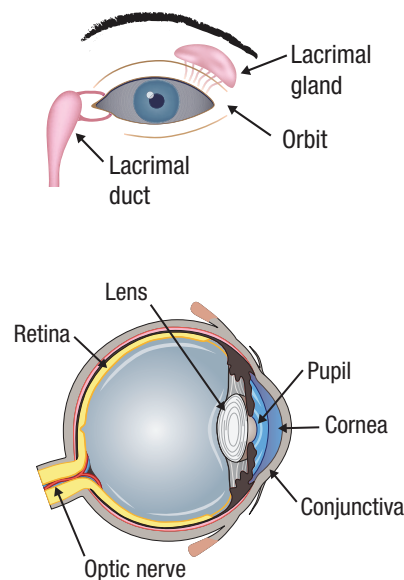


Keeping Your Eyes Healthy

Radiation to the brain, eye, or eye socket (orbit) during treatment for childhood cancer can have a long-lasting effect on the eyes. Radioiodine (I-131) treatment and chronic graft-versus-host disease (an immune response that can develop after bone marrow or stem cell transplant) can also affect the eyes. Because vision can have a significant impact on daily living, it is important for survivors who received these treatments to have their eyes checked regularly.

How do the eyes work?

The eyes are remarkable organs, allowing light to be converted into impulses that are transmitted to the brain, where images are perceived. The eyes are located in the area of the skull known as the **orbit** or eye socket. A thin layer of tissue called the **conjunctiva** covers and protects the eye and eyelids. Tears are produced in the **lacrimal gland**, located in the outer corner of the eye socket, above the eyeball. Tears flow over the eye, providing lubrication, and drain into a tiny canal at the inner corner of the eye, called the **lacrimal duct**. Light enters the eye through a clear layer of tissue known as the **cornea**. The cornea bends and focuses the light, and sends it through the opening of the eye known as the **pupil**. The pupil controls how much light enters the eye. Behind the pupil is the **lens** of the eye, which focuses the light onto the **retina**, the membrane along the back wall of the eye. The nerve cells in the retina change the light into electrical impulses and send them through the **optic nerve** to the brain, where the image is perceived.



What eye problems can develop following treatment for childhood cancer?

Cataracts: Clouding of the lens of the eye. When this happens, light cannot pass through the lens easily. Common symptoms of cataracts include painless blurring of vision, sensitivity to light and glare, double vision in one eye, poor night vision, fading or yellowing of colors, and the need for frequent changes in glasses or contact lens prescriptions (see related Health Link: Cataracts).

Xerophthalmia: Dry eyes resulting from decreased tear production due to radiation or chronic graft-versus-host disease. Symptoms include pain at the surface of the eye and light sensitivity.

Lacrimal duct atrophy: Shrinking of the lacrimal duct, which drains tears from the eye. Lacrimal duct atrophy can result in problems with increased tearing. This can be caused by radiation to the eye or orbit, or by radioiodine (I-131) therapy given for treatment of thyroid cancer.

Other eye problems:

The following eye problems are less common and are usually seen only in survivors who had radiation doses of 30 Gy or 3000 cGy/rads or higher directed at the eye or orbit:

Orbital hypoplasia: Underdevelopment of the eye and surrounding tissues, caused by radiation to the

eye or orbit. This can result in a small eye and orbit (orbital hypoplasia).

Enophthalmos: Sunken eyeball within the orbit as a result of radiation.

Keratitis: Inflammation of the cornea (the clear, outer surface of the eye). This can cause pain at the surface of the eye and light sensitivity.

Telangiectasias: Enlargement of blood vessels in the white part of the eye. These do not usually cause any symptoms, but are sometimes bothersome because of their appearance.

Retinopathy: Damage to the retina (the back surface of the eye where visual information is passed from the eye to the brain). Painless vision loss is the major symptom of retinopathy.

Maculopathy: Damage to the macula (area of central vision within the retina), which may result in blurred vision.

Optic chiasm neuropathy: Damage to the nerves that send visual information from the eye to the brain. This can result in vision loss.

Papillopathy: Swelling of the optic disc (area where the optic nerve enters the eye).

Glaucoma: Increased pressure within the eye. This can damage the optic nerve and result in vision loss.

What cancer therapies increase the risk of developing these eye complications?

- Radiation therapy at doses of 30 Gy (3000 cGy/rads) or higher to the following areas increases the risk of treatment-related eye problems:
 - Eye
 - Orbits
 - Head/brain
- Other factors that may increase the risk for developing certain eye problems include:
 - Radioiodine (I-131) treatment for thyroid cancer (increased risk for lacrimal duct atrophy)
 - Chronic graft-versus-host disease following bone marrow, cord blood, or stem cell transplant (increased risk for xerophthalmia)
 - Diabetes mellitus (increased risk for problems involving the retina and optic nerve)
 - High blood pressure (increased risk of optic chiasm neuropathy)
 - Frequent exposure to sunlight (increased risk for cataracts)
 - Certain chemotherapy drugs, such as, actinomycin-D and doxorubicin, which can increase the risk of eye problems when given together with radiation.

