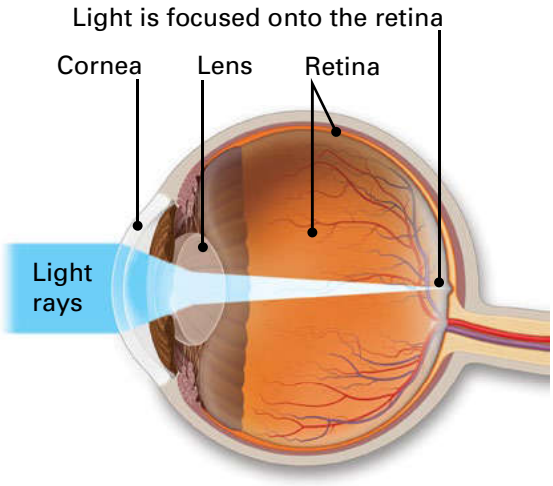
Refractive Errors

What are refractive errors?

Refractive errors are vision problems that happen when your eye does not refract (bend) light properly.

For you to see clearly, light rays must travel through your cornea and lens. The cornea and lens refract the light so it lands on the retina. The retina turns light into signals that travel to your brain and become images. With refractive errors, the shape of your cornea or lens prevents light from bending properly. When light is not focused on the retina as it should be, your vision is blurry.



In a normal eye, the cornea and lens focus light rays on the retina.

Eye Words to Know

Cornea: Clear, dome-shaped window of the front of your eye. It focuses light into your eye.

Lens: Clear part of the eye behind the colored iris. It helps to focus light on the retina (back of the eye) so you can see.

Retina: Nerve layer at the back of your eye. It sends light signals to the brain so that you can see.

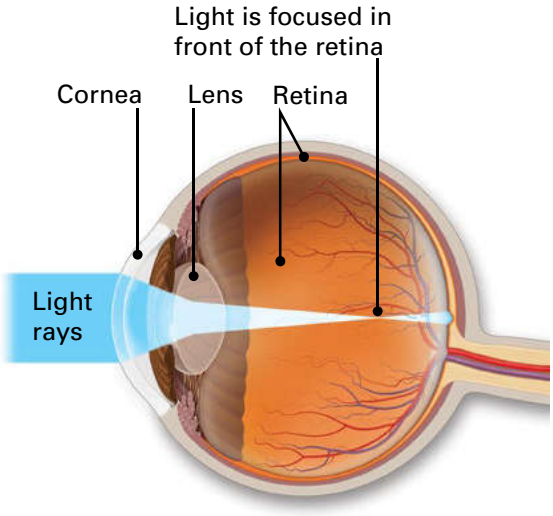
Types of refractive errors

There are 4 basic types of refractive errors.

Myopia (nearsightedness). This is when close-up objects look clear but distant objects are blurry. For instance, you can read a map clearly but have trouble seeing well enough to drive a car.

Myopia is caused by a cornea that is too steeply curved. It can also be caused by an eye that is longer than normal. In both cases, light rays are focused in front of the retina instead of on it.

Myopia is inherited, meaning that if your parents have it, you may too. Children with myopia are often diagnosed between the ages of 8 and 12. As teenagers, when their bodies grow quickly, their myopia can worsen. But between the ages of 20 and 40, myopia changes very little.

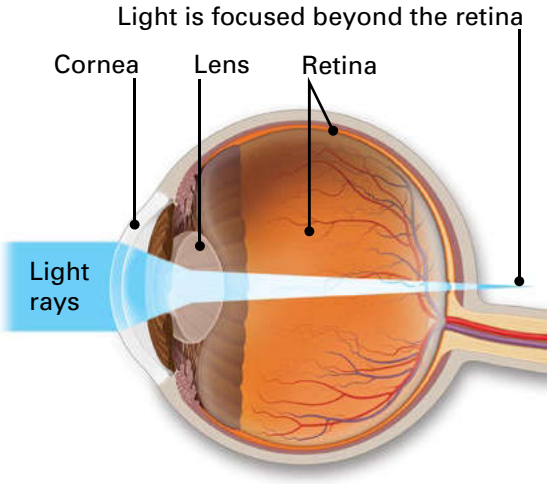


In myopia, the eye is too long or the cornea is too steep. Distant objects appear blurry because images focus in front of the retina instead of on it.

Mild myopia is called **low myopia**. Severe myopia is called **high myopia**. People with high myopia face a higher risk of having a detached retina. This is when the tissue lining the back of your eye lifts away or detaches from the eye wall. It is a serious eye problem that can cause blindness. It is important to visit an ophthalmologist regularly for exams to check the retina.

Hyperopia (farsightedness). This is when distant objects look clear but close-up objects are blurry. You might have trouble reading a book, but you can see far-away buildings clearly.

Hyperopia happens when your cornea is too flat or your eye is shorter than normal. Like myopia, hyperopia is often inherited.



In hyperopia, the eye is too short or the cornea is too flat. Close objects appear blurry because images focus beyond the retina.

