

Work-Related Eye Injuries and Illnesses

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More than 65,000 work-related eye injuries and illnesses, causing significant morbidity and disability, are reported in the United States annually. A well-equipped eye tray includes fluorescein dye, materials for irrigation and foreign body removal, a short-acting mydriatic agent, and topical anesthetics and antibiotics. The tray should be prepared in advance in case of an eye injury. Eye patching does not improve cornea reepithelialization or discomfort from corneal abrasions. Blunt trauma to the eye from a heavy object can cause a blow-out fracture. Sudden eye pain after working with a chisel, hammer, grinding wheel, or saw suggests a penetrating globe injury. Chemical eye burns require immediate copious irrigation. Nontraumatic causes of ocular illness are underreported; work-related allergic conjunctivitis increasingly has been recognized among food handlers and agriculture workers who are exposed to common spices, fruits, and vegetables. The patient's history of eye injury guides the diagnosis. Primary prevention and patient counseling on proper eye protection is essential because over 90 percent of injuries can be avoided with the use of eye protection. As laser use increases in industry and medical settings, adequate personal protection is needed to prevent cataracts. Outdoor workers exposed to significant ultraviolet rays need sun protection and safety counseling to prevent age-related macular degeneration. Contact lenses do not provide eye protection, and physicians should be familiar with guidelines for the use of contacts in the workplace. (*Am Fam Physician* 2007;75:1017-22, 1024. Copyright © 2007 American Academy of Family Physicians.)

► Patient information:

A handout on work-related eye injuries and illnesses, written by the author of this article, is provided on page 1024.

More than 65,000 work-related eye injuries and illnesses cause job absenteeism in the United States every year.¹ Workers who have the highest risk of eye injuries include fabricators, laborers, equipment operators, repair workers, and production and precision workers. More than one half of work-related eye injuries occur in the manufacturing, service, and construction industries. Most chemical and thermal eye injuries occur when persons are at work.² Eighty-one percent of work-related eye injuries occur in men, and most occur in workers 25 to 44 years of age.¹

Eye Examination

The visual acuity of a patient with an eye injury should always be tested because vision changes provide objective tools to monitor clinical improvement or deterioration. Prepare an eye tray (*Table 1*) in advance, and perform irrigation in the event of a chemical burn. Use fluorescein dye and a cobalt-blue filtered light to detect corneal abrasions. After the assessment, gently irrigate the eye to diminish the risk of an adverse reaction to the dye, such as burning.³

Only a short-acting mydriatic agent (e.g., tropicamide [Mydracil]) should be used to

dilate the pupil. The effects of longer-duration agents (e.g., atropine, homatropine hydrobromide [Isopto Homatropine]) may last for days, impairing vision and preventing patients from driving. To reduce injury and discomfort, instill a topical anesthetic (e.g., tetracaine [Pontocaine], proparacaine [Ophthetic]) before using fluorescein or removing a foreign body. Only use anesthetics in the office; if a patient uses the medication at home, it can delay healing and mask complications.

Check the expiration dates of all medications and the batteries of handheld ophthalmoscopes. A slit lamp is useful, but a thorough examination with a handheld ophthalmoscope is adequate for most patients. Evert the eyelids by placing a cotton-tipped swab on top of the upper eyelid and rolling the lid over the swab; carefully inspect the eye for foreign bodies.

Diagnosis and Management

CORNEAL ABRASIONS

Eye pain after a trauma caused by a foreign body, rubbing, or a scratch suggests a corneal abrasion. Associated symptoms may include blinking, tearing, pain with eye movement, headache, blurry vision, and foreign body sensation. Some physicians treat noninfected corneal abrasions prophylactically with topical

SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>References</i>	<i>Comments</i>
Patching is ineffective for corneal abrasions and is not recommended.	A	5, 7	Consistent with multiple randomized controlled trials and good-quality patient-oriented evidence
Topical nonsteroidal anti-inflammatory drugs are only somewhat beneficial for symptom relief in patients with corneal abrasions and may delay healing.	B	7, 8	Consistent with evidence-based medicine and one randomized controlled trial
Mydriatic agents are ineffective for corneal abrasions and are not recommended.	A	9	Meta-analysis of randomized controlled trials and good-quality patient-oriented evidence
Persons with a chemical eye burn should receive copious fluid irrigation.	C	2, 13, 14	Consensus practice
Percutaneous skin tests should be used to assess a worker's reaction to allergens.	C	4	Consensus practice

