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## 2013 AAOS Annual Meeting

### Presentation Abstract

Session: 646-660-Adult Reconstruction Knee VI

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Title: Increased Intraoperative Contamination with Space Suit Use - A Mechanism

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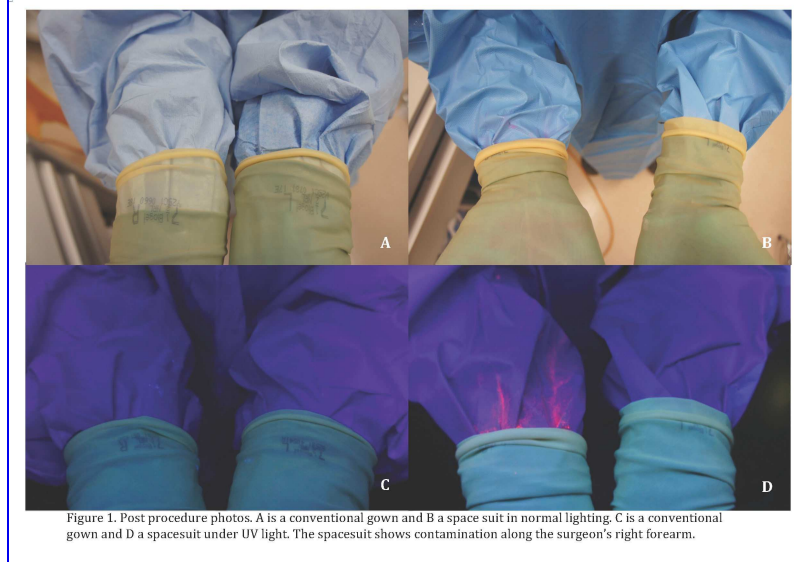
**Abstract:** INTRODUCTION: The body exhaust suit (BES) of Charnley creates 'negative pressure' inside the gown using intake/outtake tubing, removing any particles shed from the surgical team. Modern space suit (SS) systems use helmet-based intake fans, drawing air inside the gown using the hood material as a filter. This creates positive pressure inside the surgeon's gown, very different to the original BES. While early studies of BES demonstrate a clear reduction in deep infection rates, recent clinical data on SS has paradoxically reported a marked increase. Air under positive pressure will escape through any available opening, and we therefore investigated the hypothesis air leakage around the unsealed cuff in SS could carry particles into the operative field.

**METHODS:** Following a pilot study on cadavers a simulated total knee replacement (TKR) was developed. Based on a power calculation from this pilot 12 simulated TKRs were then performed in a ventilated theater environment. The surgeon's hands were covered in fluorescent 0.5um powder that approximates the size of a shedded skin squame. Contamination was tracked using standardized photos taken under UV light, then evaluated using a standardized scoring system. In addition, 0.3, 0.5, and 5um air particle counts were taken during the procedure.

**RESULTS:** The highest visual contamination was seen in the SS group with a mean score of 15.3/28, with the most contaminated region being the volar aspect of the surgeon's dominant forearm (Figure 1). No visual contamination was seen in the conventional gown group (p=0.028). Sealant tape around the inner glove

significantly lessened the rate of contamination. Air particle counts were significantly higher when the SS fan was in operation than not (mean 5um count 958 vs 254,  $p=0.045$ ).

**DISCUSSION AND CONCLUSION:** We found markedly increased particle egress into the surgical field with the use of SS in comparison to conventional gowns. In contrast to BES, no study on modern SS has demonstrated a wound contamination benefit (Table 1). Furthermore, in a study of 88,311 patients SS use resulted in a nine-fold increase in deep infection following TKR. This study provides a plausible explanation, and we would recommend that if used SS be considered for personal protection only, and supplemented with tape around the inner glove.



#### Comparative Studies on SS use

	Suit type evaluated	Assessment	Results	In favour of Suit?
Blomgren 1983	BES (Charnley Type)	Culture of wound washouts	Positive cultures in 10% BES wounds vs 43% conventional	YES
Lidwell 1982	BES (Charnley Type)	Joint sepsis and infection after arthroplasty	0.3% Incidence joint sepsis BES vs 1.3% conventional	YES
Bohn 1996	SS	Air sampling 30cm from wound	Mean 3.6 CFU/ft <sup>3</sup> for SS vs 3.6 CFU/ft <sup>3</sup> for conventional	NO
Shaw 1996	SS	Air sampling next to the wound	Mean CFU 37.0 for SS vs 29.6 for Conventional	NO
Der Tavitan 2003	SS	Wound bacterial count tetrazolium-stained membrane (TSMI)	64% of SS and 60% of conventional wounds were contaminated	NO
Pasquarella 2003	SS	Surface contamination in theatre using Settle plates	Mean 210 CFU/m <sup>2</sup> /h for SS vs 250 CFU/m <sup>2</sup> /h conventional $p=0.68$	NO

Hooper 2011	SS	6 month revision rates for infection following arthroplasty	0.243% with SS vs 0.098% conventional p <0.001	NO
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