

# Changes in Surgical Dress Reduce Contamination from Sterile Surgical Helmet Systems

Andrew Konopitski MD, Hugh Jones, Kenneth Mathis MD, and David Rodriguez-Quintana MD  
University of Texas Health Science Center at Houston, Houston, Texas

## Introduction

Sterile surgical helmet systems (SSHS) are frequently utilized in total joint replacement procedures to protect the surgeon while maintaining a comfortable working environment. However, common helmet systems generate positive pressure between the surgical gown and the surgeon's skin. In gowns with a back seam, this may allow transport of contaminated skin particles into the surgical field. This study examines the effect of surgical gown configuration on the risk of contamination of the surgical field.

## Methods

The aim of this study was to measure any differences in the contribution of viable particles to the airborne microbial load of the sterile field while wearing three different orthopedic surgical gown configurations (Figure 1):

- 1.) Standard gown with rear tied closures,
- 2.) Standard gown with a surgical vest and
- 3.) Zippered Toga style gown.

The escape of viable particles from each manner of dress was measured while the wearer performed a simulated surgery inside an environmentally controlled 1.4m<sup>3</sup> isolation chamber. The sealed chamber was outfitted with a work surface on one side and a waist level wall-mounted shelf on the opposite side. The work surface was held a series of sterilized surgical instruments and the wall-mounted shelf held 4 agar plates. An exhaust register was installed 10cm below the shelf and connected to an inline variable fan. Prior to testing, the entire inside surface of the chamber was cleaned with 70% ethanol and allowed to evaporate. A surgeon would don one of the gowning methods mentioned above and then be sealed in the chamber. Lids covering four agar settle plates positioned on the wall-mounted shelf were then removed. An anemometer was used by an outside staff member to adjust the exhaust fan to allow four air exchanges per hour. Simulated surgical movements were then performed for 60 min using a sterile polypropylene block and typical surgical tools. Upon completing the test, the agar plates were re-covered and placed in an incubator for later quantification as CFUs/m<sup>2</sup>/hr. The isolation chamber was then cleaned in ethanol and the test was repeated twice more with each of the remaining gowning configurations. Each session consisted of three tests by the same individual on the same day. The order of testing of each group was also alternated for each subsequent session. A total of 12 sessions were completed per gown configuration.

## Results

There were significant differences found between the settle rate of CFUs when comparing the three manners of dress. The viable particle settle rate for the standard surgical gown was 331.7 ±52 CFU/m<sup>2</sup>/hr. With the addition of a surgical vest, viable particle settle rate was reduced by 45% to 182.2 ±30.8 CFU/m<sup>2</sup>/hr (p=0.018). A similar reduction of 49% (170.5 ±41.9 CFU/m<sup>2</sup>/hr) was found when comparing a zippered style toga to the standard gown (p=0.011). As can be seen in Figure 2, no significant differences were found when comparing the Toga to the surgical vest group (p=0.847).

## Conclusion

When used in conjunction with surgical helmet systems, conventional surgical gowns do not completely prevent potentially contaminated particles from entering the surgical field. These results show that removing the pathway through the back seam reduced particle escape by 45% to 49%. We recommend that staff within the surgical field cover the back seam of standard gowns with a vest or don a zippered toga style gown.

## Significance

Simple cost effective variations to standard gowning can greatly reduce the potential of introducing contaminated particles into the sterile field by the surgical team.



Figure 1. (A) Standard surgical gown with tie back seam (B) Surgical vest over gown back seam (C) Toga zippered seam gown

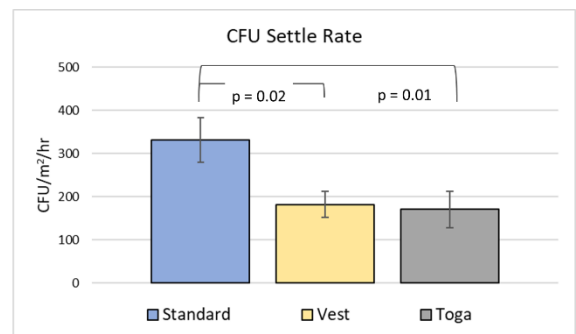


Figure 2. Chart comparing the CFU settle rates for each gown configuration.