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AST Guidelines for Best Practices in Use of Eye Protection During Surgical Procedures

Introduction

The following Guidelines for Best Practices were researched and authored by the AST Education and Professional Standards Committee, and are AST approved.

AST developed the Guidelines to support the healthcare delivery organization's (HDO) reinforce best practices eye protection during surgical procedures as related to the role and duties of the Certified Surgical Technologist (CST®), the credential conferred by the National Board of Surgical Technology and Surgical Assisting. The purpose of the Guidelines is to provide information OR supervisors, risk management, and surgical team members can use in the development and implementation of policies and procedures for eye protection during surgical procedures in the surgery department. The Guidelines are presented with the understanding that it is the responsibility of the HDO to develop, approve, and establish policies and procedures for the surgery department regarding eye protection practices per established HDO protocols.

Rationale

Pathogens can be transmitted through a variety of routes, including through the conjunctiva of the eye. This includes bacteria and viruses that can cause conjunctivitis (e.g., adenovirus, herpes simplex, *Staphylococcus aureus*), and bloodborne viruses (e.g., hepatitis B and C, and human immunodeficiency virus), herpes viruses, and rhinoviruses.¹ Additionally, infectious material can enter from rubbing or touching the eyes with contaminated fingers or objects.¹ Lastly, the eyes can be injured by projectile/airborne debris such as when bone is being drilled or sawed during an orthopedic procedure.² The use of power tools during orthopedic procedures increases spraying of body fluid and blood, including the use of pulse lavage such as during joint arthroplasty procedures.³

The Occupational Safety and Health Administration (OSHA) estimates that 1,000 eye injuries occur daily in U.S. workplaces, at an annual cost of \$300 million in lost production time, medical expenses, and workers' compensation.⁴ OSHA lists two of the primary reasons for eye injuries occurring at work is individuals not wearing eye protection or wearing the wrong kind of protection according to the work being performed.⁴ A Bureau of Labor Statistics survey of U.S. workers who suffered eye injuries revealed that nearly three out of five were not wearing eye protection at the time of the accident.⁴

CSTs, as well as the other members of the surgical team, are often splashed or sprayed by potentially infectious material during the workday placing them at a significant risk for acquiring a life-threatening infection. The first reported case of possible transmission of hepatitis B via the conjunctiva was reported in 1973. A renal dialysis department RN sustained an accidental splash in one eye with blood from a hepatitis B positive patient; soon after the incident she developed clinical symptoms that were confirmed by serologic testing.⁵ There have also been cases reported of healthcare workers (HCW) acquiring AIDS through the conjunctiva.^{6,7} The following is a summary of the literature review of studies to emphasize the importance of wearing appropriate eyewear protection during **all** surgical procedures, including endoscopic procedures.

- In a South African surgery department surgeons were requested to wear *facemasks* with an attached transparent plastic visor. The visors were collected postoperatively and inspected for macroscopic and microscopic blood splashes. Of those surgeons that participated the incidence of blood splashes was 45%.⁸ Interestingly, 59% of the surgeons who did not participate in the study also refused to wear facemasks with a visor.⁸
- A study was conducted of 100 consecutive procedures performed by a burn team wearing clean goggles, and the number of blood splashes on the goggles were counted after each procedure.⁹ There were 47 cases of potential eye splash injuries with seven of the splashes involving more than six blood droplets on the goggles.⁹
- A prospective study over six months was conducted to determine the incidence of blood splashes to the goggles and masks of surgeons and scrub personnel during cesarean sections (C-sections). Of the 144 C-sections, the rate of blood splashes on the surgeons' goggles was 63.2% and 16.0% on scrub personnel' goggles.¹⁰
- A prospective study was completed by a surgeon over a one-year period performing 384 procedures. 174 (45%) of the procedures revealed blood or body fluid splash on the lens of the wrap-round clear-lens protective glasses.¹¹ A high incidence of splashes was reported for amputations and vascular surgical procedures, and of significance, 50% of laparoscopic procedures were found to have blood or body fluid splash on the protective glasses' lens.¹¹ Operations that were longer than 30 minutes also had a higher incidence of blood or body fluid splash present on the lens.¹¹ Two important conclusions of the study stated that amputations contribute to blood and body fluids often being sprayed/airborne due to the use of bone cutters and power saws, and secondly, the projectile blood and body fluids during laparoscopic procedures may occur at the end of the procedure when ports are removed and pneumoperitoneum is released via the port sites.¹¹
- Two prospective, observational studies were conducted of dermatological surgery to determine if eye protection needed to be worn. One study assessed 100 dermatological procedures and the other 500 procedures. The first study reported 33% of the procedures produced at least one facial splash to the surgeon.¹² However, of even more importance, it was revealed that the use of monopolar electrocautery was significantly less likely to produce splashes as compared to bipolar electrocautery.¹² The second study reported blood splashes to the face shields of surgeons in 66.4% of the procedures.