What monitoring is recommended?

- Evaluation by an eye specialist (ophthalmologist or optometrist) at least once a year is recommended for any one who:
 - Had radiation to the head, brain, eyes or total body (TBI)
 - Had a tumor involving the eye

- Has graft-versus-host disease (as a result of bone marrow, cord blood, or stem cell transplant)

Note: An ophthalmologist is a medical doctor (MD or DO) who specializes in eye problems—this is different from a doctor of optometry (OD), who is also a vision specialist but not a medical doctor. Examination by an eye specialist should include vision screening, examination for cataracts, and a full examination of the internal structures of the eye. People who develop vision problems should be followed regularly by an ophthalmologist.

- Evaluation by an ocularist (a trained person who makes and fits artificial eyes) at least once a year is recommended for anyone who has had:
 - An eye removed because of cancer treatment and/or complications related to treatment
 - An artificial eye (prosthesis) that does not fit well
- Evaluation by an ophthalmologist is recommended on an as-needed basis for people who had Radioiodine (I-131) treatment, if they develop excessive tearing.

If you develop any of the following symptoms, seek prompt medical evaluation. In some cases, referral to an ophthalmologist may be needed:

- Blurry vision
- Double vision
- Blind spots
- Sensitivity to light
- Poor night vision
- Persistent irritation of surface of eye or eyelids
- Excessive tearing/watering of eyes
- Pain within the eye
- Dry eyes

How are eye problems treated?

Cataracts: Not all cataracts need treatment. In many cases, an ophthalmologist may monitor the vision closely over many years, and will recommend treatment if and when it becomes necessary. The only treatment for cataracts is surgical removal of the lens and replacement with an artificial lens. Today, cataract surgery is a low-risk procedure that is performed on an outpatient basis and works well in restoring vision.

Orbital hypoplasia: Usually no treatment is needed for orbital hypoplasia. In severe cases, rebuilding of the bones around the eye may be possible.

Enophthalmos: Plastic surgery can be done to build up the orbit.

Lacrimal duct atrophy: A surgical procedure to widen the tear drainage system can be performed if heavy tearing is a significant problem.

Xerophthalmia: Treatment of dry eye includes the frequent use of artificial tears (eye drops) or ointments

to moisten the surface of the eye. In severe cases, the tear drainage system can be blocked by surgery to reduce the drainage of tears from the eye.

Keratitis: The frequent use of artificial tears (eye drops) or ointments to moisten the surface of the eye is recommended. Patching the affected eye during sleep may also promote healing. Keratitis caused by infection is treated with antibiotic eye drops or ointment. Rarely, surgical replacement (transplant) of the cornea is necessary.

Telangiectasias: No treatment is necessary.

Retinopathy and maculopathy: Retinopathy may require laser or photocoagulation (heat) treatment of the retina. Rarely, surgery to remove the eye is necessary in severe cases.

Optic chiasm neuropathy: No treatment available.

What can be done if there is impaired vision?

If impaired vision is detected, it is important to follow the recommendations of your ophthalmologist regarding treatment. If vision is not correctable, services are available in most communities to assist people with visual impairments.

In addition, in the United States, services are available for people under 22 years of age through the local public school district or referral agencies (available under the Individuals with Disabilities Education Act, PL 105-17). Sometimes special accommodations, such as seating in the front of the classroom are all that is needed, but this usually requires that the parent request an Individualized Education Plan (IEP) for the child through the school district (see related Health Link: "Educational Issues Following Treatment for Childhood Cancer").

The Americans with Disabilities Act (ADA, PL 101-336) guarantees people with visual impairment equal access to public events, spaces, and opportunities.

How can I protect my vision?

It's important to protect your eyes whether or not you have treatment-related eye disorders. Precautions you can take include:

- Wear sunglasses with ultraviolet (UV) protection when in bright sunlight.
- When participating in sports, be sure to select protective eyewear that is appropriate for the sport. Eyewear worn for sports should be properly fitted by an eye care professional.
- Avoid toys with sharp, protruding, or projectile parts.
- Never play with fireworks or sparklers of any kind to avoid accidental injury.
- Be careful when working with hazardous household chemicals.
- Wear protective eyewear when using a lawnmower, power trimmer, or edger, and when working with dangerous equipment in the workshop.
- If you do experience an eye injury, seek medical attention promptly.

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Additional health information for childhood cancer survivors is available at www.survivorshipguidelines.org

Note: Throughout this *Health Links* series, the term “childhood cancer” is used to designate pediatric cancers that may occur during childhood, adolescence, or young adulthood. Health Links are designed to provide health information for survivors of pediatric cancer, regardless of whether the cancer occurred during childhood, adolescence, or young adulthood.

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