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Review Article

A REVIEW ON ANTIVIRAL AND ANTIBACTERIAL SURGICAL GOWN AND DRAPES

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ABSTRACT
The prevalence of human immunodeficiency virus (HIV) and hepatitis B and C viruses in the patient population is very common in today's world. Hence the need for antiviral and antibacterial surgical gowns and thereby the barrier efficacy of protective surgical gowns has gained importance. The US Occupational Safety and Health Administration and Centers for Disease Control and Prevention have published regulations that indicate how surgical apparel should protect wearers under normal conditions of use and for the duration of time for which it will be used. Person, clothing and environment are interdependent components of garment performance. In this triad, clothing plays the mediatory role between person and the environment. Clothing in the form of antiviral surgical gown plays an important role in protecting the body from any hazards in the surgical environment. A review of antiviral and antibacterial surgical gowns reveal that studies of the performance of protective clothing have considered a variety of clothing factors and environmental factors affecting the initial barrier properties of fabrics.

Key Words: Surgical gown, Antiviral gown, Antibacterial gown, Surgical drapes

INTRODUCTION
Surgical gowns are made with both fabric and non-fabric material. Leonas (1998) and Martz (1995) investigated whether there is scientific evidence, according to the systematic review, that supports the practice of wearing gowns in surgeries, according to the material they are made of. Branson *et al.,* (1991) and Berch *et al.,* (1965) studied contamination and infection of the surgical site with the use of either reusable or single-use surgical gown. Unsal *et al.,* (2005), Schoenberger (1990) and Azouni *et al.,* (2001) investigated clothing and environment as interactive and interdependent components of garment performance. In this triad, clothing mediates the relationship between person and the environment. Protecting the body from any hazards in the environment and in maintaining physiological comfort study was done by Slater (1998). Mills *et al.,* (2000) reveal that studies of the performance of protective clothing. They have considered a variety of clothing factors and environmental factors affecting the initial barrier properties of fabrics. Flaherty and Wick (1993) reveal that when a wearer dons protective clothing, the clothing must provide protection that withstands various conditions of use. Berch and Peper (1965) conclude that the durability of protective surgical gowns is critical for the safety of health care workers.

Evolution of Surgical Drapes and Gowns
Berch *et al.,* (1965) studied the essential need for surgical drapes, gowns and a glove used in surgical theatres to prevent the spread of infectious diseases. Infectious diseases such as AIDS, Hepatitis B, and Hepatitis C and *Staphylococcus aureus* have played a major role in bringing awareness towards the need for effective infection control practices. Few surgeons began to wear cotton gauze masks during surgery mainly due to the Spanish flu 1918 and the growing interest in Lister's antiseptic system. This was primarily to protect themselves from infected patients. William Halsted was the first person who designed the first pair of surgical gloves in 1890. He did it to protect the hands of his theatre nurse from harsh antiseptics. This cultivated the healthy habit of surgeons and operation theatre staff wearing rubber gloves to protect their hands from cleansing solutions. In the mid 20th century, surgeons were wearing specialised garments in the operation theatre. In the 1940s, surgical drapes and gowns became a necessity in operating rooms as a result of research that probed into the development of infection. The development of antiviral and antibacterial surgical drapes and gowns took its own due course and has come into existence in full today.

Boosting Demand of Surgical Gown & Drapes Market
Today the prime importance among patients and healthcare providers is the issue of infection control. Infectious diseases such as AIDS, Hepatitis B, SARS and MRSA have kindled attention towards effective infection control worldwide. Surgical drapes, gowns and gloves

which are used in the operating theatre have diverse utilities. They mainly protect the patient, the theatre staff and also protect theatre equipment from getting damaged. Surgical drapes are used to protect the patient from infection. The surgical gowns include those that are designed for a specific surgical procedure, incise drapes and covers for tables. Flaherty AL and Wick TM (1993) concluded that approximately 30 million surgical procedures are conducted in various countries every year. As the number of surgical procedures increases, the demand for surgical products will also increase. .However, advances in minimally invasive surgery may marginally restrain the demand, as these techniques involve less blood loss and help to minimize the wet conditions that usually prevail in the operating environment.

Protecting Surgical Staff

Medical personnel need to perform their functions particularly in the operating room, which needs to be one of the most sterile areas in any hospital. They should not be in danger of any infection. Throughout the world, industry groups and medical experts have recognized this need for greater safety and are developing new stringent standards for the improved performance of single-use medical fabrics. Pissiotis *et al.,* (1997) finally concluded that with various viruses such as HIV, Methicillin Resistant *Staphylococcus aureus* (MRSA), Creutzfeldt-Jakob disease (CJD), hepatitis and severe acute respiratory syndrome (SARS) in an increasing trend throughout the world, the need for antiviral surgical drapes have become an absolute essentiality. Doctors, nurses and other medical personnel must be better protected while treating infected patients.

Standards for protective medical garments are being updated to reflect this growing concern for greater protection. The Association for the Advancement of Medical Instrumentation, in the United States has issued a new standard in January for liquid barrier performance and classification of protective apparel including surgical gowns and drapes intended for use in healthcare facilities. The new standard clearly categorizes different fabrics as to the level of protection and therefore eliminates the guesswork of selecting the proper fabric for a procedure. The highest level of protection is level four, in which the gown fabric needs to pass viral barrier testing (ASTM F1671). A new European standard regarding surgical drapes, gowns and clean-air suites has also been introduced. Schoenberger (1990) has also conducted a research on liquid permeability on surgical gowns. Howsoever the fabric needs to meet the highest levels of protection, but also has to be comfortable. Too often, medical personnel must choose between protection and comfort. In the past, to increase protection for the wearer, comfort had to be sacrificed. Heavy gown fabrics with fabric or film reinforcement in critical zones are numerous and have been developed by many manufacturers. They provide the protection but are very uncomfortable for the wearer. The Research and Development team at Ahlstrom found a solution for a better gown fabric that will be able to deliver the highest level of protection and a greater degree of comfort with a new, unique and innovative combination of raw materials and fabric construction. Huang W and Leonas K K (2000) investigated about material which protects medical personnel from viral infections and maintains a high level of breathability and comfort even when the wearer's temperature and perspiration rises. The stipulated points below elucidate the important and specific points by which gowns are to be selected.