- Another study confirmed blood splashes to eye shields during routine endourologic and laparoscopic procedures using standard endoscopy equipment. Masks with eye shields were collected, and macroscopically and microscopically examined from 118 procedures performed by five surgeons; additionally, the masks with eye shields were collected from assisting surgeons and scrub personnel.¹³ 48.5% of surgeons' masks, 29.5% of assisting surgeons' masks, and 31.8% of scrub personnel masks were positive for blood contamination.¹³
- A prospective study of 78 vascular procedures was completed over a 16-week period that reported a 51% contamination of surgeon's eye protection.¹⁴ The study also revealed that procedures of a lesser duration resulted in a lower risk of blood contamination.¹⁴ Holzmann, et. al. confirmed in their study that extensive procedures requiring more time are associated with an increased risk for blood contamination of the protective eyewear as compared to less extensive procedures. Additionally, wound size, wound location, and patient blood thinner use also affects *blood splash* and spraying incidents.²

Conclusions of the studies recommended the use of protective eyewear during all surgical procedures and the optimal type of eyewear being indirectly vented goggles. It must also be mentioned that some of the studies have similar statistics for blood splashes on protective eyewear, thus reinforcing the necessity for wearing protective eyewear.

Evidence-based Research and Key Terms

The research of articles, letters, nonrandomized trials, and randomized prospective studies is conducted using the Cochrane Database of Systematic Reviews and MEDLINE®, the U.S. National Library of Medicine® database of indexed citations and abstracts to medical and healthcare journal articles.

The key terms used for the research of the Guidelines include: blood splash; disposable face shields; eye protection; facemasks; goggles; personal protective equipment; other potentially infectious material; surgical mask; surgical space suits. Key terms used in the Guidelines are italicized and included in the glossary.

Guideline I

Eye protection must be consistently used by CSTs in conjunction with other *personal protective equipment (PPE)* (e.g., gloves, gown, mask or respirator) as a barrier to prevent potentially infectious material from entering the eye as mandated by the American National Standards Institute (ANSI), Centers for Disease Control and Prevention (CDC), and OSHA during all surgical procedures including endoscopic procedures, or in any situation where a splash or spraying injury to the eyes could occur.

1. CSTs are required to follow Standard Precautions as mandated by the Centers for Disease Control and Prevention (CDC), as well as follow HDO policies and procedures (P&P) for the prevention of the transmission of blood and *other potentially infectious material (OPIM)* including wearing *eye protection*.¹⁵
 - A. The OSHA bloodborne pathogens standard requires that personal protective equipment (PPE) is only considered effective and appropriate if it does not permit blood or OPIM to pass through to and reach the scrub

attire, skin, eyes, mouth or other mucous membranes under normal conditions and for the length of time of use.¹⁶

As stated in ANSI/ISEA Z87.1 *American National Standard for Occupational and Educational Personal Eye and Face Protection Devices*, eye protection is required when there is a reasonable probability of eye or face injury that could be minimized or prevented by use of eye protection.¹⁷ When the probability of eye injury exists, employers are required to provide the appropriate eye protection to employees per applicable state and federal regulations.¹⁷

Besides providing protection against blood-borne pathogens and OPIM, eye protection protects against the discharge of hot liquids during diathermy. A plastic surgeon, wearing gas-permeable contact lenses that were thought to provide enough protection, developed a significant corneal ulcer due to a diathermy-induced “spitting” of hot liquid during the excision of a skin lesion.¹⁸ The lenses do not offer sufficient eye protection as they leave the conjunctiva exposed and frequently slip off the cornea.¹⁸

OSHA requires that eye protection be ANSI certified per the ANSI/ISEA Z87.1. ANSI Z87.1 should be stamped on the lens or frame of the eye protection for confirmation.

