Increasing Safety, Reducing Risk

THE ROLE OF EYEWEAR IN INFECTION PREVENTION; THE REALITY OF EYEWEAR CONTAMINATION LEVELS

VICTOR R. LANGE, CRC, MSPH

THIS RESOURCE IS FOR YOU IF YOU WORK IN OR MANAGE:

- Infection Prevention
- Emergency Rooms
- Operating Rooms
- Labor & Delivery
- Burn Units
- Healthcare Distribution

CLINICAL BACKGROUND

Infection prevention and eye protection. Leading hospitals and acute-care facilities must continuously improve protocols and procedures, demonstrating vigilance in their efforts to increase safety and reduce risk. Infection prevention is at the top of the requirements list. The role of eyewear, while perceived as important, often is underrated. According to the Occupational Safety & Health Administration (OSHA), lack of eye protection is a primary reason for eye injury and infection transmission.

The role of eyewear is magnified in a healthcare setting. Risks include viral and bacterial infection causing conjunctivitis (adenovirus, herpes simplex, staphylococcus aureus) and systemic infections, including bloodborne viruses (hepatitis B and C and human immunodeficiency viruses), herpes viruses, and rhinoviruses. Infection transmission by blood splash into eye mucous membranes (conjunctiva) is documented.[1] Infectious agents can be introduced to the eye directly—via splashes, sprays, or airborn droplets—or from touch. Procedures involving blood and body fluid secretions or excretions (endotracheal suctioning, bronchoscopy, invasive vascular procedures, even obstetric procedures) require the most stringent protection.

The National Institute for Occupational Safety and Health (NIOSH) and the Centers for Disease Control and Prevention (CDC) recommend eye protection to reduce the risk of disease transmission through conjunctiva .[2] Generally, it is suggested that appropriate products be selected based on anticipated exposure level and vision needs.[3] OSHA Bloodborne Pathogens Standard mandates eyewear use when blood or body fluid exposure is likely.[4]

1 Hosoglu S, Celen MK, Akalin S, Geyik MF, Soyoral Y, Kara IH et al. Transmission of hepatitis C by blood splash into conjunctiva in a nurse. American Journal of Infection Control. 2003 Dec;31(8):502-4.

2 "Workplace Safety & Health Topics: Eye Safety—Eye Protection for Infection Control," Division of Safety Research, National Institute for Occupational Safety and Health, Published online by the Centers for Disease Control and Prevention, May 27, 2009 (last review date); and "Eye Protection for Infection Control," US Department of Health and Human Services, Centers for Disease Control, 2004.

3 Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings.

4 Regulations (Standards – 29 CFR) Bloodborne pathogens – 1910.1030. US Department of Labor, Occupational Safety and Health Administration.

What we don't know CAN hurt us.

However, many in-place protocols and practices may not consider that splashes and sprays can occur without healthcare worker knowledge (i.e., without an apparent "event"), leading to an unintended failure in protocol adherence and an increased exposure in healthcare worker risk. This is a point that bears repeating: eyewear contamination can occur without visible evidence. In a study of radiologist eyewear contamination during invasive vascular procedures, glasses worn were inspected for droplets post procedure. Approximately 6.7% of procedures resulted in glass splashes. In 40% of cases, radiologists were unaware of a splash and there was no known spray event. A significantly increased risk of spray event and eye splash occurred during procedures lasting longer than 30 minutes and during thrombolysis; a significantly increased risk of spray events occurred during angioplasty versus perfemoral arteriography; and a significantly increased risk of eye splashes occurred with more than two catheter changes.[1]

And, many protocols may not be adhered to stringently enough, simple due to human nature and the realities of behavior. Another study investigated attitudes toward and the impact of protective eyewear use during plastic surgery (local anesthetic skin lesion surgery), which is an even lower-risk environment than a cardiac one, for example. Though risk of contamination was recognized, behavioral change was only apparent in high-risk cases. Goggles were inspected for macroscopic splashes post surgery. Splashes occurred in nearly 30% cases but the surgeon was aware of a splash in only 14% of instances.[2] Based on experience, the Association of Surgical Technologists (AST) asserts that failure to wear and maintain proper eye protection, and failure to effectively remove and dispose of eye protection, can result in infection contamination.[3]

Depending on the type of eyewear used, the possibility of an unknown splash event, and the likelihood of error in assessing risk, it can be conferred that eyewear can both prevent ocular transmission and remain a source of contact and cross-contamination if not properly selected, cleaned, or disposed. Infection control protocols may need to be altered, particularly with regard to eyewear use in highly invasive settings. And, to date, few clinical resources are available to indicate whether disposable or reusable eyewear is more or less effective in the infection-prevention task.

1 Davidson IR, Crisp AJ, Hinwood DC, Whitaker SC, Gregson RH. Eye splashes during invasive vascular procedures. Br J Radiol. 1995 Jan;68(805):39-41.

2 McNamara IR, Tehrani H, Sassoon EM. Ocular contamination during lesional surgery. J Plast Reconstr Aesthet Surg. 2006;59(3):263-5.

