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Cloth Skull Caps Shown to be More Effective than Bouffant-Style Disposable Caps at Preventing Airborne Contamination in the Operating Room

Surgeon's skullcaps and bouffant caps evaluated in environmental tests during mock operations, with cloth skullcaps showing minimal airborne contamination.

SAN DIEGO (Wednesday, October 25, 5:45 pm PDT): One of the first studies testing the effectiveness of different operating room (OR) head coverings in preventing airborne contamination has found that surgeon's caps that expose small amounts of the ears and hair are not inferior to the bouffant-style, disposable scrub hats that cover those features. Results of the study were presented today during a Scientific Forum session at the American College of Surgeons (ACS) Clinical Congress 2017, and will be published online on the *Journal of the American College of Surgeons* website tomorrow, in advance of print publication.

“Recently there have been concerns that exposed hair in the OR could increase the risk of surgical site infections, although there is no definitive evidence that it does,” said principal investigator Troy A. Markel, MD, FACS, assistant professor of pediatric surgery at Riley Hospital for Children at Indiana University Health, Indianapolis. “In fact, there are very few published scientific data supporting what the optimal headgear in the OR is.”

For their study, the researchers tested three common styles of commercially available surgical headgear. Disposable shower cap-like bouffant hats underwent testing, as did two types of surgical skullcaps, another name for the tie-in-the-back, close-fitting caps that are popular with surgeons: disposable caps with paper sides, and freshly home-laundered, reusable, cloth skullcaps.

Unlike most tests for environmental quality, which Dr. Markel said are typically done in a static laboratory, their airborne contamination testing was performed in an actual OR under changing conditions. For each style of hat the OR team wore, they performed a one-hour mock operation, which included gowning and gloving, passing surgical instruments, leaving and reentering the OR, and performing electrocautery on a piece of raw steak to generate particles that were discharged into the air. Each hat style underwent testing four times, twice

at each of two different hospitals. Both ORs had high-efficiency air-cleansing ventilation systems, according to the researchers.

The multidisciplinary research team—a microbiologist, engineers specializing in ventilation, an industrial air hygienist, and a surgeon—used their previously developed method involving multiple tests of what they call environmental quality indicators.¹ In one test using a particle counter, they counted tiny airborne particles, such as hair and skin cells, that landed in various parts of the room. They also measured microbial shedding, the bacteria and other microorganisms collected and grown in Petri dishes placed at the sterile operating field and the instrument table in the back of the room.

During the mock operations, the bouffant hats and the disposable surgical skullcaps had similar airborne particle counts, the study investigators reported. However, cloth skullcaps, which do not have a porous crown like their disposable counterparts, reportedly outperformed bouffant hats, showing lower particle counts and significantly lower microbial shedding at the sterile field compared with bouffant hats.

Additionally, the investigators tested the fabric of each hat style for permeability (air flow), penetration (amounts of particles that pass through), and porosity (pore, or hole, size). Results of fabric analysis revealed that the bouffant hats had greater permeability than either of the other caps, the investigators reported.

“Some organizations and hospitals have suggested that all OR personnel wear disposable bouffant-type hats, but we found no apparent infection-control reason to disallow disposable skullcaps in the OR,” Dr. Markel reported.

The researchers did not compare the amounts of airborne contaminants with infections at the surgical site. However, because they observed no statistically significant difference in the amounts of airborne contaminants in the OR between the disposable skullcaps and the disposable bouffant hats, he said, “I think it is difficult to say that one disposable hat is better than the other to prevent surgical site infections.”

Their study results have the potential to make an impact on the OR attire policies of hospitals and health care regulatory bodies, according to Dr. Markel.

“I expect our findings may be used to inform surgical headgear policy in the United States,” he said. “Based on these experiments, surgeons should be allowed to wear either a bouffant hat or a skullcap, although cloth skull caps are the thickest and have the lowest permeability of the three types we tested.”

Although Dr. Markel said that reusable skullcaps are “probably best” for minimizing airborne contamination in the OR, their disadvantage is the need to wash them. “Most hospitals don’t have facilities to launder them, and surgeons may not launder their skullcaps every day,” he said. “There needs to be a way to guarantee that reusable skullcaps are clean.”

The Chicago-based ACS recommends that cloth skullcaps be changed and cleaned daily.²

Dr. Markel’s co-researchers for the study were: Thomas Gormley, PhD, from Middle Tennessee University, Murfreesboro; Damon Greeley from Global Health Systems, Fort Mill, S.C.; John Ostojic from ARTEC Environmental Monitoring, Indianapolis; Rahul Bharadwaj,

PhD, Jonathan Rajala, PhD, and Angie Wise, MS, from AAF Flanders, Jeffersonville, Ind.; and Jennifer Wagner, PhD, from Prism Environmental Health and Safety, Discovery Bay, Calif.

“FACS” designates that a surgeon is a Fellow of the American College of Surgeons.

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1. Gormley T, Markel TA, Jones HW 3rd, et al. Methodology for analyzing environmental quality indicators in a dynamic operating room environment. *Am J infect Control*. 2017;45(4):354-359.
2. American College of Surgeons Board of Regents. Statement on operating room attire. Published online August 4, 2016. <https://www.facs.org/about-ac/s/statements/87-surgical-attire>. Accessed September 14, 2017.

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