- Dual protection for both healthcare professionals and patients. Impermeability to moisture is a significant criterion in choosing appropriate gowns and drapes.
- Garment and draping materials that allow penetration of infectious body fluids and microorganisms can lead to "strike- through," contamination, and disease. Placing high importance on protection is to be mainly considered when choosing a drape.
- As to Taylor (1994) the ability of reusable gowns to resist strike of various viruses with the number of uses, washings, and sterilization cycles has to be assessed. There are no universally adopted methods for counting numbers of uses of a reusable gown or drape. Laundry workers risk exposure to blood borne pathogens from contaminated gowns and drapes.
- Single-use items are often falsely implicated for certain costs of waste disposal. Improper waste segregation, rather than use of single-use gowns and drapes, is usually the cause of increased amounts regulated medical waste.

Issues of safety and infection control must be in the total equation when choosing between reusable and single-use gowns and drapes. Gowns and drapes act as barriers to prevent transmission of microorganisms to preserve sterility. Preventing "strike-through" is a critical factor in choosing materials for gowns and drapes. As to Yang *et al.,* (2000) Protection of haws from coagulase-negative *Staphylococcus aureus*, methicillin-resistant *Staphylococcus aureus* (MRSA) and other resistant

organisms, and blood borne pathogens is necessary for safe practices. Choices are made on safety issues as well as cost. Exposure to blood has for years been recognized as a risk for infection, so barriers are needed.

Protective Clothing for Health Care Workers

Protective clothing is absolutely compulsory for hospital support staff in operating rooms, isolation areas, emergency rooms and intensive care units. Surgical gowns are used widely in healthcare facilities as a core part of personal protective equipment. Their original use was to protect patients from post-surgery infection caused by contaminants in the environment. More recently the function of surgical gowns has become bidirectional towards patients and also doctors. They serve to minimize the cross infection between patients and health care workers suggested by Mangram *et al* (1999).

The three most commonly used nonwoven fabrics for surgical gowns and drapes are spun lace, spunbond-meltblown-spunbond (SMS) and wet-laid. Spun lace nonwoven fabric is a hydro entangled material constituted of wood pulp and polyester fiber. SMS fabric refers to a fabric constituted of three thermally or adhesively bonded layers (spun bond layer provides the strength, melt blown layer is the barrier). Wet-laid fabric is a non-woven fabric consisting of wood pulp or a blend of polyester and wood-pulp fibers. Juliane C B and Rubia A L (2009) reviewed that Chemical treatment can be used to improve liquid penetration resistance. Additional forms of coatings are often added to reusable and single-use products to improve their performance in barrier resistance, absorbency and non-slippage.

Surgical Gowns and Their Protective Performance

A property of visible synthetic blood penetration was proved in 1990 by Shadduck et al. Disposable gowns made of spun bonded-melt blown-spun bonded polyolefin, plastic-reinforced gowns, and woven polyester gowns showed better performance than washed cotton/polyester gowns and disposable gowns made of spun laced polyester/wood pulp. Telford and Quebbeman did a study on strike-through rate of a line of disposable gowns and reusable gowns by using tests equivalent to ASTM F1670 and ASTM F1671. They found that the overall strike through rate was 7% for gowns constructed of spunbonded-meltblown-spunbonded fabric and 9% for gowns constructed of expanded polytetrafluoroethylene fabric.

Leonas (1998) evaluated the barrier efficacy of five commercially available reusable surgical gowns and found that laundering reduced the ability of the fabric to prevent the transmission of bacteria through the fabrics. Smith and Nichols pointed out that reusable gowns eventually lose their barrier properties as a result of abrasion and damage during wearing and the breakdown of the fabric during laundering and sterilization. Slater pointed out that disposable gown could be stiffer and less thermally comfortable than reusable gowns in long procedures.

Body fluids will be at a temperature close to the internal body temperature (e.g., 36-38^{o}C), while other liquids used in the operating room (alcohol, iodine) may be the same as or cooler than ambient temperature. Certain regions of the gown may be repeatedly or continuously exposed to blood or other fluids during surgical procedures. Laufman *et al.,* (1975) performed a study that correlated the stress of stretching surgical gown and drape material with moist bacterial strike-through. They found that there were significant differences in wet bacterial strike-through performance between the various types of nonwoven materials and woven materials under study. Flaherty and Wick indicated that contact of surgical gowns with human blood for 1 hour before applying an external pressure increased the liquid penetration of the gowns.

As part of the AMRIN study, resistance of commensal *Escherichia coli* and *Staphylococcus aureus* High against a number of antimicrobial agents was determined by disk diffusion. Rates of carriage of (multi) resistant *Escherichia coli* were observed for patients on the day of discharge from hospital: 73% for ampicillin, 55% for cotrimoxazole, 43% for chloramphenicol, 22% for ciprofloxacin, 18% for gentamicin and 13% for cefotaxime. Compared with the presence of resistant *Escherichia coli* in patients upon admission, patients visiting a public health centre and healthy relatives, there was a marked increase in resistance among patients upon discharge.

CONCLUSION

Thereby the essentiality for antiviral and antibacterial surgical gowns and drapes has been proved. The demand for these surgical gowns and drapes is facing an increasing trend in the market as the surgical procedures are increasing these days.

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