3 Association of Surgical Technologists. AST Recommended Standards of Practice for the Use of Eye Protection During Invasive Surgical Procedures, April 13, 2008.

CURRENT RESEARCH

The reality of eyewear contamination.
A preliminary clinical study regarding protective eyewear use in an operating room (OR) setting was designed to further best- practice infection-control protocol development.[1] The study primary aim was to gather

data helpful in informing risk (infection, cross-contamination). A secondary aim was to gather data helpful in informing eyewear product selection and decontamination efforts.

The study protocol stands on the regulatory and standards-based recommendations (from OSHA, NIOSH, the CDC, and AST) regarding the use of eye protection to reduce the risk of injury and transmission of infectious material and disease. In the study facility setting, the in-place protocol specifies eyewear be selected based on anticipated level of injury, exposure, and vision needs; both the facility Standard & Contact Precautions as well as Bloodborne Pathogen Exposure Control Plan specify the need for eyewear use. (Droplet Precautions make no eyewear recommendation; Airborne Precautions do not address eyewear.) The pool of eyewear used in the OR, therefore, includes both disposable and reusable products, depending on individual choice. Protocol mandates disposable eyewear be

discarded immediately after use and reusable eyewear be decontaminated in accordance with defined criteria.

The study assumed that sprays or splashes can occur without healthcare provider knowledge (again, without an apparent "event") and that all members of a surgical team are often sprayed or splashed by potentially infectious material in the course of the workday. The study, therefore, sought to evaluate contamination levels of eyewear utilized in the OR, including by product type (disposable, reusable/non-disposable) and regarding decontaminated non-disposable products prior to re-entry into the OR suite and of all products upon exit from the OR suite.

A summary of study testing methods.
Over the study period (approximately 30 days), the type of eyewear worn by OR personnel was recorded, with prompt removal prior to exiting the

OR suite. All eyewear was swabbed and swabs were cultured for organism growth. Non-disposable products also were cultured for organism growth post decontamination.

To determine the level of microbial contamination and for disinfection efficacy testing, a single sterile swab moistened with trypticase soy broth (TSB) was wiped over the entire eyewear product surface. The swab was placed in 2 mL of TSB and immediately transported to the laboratory. After the swab in the TSB was vortexed for one minute in the Fisher Vortex Genie 2 on the highest (i.e., number 8) setting, 100 mL of the specimen was plated onto trypticase soy agar with 5% sheep blood by use of the spread plate technique.

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1 Victor R. Lange, CRC, MSPH, was the study principal investigator. The study was conducted independently. TIDI Products, LLC provided budget support and product.

The specimens were incubated at 37°C for 48 hours. Isolates were identified on the basis of Gram stain findings, colony morphology, detection of hemolysis on sheep blood agar, and colony pigmentation, as well as results of the tube coagulase test (for Staphylococcus species), detection of NaCl and results of the bile esculin test (for Enterococcus species), and detection of conidia by microscopy (for Aspergillus species). Susceptibility testing was performed on Staphylococcus aureus and enterococcal isolates by use of antibiotic-containing agars (6 mg/mL for oxacillin

and 6 mg/mL for vancomycin). All testing was completed under the direction of the investigator.

A summary of study findings.
Eyewear was collected from OR personnel participating in 71 surgical cases in four Ors during the study period. Power tools were used in 26.7% of the cases. 276 individual disposable pieces of eyewear and 39 reusable pieces of eyewear were recovered, isolated, and cultured for microbial contamination post OR use. The mix of products used, and therefore tested, was the result of healthcare worker choice. 104 of the 276

disposable pieces of eyewear (37.7%) and 37 of 39 reusable pieces of eyewear (94.9%) cultured positive for contamination post OR use.

To ascertain the remaining bioburden on reusable eyewear, the 39 pieces of reusable eyewear also were isolated for disinfection studies. Immediately after use, reusable eyewear pieces were disinfected with a germicidal wipe containing a quaternary/alcohol-based solution. The surface disinfectant was allowed to dry for two minutes in accordance with guidelines. Of the 39 pieces of reusable eyewear disinfected immediately after use, 29 of the 39 pieces (74.4%) contained microbial growth post-disinfection. This is possible due to the various intricate surface details within the reusable eyewear, product design/construction, which do not allow for 100% surface disinfection.

