuição da eficácia de barreira a partir de 4 horas de uso.

**Palavras-chave:** máscara cirúrgica, infecção hospitalar, barreira microbiana

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