Most babies and young children tend to have mild hyperopia without blurry vision. Their eyes can focus so that they have clear vision at both near and far distances. As their eyes grow and get longer, their hyperopia generally lessens.

As we get older, we gradually lose our ability to focus. Adults with hyperopia may have trouble reading or doing close-up work.

Astigmatism (distorted vision). This condition distorts or blurs vision for both close-up and distant objects. Things can look too tall, wide or narrow. Straight lines can look bent.

Astigmatism happens when your eye is not perfectly round like a ball. Basically, it is when your eye is shaped more like a football than a basketball. You can have astigmatism along with myopia or hyperopia.

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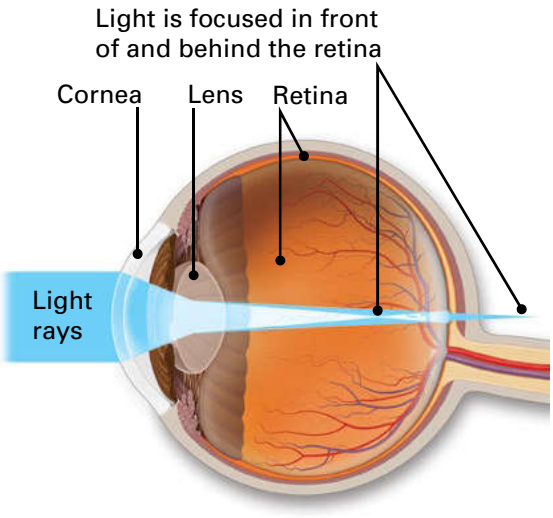

In astigmatism, the cornea is uneven. Images focus in front of and beyond the retina, causing both close and distant objects to appear blurry.

Presbyopia ("aging eye"). This is when you have trouble reading and seeing close objects. It is a natural part of aging. Presbyopia usually begins after age 40.

The eye's lens needs to change shape to focus. When we are young, our lenses can change shape easily. After age 40, the lens becomes less flexible. That makes it more difficult to see things up close.

You can have presbyopia along with myopia, hyperopia, or astigmatism.

Correcting refractive errors

Eyeglasses or contact lenses. These are the easiest and most common ways to correct vision problems caused by refractive errors. They adjust your vision so that you can see more clearly. An eye care provider tests your vision and, as needed, gives you a prescription for glasses or contact lenses. Over time, you will need new prescriptions as your eyes change.

There are many options to consider when buying glasses or contacts. Talk with your eye doctor about the lens choices that can meet your vision and lifestyle needs.

Getting glasses?

Here are options to consider:

- Special coating to protect your eyes from harmful ultraviolet (UV) light.
- Polycarbonate lenses (for goggles or eyeglasses). These protect your eyes from injury during sports, woodworking, or other tasks.
- Bifocals. These allow you to see distant objects clearly while looking through the top of the lens. You can read or do close tasks looking through the bottom of the lens.
- Trifocals or progressive lenses. You can look through different parts of the lens for clear vision at different distances.
- Reading glasses. You can buy these "over the counter" (without a prescription) or get prescribed ones to see things up close.

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Refractive surgery. This type of surgery corrects your eye's refractive errors to improve vision. In most cases, an ophthalmologist reshapes the cornea to adjust how light travels through it. Here are some of the more common procedures.

- **LASIK.** Your ophthalmologist creates a thin flap in your cornea and uses a laser to reshape the tissue.
- **Epi-LASIK.** Similar to LASIK, your ophthalmologist creates a flap in your cornea to reshape the underlying tissue. However, the flap in this procedure is made from a much thinner sheet of cells than in LASIK.
- **PRK.** Like LASIK, corneal tissue is reshaped to allow light to focus properly on the retina. With PRK, though, your ophthalmologist does not create a flap of tissue on the cornea. Instead, the cornea's entire outer layer of cells (called the epithelial layer) is removed. Then the exposed part of the cornea is treated with a laser. The epithelial layer grows back a few days after the procedure.

There are other procedures to correct refractive errors. For instance, **refractive lens exchange (RLE)** replaces the natural lens with an artificial one (called an intraocular lens or IOL). The new lens refracts light differently to provide better vision. Different IOLs provide different options for vision correction.

As with any surgery, refractive surgery carries risks of possible complications and side effects. For instance, after having a refractive procedure, you may see glare or rings (halos) around lights. You might also have poor night vision.

Talk with your ophthalmologist about your vision needs and expectations. Together you can explore your options for achieving better vision.

Summary

Refractive errors are vision problems that happen when your eye does not refract (bend) light properly. When your cornea or lens does not focus light properly on the retina, your vision is blurry.

There are four basic refractive errors: myopia (nearsightedness), hyperopia (farsightedness), astigmatism (distorted or blurry vision at any distance) and presbyopia (loss of near vision with age). When light is not focused on the retina as it should be, your vision is blurry.

Refractive errors can be corrected with eyeglasses, contact lenses and surgery. You and your ophthalmologist can discuss the best way to correct your refractive error.

Get more information about eye health from EyeSmart—provided by the American Academy of Ophthalmology—at **aao.org/eyesmart**.

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