Department of Orthopedic Surgery

UTHealth The University of Texas Health Science Center at Houston

Changes in Surgical Dress Reduce Contamination from Sterile Surgical Helmet Systems

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Disclosures

- None of the authors participating in this study has relevant conflicts to disclose.

Background: Space Suits and Surgical Helmet Systems

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Complications - Infection

Surgical Helmet Systems Are Associated With a Lower Rate of Prosthetic Joint Infection After Total Knee Arthroplasty: Combined Results From the New Zealand Joint Registry and Surgical Site Infection Improvement Programme

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- New Zealand Joint Registry (19,322 patients)
  - 90 day PJI Rate
  - Revision for PJI within 6 months

- **SSHS resulted in decreased rates of PJI and revision for PJI (OR = 0.5) compared to conventional gowning**

Surgical Helmet Systems: Airflow

Surgical helmet systems ventilate the surgeon using an in-built battery-operated fan.

- Air drawn into the suit passes over any exposed skin within the suit and through the wearer's convection transport layer.
- Ultimately, the air within the suit escapes into the operating room via available pathways, including the back seam of the gown, the feet, and the glove/gown interface.

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Background

Journal of Hospital Infection 99 (2018) 279–283

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevier.com/locate/jhin

Comparison of air exhausts for surgical body suits (space suits) and the potential for periprosthetic joint infection

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Figure 3. Air egress with the Flyte system and dedicated zippered suit.

Figure 1. Air egress with the T4 system.

Investigation of air flow : Schlieren imaging

Back seam at waist level

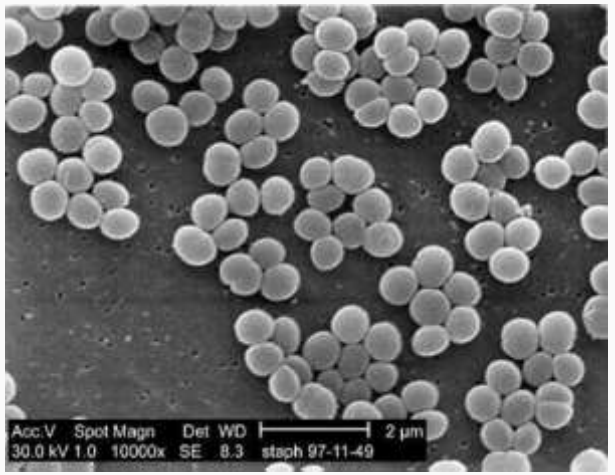
Research Questions

Purpose:

- Examine the effect of surgical gown design on the risk of contamination of the surgical field

Hypothesis:

- Surgical gowns that eliminate an open back seam will reduce contamination of the surgical field



Staph ~ 1um diameter

Gowning Methods Evaluated in Combination with a Sterile Surgical Hood System (T4 Stryker)

Standard gown, rear tied closure (SG)

A Level 4 standard surgical gown (Medline Inc.) + a Flyte Peel-Away Hood

Standard gown, w/ vest (SG+V)

SG plus a button-front sleeveless surgical vest (UltraGard, Medline) covering the gown's back seam.

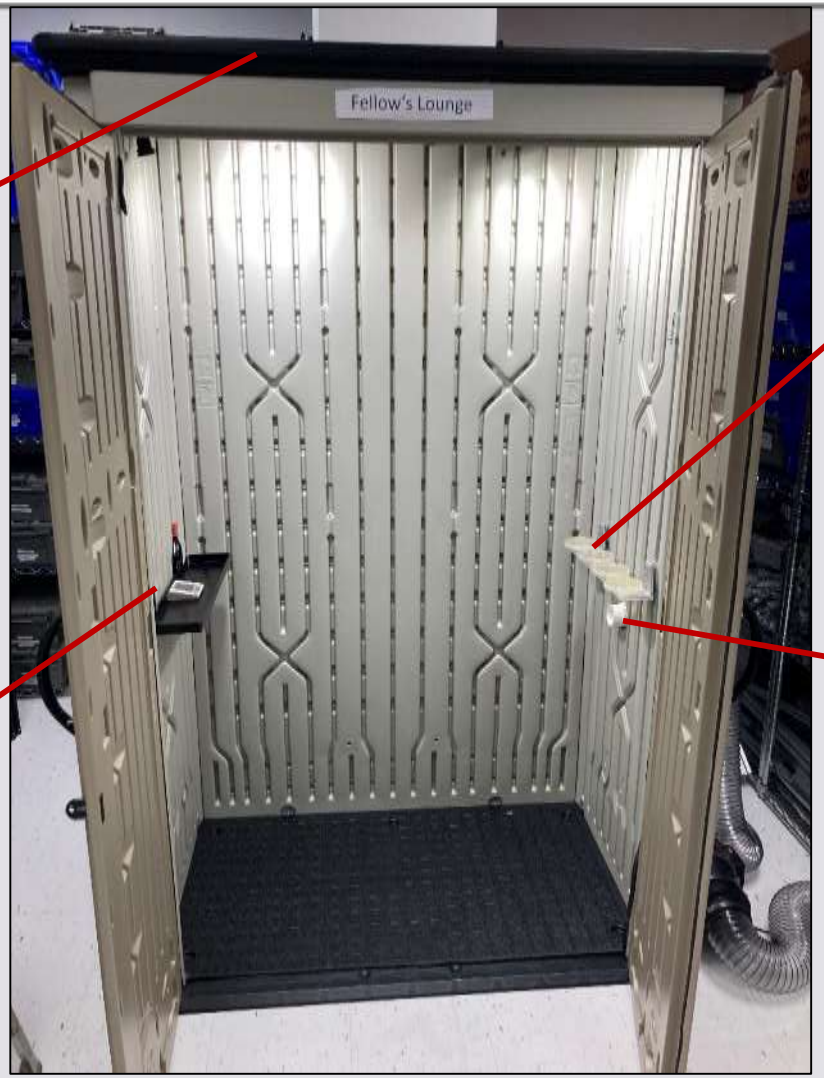
Zippered style toga (ZT)

