Surgical face mask in modern operating room

This essay will critically analyze the use of surgical face mask in the modern operating room. It will also provide an overview study on the effectiveness of the surgical masks and the author's experiences will also be highlighted. Norman (1995) states that surgical face masks are used as physical barriers to prevent nurses, patients and visitors from touching their own noses and mouths to reduce or prevent contact transmission of infection agents.

Face masks could have two functions, firstly to protect the patient from the healthcare worker and secondly, to protect the healthcare worker from the patient (Norman 1995). The surgical face mask has become an integral part of the uniform for theatre personnel since introduction in an attempt to reduce the rate of the chemical wound infections (von Mikulicz 1897), it is only recently that people have asked if the masks do actually protect the patient from infection in the operating theatre.

In 1990's the necessities for mask have turn full circled, but this time to protect the staff. The operating theatre is considered as high risk area in relation to potential contact with blood and body fluids. Peri-operative nurses and medical personnel are repeatedly exposed to these risks and this is why their works necessitates the use of protective clothing, and in particular, face wear (Gruendemann et al 1995). Face masks and goggles should be worn when splashing. Splattering or aerosolisation of blood is anticipated (Gruendemann et al 1995).

Gruendemann further stated that it is safer for all patients to be treated as potentially infective, whatever their status in life but in the author's experience sometimes scrub personnel only wear masks and eye-wear when

they consider themselves to be in contact with a high-risk patient by applying universal precaution. The term Universal precaution originates from the Centre for Disease Control in Atlanta (Taylor 1993). The basic aim of universal precaution is to lower the level of contact with blood or body fluids.

This reduces the risk to all personnel of contact with blood borne viruses and pathogenic organisms carried in other body fluids (Wicker 1991). The precautions recognized that there are high-risk environments rather than high-risk patients. However, when the theory of droplet infection was introduced, Meleney(1927) and Walker(1930) both advocated the wearing of masks in operating theatre to reduce the risk of haemolytic streptococcus. People expel large number of saliva from their mouth when they sneeze but much less when they talk, cough and breathe (Duguid 1946).

Duguid found that on average 39000 bacteria containing particles produced from a sneeze, 710 from a cough and 36 from speaking 100 words loudly. Letts et al (1983) studied the role of mask efficiency during the conversation by measuring both microbial contamination of stimulated wound and operating room air. It appeared that air contamination was increased by the presence of operating room personnel which varied according to the density of the traffic with a significant increase in contamination in a stimulated wound during conversation.

The study recommended reducing conversation and wearing a mask below a hood to reduce bacterial fallout from oral and nasal cavities. Orr's study (1981) directly contrasts the results of Lett's (1983) study. Orr's study was designed to determine whether surgical mask wearing reduces the wound

infection rate in general surgery. After an initial pilot study of one month during which no masks were worn, there was found to be no rise in the incidence of wound infections. Masks were abandoned in approximately 1000 operations during the six month period of the study.

The wound infection rate was found to be 1. 8% in unmasked period. Orr's (1981) results showed that the incidence of post-operation wound infection is related to the surgical procedure, as well as other factors such as surgical skill, adequate surgical scrub, appropriate culture material, antibiotic prophylaxis, and correction of dehydration and poor nutrition. Orr (1981) also suggested that for procedures lasting less than 15 minutes, the operator should wear a face mask, particularly when the face is in close proximity to the operator field, and the need for speaking is anticipated.

According to Orr's (1981) studies, the writer thinks that there is no positive evidence that the use of a mask has any effect on the incidence of wound infections during surgery. Tunevall (1991) carried out a prospective study on the effect of wearing face masks on the surgical infection rate of 3088 patients during a two year period in acute and elective general surgery. Tunevall(1991) found that there was no statistical significance between the masked and unmasked group. The bacterial species cultured did not differ in any way between the two groups, supporting the conclusion that masks have no effect on rates of wound infection.

Hunt(1991) states that the wearing of face mask by non-scrubbed staff in theatre with forced ventilation appears to be unnecessary and advocates whispering or quiet talking and mouth breathing during an operation. These

recommendations would be difficult to enforce in a clinical situation. Ritter et al(1976) demonstrated during simulated operations that the case of clinical masks did not make any difference to the number of bacteria deposited on Settle plates in an operating room. What did appear to make a difference was whether the door to the room was open and the amount of traffic entering and leaving the room.