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, see page 957 or <http://www.aafp.org/afpsort.xml>.

antibiotics, although the evidence supporting this practice is limited. Ointments are more soothing and persist on the cornea longer than eyedrops. Erythromycin and bacitracin (AK-tracin) are preferred over gentamicin (which may be toxic to corneal epithelium) and Neosporin (which has a relatively high allergic reaction rate).⁴

Studies have shown that eye patching does not improve corneal reepithelialization or discomfort and increases pain in one half of patients.⁵⁻⁷ The addition of a topical nonsteroidal anti-inflammatory drug (NSAID; e.g., ketorolac [Acular], diclofenac [Voltaren]) has been shown to be somewhat beneficial for symptom relief⁷ and for decreasing narcotic use and time off work; however, NSAIDs may delay healing.⁸ Mydriatic agents are no longer recommended to treat corneal abrasions because they offer no additional benefit.⁹ Regardless of the ocular agents used, always offer oral analgesics because pain may be severe. Advise the patient to avoid wearing contact lenses until the abrasion is healed and symptoms are resolved.

If symptoms and the abrasion improve after one day, reevaluate in two or three days. Refer the patient to an ophthalmologist for any of the following scenarios: a small- to moderate-sized abrasion has not resolved by the third day; the cornea has not improved at any of the follow-up examinations; symptoms do not decrease each day; or the edge of the abrasion is white or gray, which may indicate infection.⁷

Progression to recurrent corneal erosion (i.e., breakdown of the corneal epithelium) may occur years after a corneal abrasion. Symptoms of corneal erosion mimic the

Table 1. Suggested Eye Tray Contents for the Treatment of Eye Injuries

Medications

- Short-acting mydriatic agent (e.g., tropicamide [Mydracyl])
- Topical anesthetic (e.g., proparacaine [Ophthetic], tetracaine [Pontocaine])
- Topical antibiotics (e.g., bacitracin [AK-tracin], erythromycin)

Materials

- Basin to catch water during eye irrigation
- Cobalt-blue filtered light and fluorescein dye to detect corneal abrasions
- Cotton-tipped swabs to facilitate examination and foreign body removal
- Diluted sodium hypochlorite spray to disinfect work surfaces
- For chemical burns: intravenous drip tubing, one liter of isotonic saline, litmus or pH paper
- Handheld ophthalmoscope
- Hypodermic needle (18 gauge) for removal of foreign bodies and rust rings
- Loupe
- Sterile water

NOTE: An eye tray should be prepared in advance in case of an eye injury.

initial corneal abrasion, and tearing on awakening is common. Refer patients with recurrent corneal erosion to an ophthalmologist.

FOREIGN BODIES

Foreign bodies are common with corneal abrasions. After instilling topical anesthesia, remove superficial foreign bodies using a cotton-tipped swab soaked in saline. Remove minor irritants by irrigating the eye with eyewash solution. Soot from fires can contain toxic and allergenic particles that can further irritate the eye. For example, a firefighter can be exposed to rhus (e.g., poison ivy, sumac, and oak) from a brush fire. Foreign bodies embedded deeper into the cornea require removal with a hypodermic needle and using a slit lamp. If a foreign body is not easily removed, refer the patient to an ophthalmologist.

Oxidation of a ferrous foreign body in the eye can leave rust residue (“rust rings”). Remove rust rings to decrease inflammation and scarring.¹⁰ Before removal, instill a topical anesthetic. Place an 18-gauge needle on the end of a cotton-tipped swab or rotary drill. Hold the needle at 90 degrees to the affected surface of the eye, and gently scrape the ring until it is removed. Refer the patient to an ophthalmologist if you are uncomfortable performing the procedure, if the ring cannot be removed completely, if the ring has been present for one week or more, or if you suspect recurrent corneal erosion. Offer the patient an oral analgesic for pain relief.