A Flyte Zippered Toga style gown (Stryker).

Experiment - Illuminated Isolation Chamber

- Space within the chamber: $50ft^3$.
- Sufficient to allow a surgeon to perform sawing, drilling and broaching.
- Sterile equipment placed in chamber: reciprocating saw, drill, rongeur and two batteries.

Filtered incoming air



Surgical Work surface

Settle Plates: Bacteria & Fungus

Adjustable exhaust system

Methods

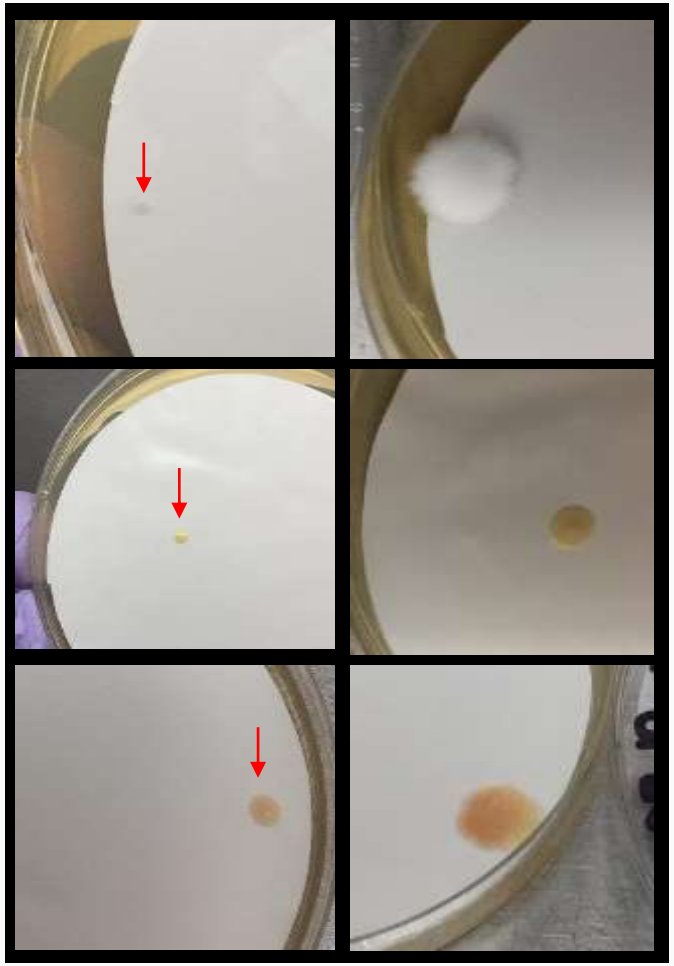
- The surgeon wore two pairs of Protexis Orthopaedic surgical gloves (Cardinal Health) with the inner gloved taped around the cuff.
- Each gown configuration was tested 12 times (36 hours total)
- The three gowning methods were tested on any given day
- The order of gowning was changed each day (e.g. Day 1: SG, SG+V, TS; Day 2: SG+V, SG, TS, etc.).