- 1) Prescription eyeglasses and contact lenses are not considered eye protection and therefore, do not provide proper infection control protection.^{1,15,17,19}
 - a) Prescription eyeglasses with side protection do not adequately protect against splashes or sprays.^{1,20}
 - b) Contact lens users should meticulously practice hand washing guidelines when inserting, adjusting, or removing contact lenses.¹
- 2) Face shields that are open at the bottom and safety glasses do not provide proper infection control protection.^{1,21} Face shields provide secondary protection and primary eye protection, such as *goggles*, should also be worn.⁴
- 3) NIOSH also recommends that *disposable face shields* that are made of light weight films attached to a *surgical mask*, referred to as surgical mask with eyeshield, splashguard, or visor, should not be relied upon to provide optimal protection.¹

Guideline II

Goggles that are indirectly vented with a manufacturer’s anti-fog coating are the recommended protective eyewear that provide optimal protection from splashes, sprays, respiratory droplets, and debris (e.g., bone).^{1,22} A second type of protective eyewear that provides optimal protection is the surgical protection systems also referred to as body exhaust system, and informally called “*surgical space suits*” that are usually donned/used during orthopedic procedures.

1. Goggles must be indirectly vented; directly-vented goggles may allow the entrance of potentially infectious material by splashes or sprays.^{1,4}
 - A. The goggles must be as comfortable as possible, allow for sufficient peripheral vision, and be adjustable to ensure a secure fit.¹ The goggles must fit snugly across the brow from one corner of the eye to the other to be effective.^{1,17}
 - B. There are various styles of goggles that adequately fit over prescription glasses that don’t interfere with the fit of the prescription glasses. Additionally, wearers of prescription glasses can obtain prescription inserts for goggles.¹
2. The surgery department should obtain the manufacturer’s written information and instructions for use (IFU) for the goggles, and have the information available for surgery personnel.¹⁷
 - A. Prior to use, the CST should complete a thorough visual inspection of the goggles to identify possible defects, e.g., excessive scratches on the lens that could interfere with visualization of the surgical field; cracked lens; and broken parts.¹⁷
 - B. Goggles should be maintained in usable condition per manufacturer’s IFUs. During non-use, the goggles should be stored so that they are protected from damage.¹⁷
3. For non-disposable goggles, it is recommended that all surgery personnel are provided his/her own goggles that is only worn by that person to ensure the appropriate fit is maintained and minimize the potential of exposure to the wearer.¹ However, if the goggles are used by more than one person, the goggles should be cleaned and disinfected prior to use by another person.¹⁷

Guideline III

Goggles should be carefully removed to minimize blood and body fluid splashes to the mucous membrane, particularly the conjunctiva of the eye, as well as prevent other surgical team members from being splashed. The used goggles should be placed in a designated receptacle to be collected for cleaning and disinfection.¹

1. Removal of gloves can cause blood splatter; therefore, the eye and face protection should be removed last.
2. Goggles should only be handled and removed by the portion that secures it to the head (i.e., ties, elasticized band), since those are considered relatively clean, as opposed to the front and sides which are likely to be contaminated by splashes and sprays of blood and body fluids.^{1,15}

3. Upon removal, goggles should not be carried outside of the surgery department. HDO procedures and manufacturer's instructions should be followed for cleaning and disinfecting goggles.
 - A. A labeled container for used (potentially contaminated) goggles should be available in the surgery personnel change/locker rooms.¹ The used goggles should be placed in the container for collection to be taken to the decontamination room for cleaning and disinfection. The goggles should be physically cleaned and disinfected with the manufacturer's recommended disinfectant, thoroughly rinsed, and allowed to air dry.¹
 - B. If a CST needs the goggles for the next procedure, and another pair of goggles is not available, he/she should clean and disinfect the goggles, and dry using a non-linting, soft cloth to prevent scratching the lens. Non-sterile gloves should be worn when cleaning and disinfecting the goggles.¹

Guideline IV

The surgery department should review the policies and procedures (P&P) regarding use of eye protection during surgical procedures on an annual basis.