BLUNT TRAUMA

Bleeding into the anterior chamber of the eye (hyphema), retina, or vitreous may suggest blunt trauma. Retinal detachment may present as a dark curtain covering part of the visual field. Advise the patient to remove contact lenses because swelling may prevent removal later, and refer him or her to an ophthalmologist.

Eyelid lacerations should be treated by a specialist, unless it is a small or partial-thickness laceration. Larger and deeper lacerations and those involving the lateral and medial edges of the eyelid or the eyelid margin can cause scarring, retraction, and the inability to

close the eyelid if they are not repaired properly. Lacerations involving the nasal portion of the upper or lower eyelids may damage the lacrimal drainage apparatus.

Penetrating injuries are caused by high-velocity impacts and should be suspected if sudden eye pain presents in patients who have used a chisel, hammer, grinding wheel, or saw. Pupil or lens changes (e.g., cataract, dark surface uveal tissue, vitreous hemorrhage) also are suggestive of a penetrating injury. Head injuries can dislocate the lens. A dilated pupil indicates a possible cerebral injury.¹¹

To evaluate the orbit for an intraocular fragment, dilate the pupil (unless intracerebral bleeding or swelling is suspected) and obtain an orbital computed tomography (CT) scan (axial and coronal views; thin cuts of 1 to 1.5 mm). If CT is not available, radiographs (up and down gaze views) are useful.¹¹ Use an ocular shield (a hard, protective cover) to avoid pressure on the orbit, and refer the patient to an ophthalmologist immediately if a fragment is detected.

CHEMICAL BURN

Ocular chemical burns make up a significant percentage of work-related eye injuries¹² and require rapid treatment. Alkalis (pH greater than 10) are more dangerous than acids (pH less than 4), with the exception of hydrofluoric acid,¹³ because they may penetrate the cornea for an extended period. Litmus or pH paper can assist in determining alkalinity or acidity. Although most chemical burns are mild and without residual effects, patients with severe burns have a poor prognosis.²

For a chemical eye burn, immediately begin copious irrigation with one liter of physiologic saline over one to two hours using intravenous drip tubing.^{2,13,14} Promptly refer the patient to an ophthalmologist¹⁴; irrigation can be continued during transportation for definitive treatment.¹⁵ Use litmus or pH paper to judge the response to irrigation. When the pH level is near neutral (6 to 8 pH), discontinue irrigation. Hydrofluoric acid burns are common in the semiconductor industry, and treatment

Recurrent corneal erosion may occur years after a corneal abrasion injury.

Work-related allergic conjunctivitis has been increasingly reported among food handlers and agricultural workers.

is similar to other chemical burns using isotonic saline, isotonic magnesium chloride solution, or Hexafluorine (a hypertonic, amphoteric, chelating solution).¹⁶ Instill a topical anesthetic before irrigation to diminish pain.

The composition of a chemical can be obtained from Material Safety Data Sheets, which are required at some workplaces, or by contacting the Agency for Toxic Substances and Disease Registry (<http://www.atsdr.cdc.gov>).

CONJUNCTIVITIS

Work-related allergic conjunctivitis increasingly has been reported among food handlers and agriculture workers exposed to common spices, fruits, and vegetables. Workers may be unaware that a work-related allergen is causing recurrent conjunctival symptoms, often including rhinitis and asthma. Improvement in symptoms when the patient is not at work is suggestive of work-related allergic conjunctivitis, and a family history of allergic conjunctivitis often is present. Percutaneous skin tests can reveal reactions to allergens, and cross-reactivity is common.^{4,17,18} Outdoor workers are at increased risk of allergic reactions to grass, ragweed, and rhus.¹⁹ Allergic conjunctivitis is characterized by red, itchy eyes; serous or ropy secretions; bulbar conjunctiva swelling; and red, hypertrophic papillae under the upper eyelid.²⁰