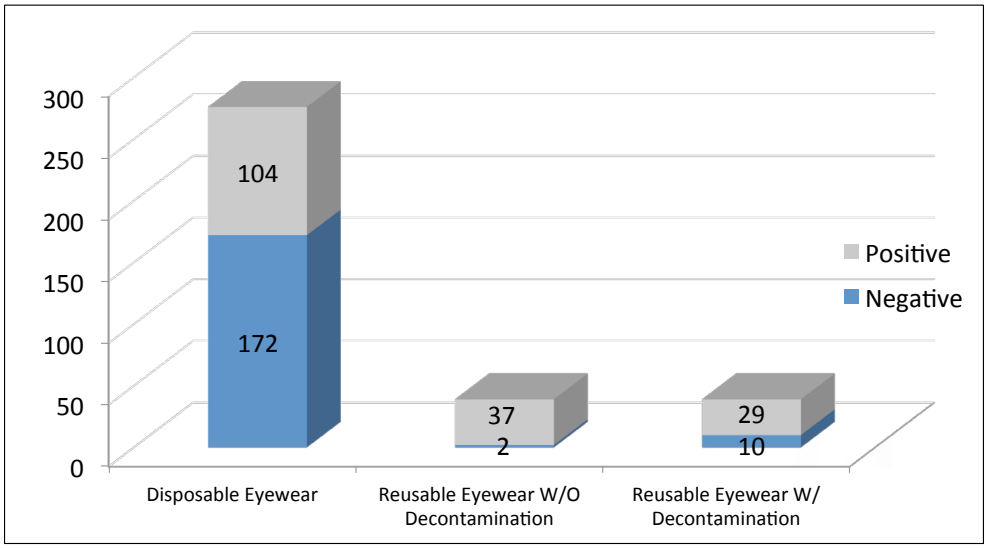

Figure 1. Eyewear Pieces Subjected to OR Contamination

Organisms identified in cultures.
Of the 276 disposable pieces and 39 reusable pieces studied, 141 pieces (104 disposable and 37 reusable pieces) tested positive for contamination (45%). Of the 141 pieces that tested positive, Coagulase Negative Staphylococcus colonies grew in 62 of 141 (43.9%) positive specimens. Remaining organisms consisted of Gram Positive Cocci (51 instances, 36.1%), Bacillus (15 instances, 10.6%), Diptheroids (8 instances, 5.6%) and Micrococcus species (5 instances, 3.5%).

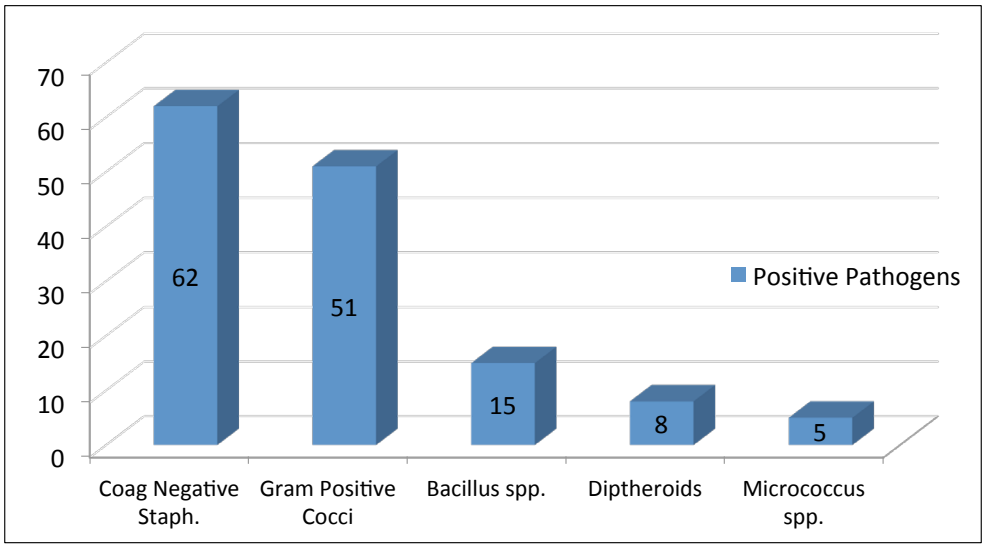

Figure 2. Microbial Analysis

RESEARCH CONCLUSIONS

It can be concluded that, while eyewear is intended for use as an infection-prevention tool, eyewear can increase cross-contamination and infection risk, particularly in high-risk spray or splash environments. Disposable eyewear can reduce the likelihood of inter-case contamination if not re-used between cases (i.e., if fresh eyewear is used regardless of perceived events). Standard disposable eyewear will not necessarily reduce cross-contamination risk within a case (should a spray or splash event occur without healthcare worker knowledge). Reusable eyewear, or eyewear with reusable components, may pose a risk of carrying bioburden due to the inability of disinfecting all surface details, thereby increasing cross-contamination risk. Simplified design is less likely to retain bioburden. Antimicrobial material components, on disposable, reusable, or hybrid products, may assist in cross-contamination prevention.

KEY TAKEAWAYS

- Infectious disease transmission can occur via mucous membranes of the eyes.
- Blood splashes can occur without healthcare provider knowledge.
- Eyewear can prevent transmission, as well as be a source of ongoing risk.
- Disposable eyewear may reduce inter-case, but not intra-case risk.
- Reusable eyewear may carry cross-contamination risk even with protocol-adhered decontamination.
- Eyewear with antimicrobial material or components could assist in reducing cross-contamination risk.

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www.tidiproducts.com
570 Enterprise Drive
Neenah, WI 54956
(920) 751-4300