Ritter found a 33 fold increase in the counts of airborne bacteria when five people entering an empty operating room. For example, in the author's clinical area, the policy is that masks shall be worn at all times during surgery because of the number of orthopaedic surgeries. This is supported by Hunt (1991). Moss (1995) recommended that all people entering the restricted area of the surgical suite should wear a mask when there are open sterile items and equipment present. A practical person may say that surgical masks protect the patient from the operator's sweat and protect the operator from the patient's blood.

A study from Colchester in 1981 actually showed a 50% reduction in infection rates when mask were not worn. The present guidance for clinical health care for protection against infection with HIV " Hepatitis Viruses" recommends that for all operations eye and mouth protection should be worn (Ransjo 1986). This can achieved with the mask and goggles but alternatively a full face visor could be worn. Ransjo(1986) and Reingold(1988) states that the present generation of mask does not protect staff either from airborne bacteria or Hepatitis B Viruses. Theatre personnel may adopt self protection as a reason for wearing mask.

In 1995, a study was carried out on skin and mucous membrane contacts with the blood during surgical procedures (Tokars et al 1995). Mucous membrane contacts occurred in 15 of 1166 surgeons using no facial protection other than a surgical mask. This rate was significantly higher than among those wearing goggles or visors. The spread of infection through the mucosal surfaces, including the conjunctiva, has been well documented (Giachino et al 1988). An Italian auxiliary nurse was diagnosed as HIV positive two months after taking blood from a patient. A test tube carrying the blood shattered and a drop flew into her eye (Moss 1995).

Quebemenn et al (1991) found in their study that the face was more likely to be contaminated from the splashing of blood and body fluids in orthopaedic, cardiothoracic and in vascular surgery than in gynaecology and general surgery. Brearley(1989) states that the incidence and rate of contamination are higher in complex and long operations, but contamination can occur during minor procedures. In Brearley's study of blood splashes to surgeons, data was collected from 257 operations. Overall more than 10 splashes over spectacles were present on 8 separate occasions. They were aware of these splashes in only three of the occasions.

Such splashes are unlikely to cause a reflexive blink when hitting the eye and blinking is unlikely to prevent infection anyway (Brearley 1989). As one viral particle of HIV is sufficient to infect a human being, even such minute splashes to the conjunctiva are of great significance (Berry 1995). Many everyday procedures performed by nurses can carry a risk of exposure to infection, for example catherization. The Occupational Safety and Health Administration(OSHA) in America believes that two million hospital

healthcare workers are at risk of harmful blood-borne pathogens, and 60% of these workers are nurses.

It also recognizes that the operating theatre is one of the highest risk areas in the hospital. Exposure to these blood-borne pathogens can occur in two ways; Cutaneous and percutaneous (Ronk 1994). The American study shows personnel only wore maximum protection for major invasive procedures such as surgical entry into the tissues, cavities, organs or the repair of major traumatic injuries or when they were next to the operative field (Moss 1995). Results have shown in Ronk's (1994) study that even nurses who circulate are at risk; however little is known of their perception of risk and further studies need to be carried out in this area.

Another study of compliance in United States in Accidental and Emergency department gave recommendations for the use of masks and eyewear. It revealed that healthcare professionals were much less likely to don masks and eyewear during urgent procedures than in non-urgent minor procedures where bleeding was not present (Berry 1995). For example, the urgent condition of a critically ill patient may lead nurses to perform invasive procedures without maximum protection (Berry 1995). Surgical masks are not particulate respirators. They filter or direct air away from the sterile field or patient.

They typically are not designed to provide a tight enough cover to the face to prevent air-leakage around the mask edges. (Prust 1997) The filters of many types of surgical masks may not filter submicron-sized aerosols. There is a misconception that because a surgical mask covers the nose and the

mouth and the wearer breathes through it; all inhaled air is drawn through the mask and filtered based on the level of filtration efficiency claims on the masks. (Prust 1997) Prust (1997) states " Wear a single surgical mask in surgical environments where open sterile supplies or scrubbed persons may be located.

A mask should cover both the nose and the mouth and be secured in a manner to prevent venting. In the author's clinical area, the policy is that masks should be carefully removed and discarded after use by handling only the ties. They are not to be saved by hanging around the neck or tucking into the pocket for further use. Prust (1997) states that high filtration surgical masks may be worn by peri-operative personnel during procedures that generate surgical smoke to minimize noxious odours and/or potential toxic effects of smoke.

Regarding laser safety, Prust (1997) states that " High filtration surgical masks for laser use should be worn during procedures that produce plume". Occupational exposure to the electro-surgical smoke and laser plume are important issues faced by the Operating Room personnel. The need to protect surgical team members from breathing smoke by proper use of efficient smoke evacuation system has been well documented by Prust (1997). Protection through engineering controls and smoke evacuation systems has not been consistently provided (Prust 1997).