Treatment of allergic conjunctivitis includes avoidance of the allergen and the use of topical mast cell stabilizers (e.g., lodoxamide [Alomide], cromolyn [Crolom]). Topical corticosteroids are helpful but increase the risk of glaucoma and cataracts, and long-term use is associated with systemic adverse effects. Antihistamine eye-drops (e.g., ketotifen fumarate [Zaditor], olopatadine [Patanol]) are alternatives to topical corticosteroids.²¹

Bacterial conjunctivitis generally presents as copious discharge and puffy eyelids. Most bacterial conjunctivitis cases are self-limited to five to seven days, although topical antibiotics can reduce recovery time.²²

Patients with acute bacterial conjunctivitis should not return to work until the discharge clears.

Viral conjunctivitis often is associated with an upper respiratory infection and is characterized by diffuse conjunctival injection, a serous discharge, and excessive eye watering. An education program and infection control policy for viral conjunctivitis would be helpful in the workplace. The risk of spreading the disease is reduced with frequent handwashing and by not sharing towels. Adenovirus can remain viable for 72 hours on work surfaces such as counters and doorknobs; therefore, a diluted sodium hypochlorite spray should be used to disinfect work surfaces. Workers who present with viral conjunctivitis symptoms should not go to work for seven to 10 days after the onset of symptoms (the most infectious period),²³ although this may not be practical for many patients.

Prevention

Ninety percent of work-related eye injuries are preventable with adequate eye protection.²⁴ Educate your patients about the benefits of eye protection and proper maintenance of equipment.²⁵ Easy access to an eyewash method also is important.

The Occupational Safety and Health Administration (OSHA) mandates that employers provide workers with adequate eye protection.²⁶ Safety goggles should have proper vents (indirect), and side shields are particularly important in an industrial setting where flying dust and other particles are often present. However, goggles with side shields do not offer sufficient protection against dust, fumes, and vapors for persons who wear contacts.²⁶ Cleaning solution for contact lenses and storage for eye protection equipment should be available in the workplace.²⁶

Because laser use has increased in industrial and medical settings, adequate personal protection is needed to prevent cataracts. Welding causes 1,200 eye injuries annually in the United States.¹ Optical radiation from welding can affect the eyes and skin, and protective equipment, including a welder's helmet and safety goggles, are essential.²⁷

Table 2. OSHA Safety Recommendations for Workers Who Wear Contact Lenses

Avoid the following chemicals when wearing contacts: acrylonitrile; 1,2-dibromo-3-chloropropane; ethylene oxide; methylene chloride; 4,4' methylenedianiline

Wear well-fitting, indirectly vented goggles or a full-face respirator to prevent exposure to chemical and caustic hazards (close-fitting safety goggles with side shields do not provide sufficient protection)

Use a wetting agent or artificial tears to decrease dry eyes

If a chemical burn occurs, do not delay irrigation to remove contact lenses; if the lenses are not flushed out with irrigation, they may be removed after irrigation

OSHA = Occupational Safety and Health Administration.

Information from reference 26.

For outdoor workers, significant exposure to ultraviolet rays has been associated with age-related macular degeneration. These workers should receive counseling about sun protection.²⁸ The preventive benefits of antioxidants (e.g., from dark-green, leafy vegetables) against age-related macular degeneration require further investigation.²⁹

Contact Lens Use

Over 24 million working adults in the United States wear contact lenses, which offer no eye protection.³⁰ The OSHA guideline (*Table 2*)²⁶ recommends that workers who wear contact lenses wear appropriate safety eyewear (i.e., impact-resistant polycarbonate safety glasses),²⁶ that they remove contact lenses (with clean hands if possible) when eye irritation occurs, and that they avoid wearing lenses when working with certain chemicals.²⁶

Previously, workers who used respirators were advised to avoid wearing contact lenses.³¹ It has been shown, however, that wearing glasses with a respirator decreases the visual field, and that wearing contact lenses is safer than glasses.⁶

Police officers often are at risk of head trauma during an altercation. Those with distant vision worse than 20/80 should use soft contact lenses rather than hard or conventional lenses because soft lenses are less likely to fall out and compromise the officer's ability to act in self-defense.

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