

# Refractive Error & Visual Acuity

## What is refractive error?

Refractive error occurs when the eye is unable to focus light because it does not fall properly on the retina, causing vision to be blurry. For clear vision, light rays reflecting from an object need to fall directly onto the macula (the central part of the retina) in the back of the eye. The different parts of the eye and the length of the eye determines if the light rays focus on the back of the eye – this includes the cornea (the clear front surface of the eye), the lens (helps to bend the light toward the retina), and the liquid inside the eye (aqueous humor and vitreous). If the light does not focus on the retina, then blurry vision will result and this blurred vision is called refractive error.

## What are the types of refractive errors?

### Myopia (Nearsightedness):

Myopia occurs when the eyeball is too long for light rays to focus properly on the retina. As a result, images of distant objects, such as road signs, appear blurred.

### Hyperopia (Farsightedness):

Hyperopia occurs when the eyeball is too short for light rays to focus properly on the retina. As a result of moderate amounts of hyperopia, images of near objects, such as a text on a smartphone, appear blurred.

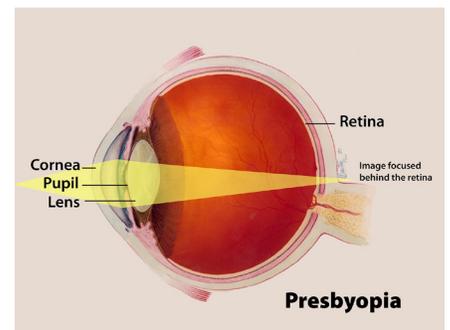
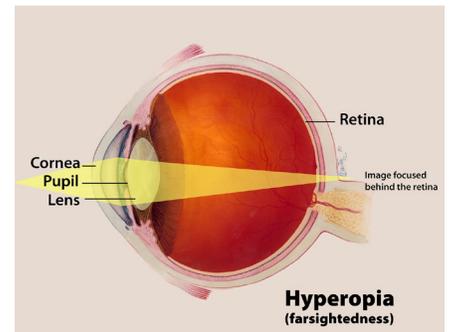
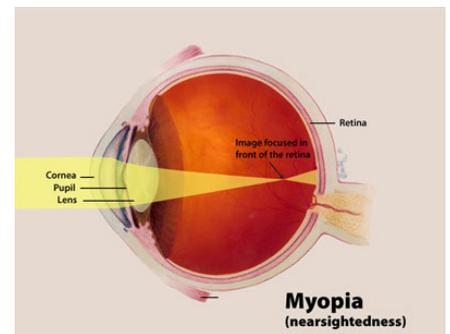
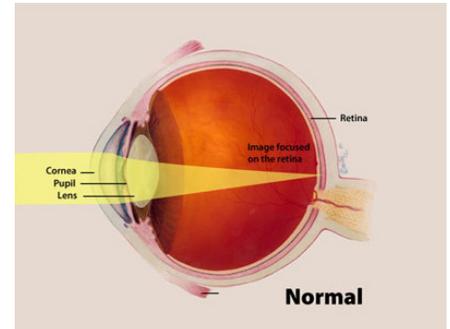
### Astigmatism:

Astigmatism occurs primarily from an irregular shape of the front surface of the cornea at the front of the eye. In astigmatism, the cornea tends to be shaped more like a football instead of a basketball, and this difference in shape causes light rays to scatter across the retina instead of focusing properly on the retina. Astigmatism can cause blurriness of objects up close and far away.

### Presbyopia:

Presbyopia is a condition that tends to occur with aging – usually age 40 and older – where a person is unable to see objects clearly up close. This occurs when the lens of the eye hardens with aging and is no longer able to focus clearly for near objects. Reading glasses can help to read and view near objects.

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# Refractive Error & Visual Acuity *(Continued)*

## How common is refractive error?

Uncorrected refractive error is the most common cause of vision impairment worldwide and the second most common cause of blindness according to World Health Organization (WHO). Globally, it is estimated that 153 million people have significant vision impairment that affects their distance vision due to uncorrected refractive error. In addition, 517 million people do not have proper correction for presbyopia.

In the United States, more than 48 million people over age 40 years have refractive error. It is estimated that 16 million people ages 12 years and over have uncorrected and/or undiagnosed refractive error.

Uncorrected refractive error occurs in all ages and ethnicities and can affect education, employment, health, and quality-of-life. Recent studies have shown that an increasing number of children are getting myopia because of many reasons, including reduced play time outdoors and increased screen time.

## What is visual acuity and how does visual acuity differ from refractive error?

Refractive errors occur when the structure of the eyes will not allow light rays reflecting from objects to focus properly at the retina found in the back of the eye. When looking at an object, each eye receives a separate image of that object. The information from each eye is then combined into one image in the part of the brain, where vision actually occurs. Visual acuity is the measurement of the sharpness or clearness of how well the brain “sees” that object.

## How is visual acuity measured?

Visual acuity is usually measured with an eye chart using letters, numbers, or symbols – called “optotypes”. Visual acuity is defined as the quantifiable measurement of the sharpness or clearness of eyesight when naming black optotypes on the white background of an eye chart (e.g., a Snellen chart or Lea chart). “Normal” visual acuity is 20/20. This means a person can see clearly the majority of optotypes on the 20/20 line of the eye chart when standing 20 feet away from the eye chart.

What does a visual acuity of 20/40 mean? If a person has a visual acuity of 20/40, the person can see a letter or symbol from 20 feet away the same as a person with normal eyesight would see it from 40 feet away. Here is an example. Let’s say Johnny has a visual acuity of 20/20 and Jane has a visual acuity of 20/40. If Johnny and Jane stood 20 feet away from an eye chart, John could move backward 40 feet from the eye chart and still see clearly those same optotypes Jane can only see clearly standing 20 feet from the eye chart. If Jane joined Johnny 40 feet from the eye chart, Johnny could see the optotypes clearly, but Jane would see blurry optotypes and likely would need prescription eyeglasses to see what Johnny can see.

## How are refractive errors corrected?

Refractive errors are usually easily corrected with optical corrections, specifically prescription eyeglasses and contact lenses. Refractive errors can also be corrected by refractive surgery.

If you or your child shows any signs of eye problems or blurry vision, you should visit an eye care professional for a comprehensive eye exam.

Prevent Blindness partners with many leading organizations to provide free exams and/or eyeglasses. For more information on these programs, call (800) 331-2020 or visit [www.preventblindness.org](http://www.preventblindness.org).