1. The surgery department should include members of the surgical team and administration when reviewing the P&Ps, including CSTs, surgeons, RNs, risk management, and infection control officer.
 - A. The surgery department should document when the P&Ps were reviewed, revision completed (if necessary), and who participated in the review process.
2. CSTs should be familiar with the P&Ps for use of eye protection during surgical procedures. The orientation of new employees should include reviewing the P&Ps.

Guideline V

CSTs should complete continuing education to remain current in their knowledge of the use of eye protection during surgical procedures.²³

1. The surgery department should provide training to the surgical personnel in the proper use, cleaning and disinfection, inspection, maintenance, storage, and limitations of the goggles.^{4,17}
2. The continuing education should be based upon the concepts of adult learning, referred to as andragogy. Adults learn best when the information is relevant to their work experience; the information is practical, rather than academic; and the learner is actively involved in the learning process.²⁴
3. It is recommended surgery departments use various methods of instruction to facilitate the learning process of CSTs.
 - A. If the education is primarily lecture, methods to engage learners include presentation of case studies for discussion, and audience discussion providing suggestions for reinforcing the use of eye protection.
 - B. Other proven educational methods include interactive training videos, and computerized training modules and teleconferences.
 - C. The continuing education should be delivered over short periods of time such as in modules, and not in a one-time lengthy educational session.

4. Continuing education programs should be periodically evaluated for effectiveness including receiving feedback from surgery department personnel.
5. The surgery department should maintain education records for a minimum of three years that include dates of education; names and job titles of employees that completed the continuing education; synopsis of each continuing education session provided; names, credentials, and experience of instructors.

Competency Statements

Competency Statements	Measurable Criteria
<ol style="list-style-type: none"> 1. CSTs are knowledgeable of Standard Precautions and implementing the standards in the surgery department to prevent the transmission of blood-borne pathogens. 2. CSTs are knowledgeable of the risks and hazards associated with lack of eye protection during surgical procedures. 3. CSTs have the knowledge and skills for properly using eye protection as part of the overall use of PPE. 	<ol style="list-style-type: none"> 1. Educational standards as established by the <i>Core Curriculum for Surgical Technology</i>.²⁵ 2. The didactic subjects of PPE including eye protection, Standard Precautions, transmission of infectious materials, and the hazards of blood-borne pathogens are included in a CAAHEP accredited surgical technology program. 3. Students demonstrate knowledge of the application of Standard Precautions including the proper donning of PPE in the lab/mock OR and during clinical rotation. 4. CSTs complete continuing education to remain current in their knowledge of PPE, blood-borne pathogens rules, Standard Precautions, and preventing the transmission of infectious diseases.²³

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Glossary

Blood splash: The discharge or airborne expulsion of blood during a surgical procedure.

Disposable face shields: Transparent, light-weight film, usually plastic, that is attached to a surgical face mask.

Eye protection: Any of several types of devices worn to protect the eyes from blood splashes and sprays, chemicals, liquids, and OPIM.

Facemasks: See surgical mask.

Goggles: Eye protection that completely encloses the eyes that consists of lenses, indirect vents, and an elastic band to hold the device in place.

Personal protective equipment (PPE): Garments and devices designed to protect the wearer's body from injury or infection including clothing, eye protection, gloves, and hair cover.

Other potentially infectious material (OPIM): Human body fluids other than blood including amniotic fluid, any body fluid that is visibly contaminated with blood, cerebrospinal fluid, pericardial fluid, peritoneal fluid, pleural fluid, saliva in dental procedures, semen, synovial fluid, and vaginal secretions.

Surgical mask: A single-use device made of fabric that is worn over the nose and mouth by surgical personnel to prevent contamination of the sterile field, and protect the wearer from splashes and sprays.

Surgical space suits: Informal name for surgical protection system or body exhaust system that consists of a large face shield that is attached to head gear, and fabric that covers the rest of the head, fully enclosing the head and neck; usually used during major orthopedic procedures.

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