Surgical mask or special 'laser' mask has been an attempt to reduce exposure to smoke. Specific requirements for providing respiratory protection equipment for operating room personnel exposed to surgical

smoke and plume have not been mandated in many facilities even when a smoke evacuator is used. Operating room personnel choose to use a high-filtration surgical mask for an extra measure of protection against exposure to the plume and to reduce the odour.

" High-filtration masks (with a filtering capability of particulate matter at least 0. 3 microns in size, ideally 0. micron) should always be worn during surgical procedures that produce smoke. To add further protection against unevacuated plume in the air, the mask should be worn properly covering the nose and the mouth. The sides of the mask should conform to the face adequately". States Prust (1997). In the author's clinical area, they are introducing high-filtration masks for laser-assisted operations. However Prust (1997) urged that manufacturers of laser masks use differing text methods to support submicron or high filtration efficiency filter claims.

No filtration efficiency tests have been established as a standard to determine the efficiency of a laser against surgical smoke. Another concern regarding laser surgical masks is that masks are particulate filters and they will not filter gaseous or semi-volatile chemicals that are present in surgical smoke. Gaseous chemicals require a chemical absorbent if the concern is respiratory protection for healthcare workers; respiratory protection equipment may be appropriate. (Prust 1997) Fluid resistance is a mandatory product performance requirement for surgical masks worn as personnel protective equipment.

The OSHA Blood borne Pathogen Standards (BBPs) mandates that Personal Protective Equipment (PPE)(will be considered appropriate only if it shall not

permit blood or other potentially infectious materials to pass through or reach the employees' skin, eye, mouth or other mucous membranes under normal conditions of use. (Prust 1997) The primary feature that masks a mask fluid resistant is the composition of the layers in the mask. The layers may be chemically structured to be inherently fluid resistant or the layers be mechanically designed to reduce the likelihood of fluid penetration.

There is no OSHA mandate nor any professional or governmental standard specifying how or what level a mask should be fluid resistant. (Prust 1997) All surgical masks must be fluid-resistant to meet the requirements of Personal Protection Equipment. Healthcare professionals concerned about the effects of exposure are requesting that surgical masks meet higher standards than ever before. Often masks are made from uncomfortable and heavy materials, making them cumbersome to wear (Berry 1995).

Wearers of such equipment may not wear it for the duration of the surgical procedure due to discomfort. This equipment should be provided by the employer (HASAW Act 1975) and be readily accessible to all scrub personnel when needed. Another finding of Berraff's 1989 study was that protective equipment was ineffective and unavailable. By standardising to the minimum number of required mask categories and vendors, cost-saving should be the result. Successful mask standardization must involve an objective process of performance, quality and value analysis.

Mask standardization may not be popular with healthcare support workers who are reluctant to change the type or brand of mask they have worn for years, but minimizing the number of products serving the same function is

critical in today's healthcare spending environment. Conclusion In conclusion, research has shown that there is very low compliance with the recommended use of facial wear among healthcare workers working in high-risk environments. It has been proven that blood-borne viruses such as HIV and HBV can contaminate the conjunctiva leading to infection, and therefore the need for maximum protection should not be compromised.

Circulating personnel in the operating theatre, including anaesthetists, should continue to wear surgical face masks whenever open sterile items and equipment are present (Romney 2001). Recent studies arguing that " unmasked" circulators pose a low risk to patients, contain flaws. The risk of transmission of infectious agents from the naso- and oropharynx of " unmasked" circulating staff to patients is probably low; nevertheless, more well designed clinical studies are required before changes in practice can be implemented (Romney 2001).

Healthcare workers seem to be putting themselves at unnecessary risk through what could be a fundamental misunderstanding of universal precaution, or through simply understanding the risks. Whatever the reasons for not wearing protective facial wear, researchers believe that the practice of universal precaution will not be universal until healthcare workers will not develop a better appreciation of the potential for any patient to be infectious (Ronk 1994). Some studies suggest that surgical face masks might actually increase the incidence of surgical wound infection by increasing the shedding of facial skin Letts (1983).

Research with carefully designed clinical studies is required in specialised areas, such as cardiac or orthopaedic surgery, where the use of mask is traditionally defended to ensure that their use is beneficial and is required. Finally, most authorities now assert that masks also serve to protect the operating theatre team as well as the patient. Blood exposures occurring on the face and neck of operating theatre personnel are not uncommon. In the future, full face visors may play a prominent role in protecting staff from potentially serious occupational exposures.