Methods

- The helmet system was powered once the surgeon was fully gowned.
- Upon entering the booth, the study participant was handed a sterile polypropylene block and a sterile filter cover for the exhaust fitting.
- After sealing the door to the isolation chamber, lids covering the agar culture plates were removed.
- Structured surgical activities were performed for 60 minutes. These involved drilling and sawing the polypropylene block

Methods

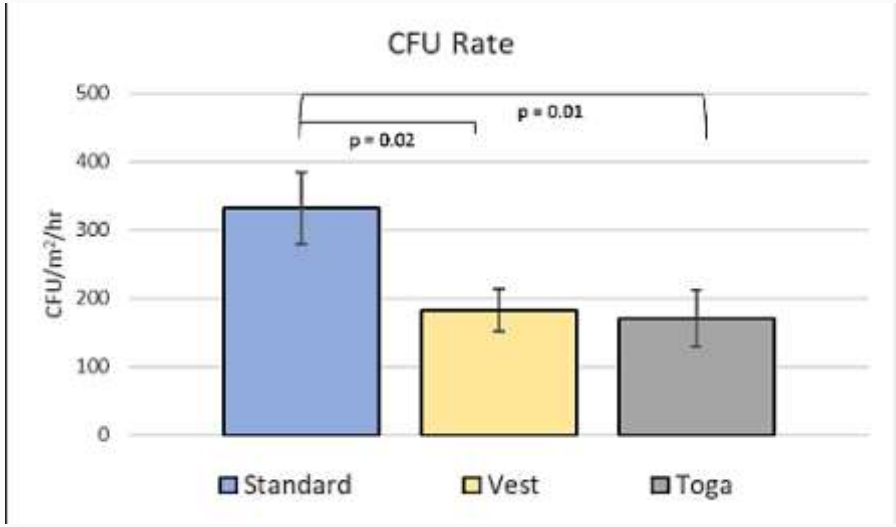
Extended growth

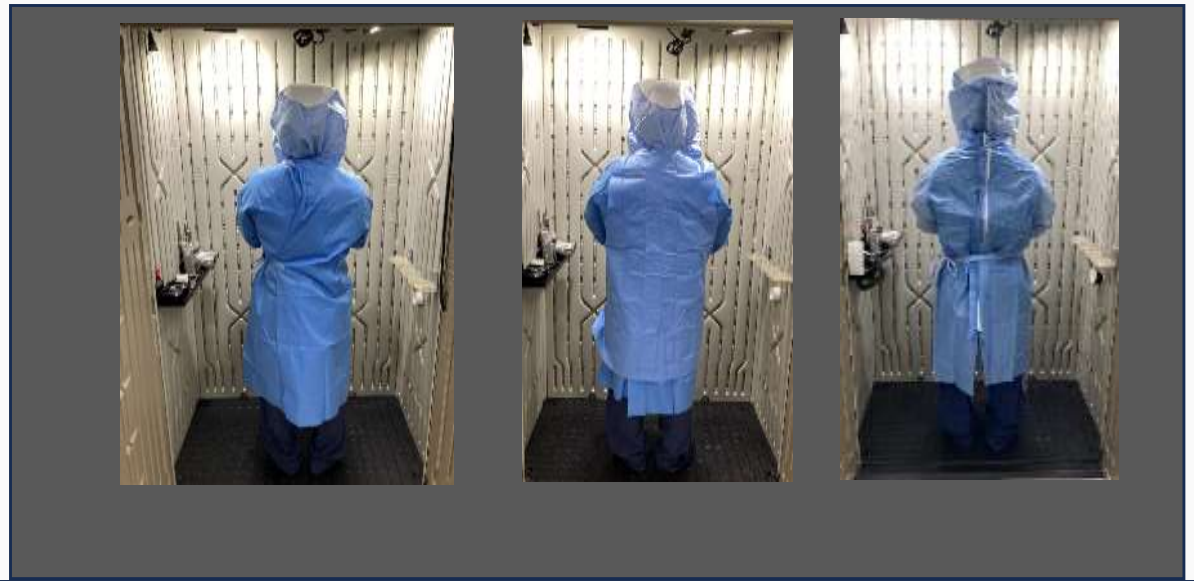


- Passive agar settle plate collection (1hr exposure time)
- Plates Cultures performed:
  - Sabourand (144 hrs/ 25˚C) – fungi
  - Tryptone (72 hrs/ 37˚C) – bacteria
- Bacterial and fungal counts measures in colony forming units per square meter per hour (CFU/m^2/hr)

Results: Average Contamination Rates

- Standard Gown
  - 332 +/- 52 CFU/m^2/hr
- Gown + vest
  - 45% reduction in contamination compared to standard gown
  - 182 +/- 31 CFU/m^2/hr
- Zippered Toga
  - 49% reduction in contamination compared to standard gown
  - 171 +/- 42 CFU/m^2/hr





Conclusions

- When used in conjunction with surgical helmet systems, conventional surgical gowns do not prevent potential contamination of the surgical field.
- 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.
- We hope this data will be beneficial in providing evidence to develop standardized gowning methods and contribute to improved quality