

Astigmatism

Astigmatism is a vision condition that causes blurred vision due either to the irregular shape of the cornea, the clear front cover of the eye, or sometimes the curvature of the lens inside the eye. An irregular shaped cornea or lens prevents light from focusing properly on the retina, the light sensitive surface at the back of the eye. As a result, vision becomes blurred at any distance.

Astigmatism is a very common vision condition. Most people have some degree of astigmatism. Slight amounts of astigmatism usually don't affect vision and don't require treatment. However, larger amounts cause distorted or blurred vision, eye discomfort and headaches.

Astigmatism frequently occurs with other vision conditions like [nearsightedness \(myopia\)](#) and [farsightedness \(hyperopia\)](#). Together these vision conditions are referred to as refractive errors because they affect how the eyes bend or "refract" light.

The specific cause of astigmatism is unknown. It can be hereditary and is usually present from birth. It can change as a child grows and may decrease or worsen over time.

A [comprehensive optometric examination](#) will include testing for astigmatism. Depending on the amount present, your optometrist can provide eyeglasses or [contact lenses](#) that correct the astigmatism by altering the way light enters your eyes.

Another option for treating astigmatism uses a corneal modification procedure called [orthokeratology \(ortho-k\)](#). It is a painless, non-invasive procedure that involves wearing a series of specially designed rigid contact lenses to gradually reshape the curvature of the cornea.

[Laser surgery](#) is also a possible treatment option for some types of astigmatism. It changes the shape of the cornea by removing a small amount of eye tissue. This is done using a highly focused laser beam on the surface of the eye.

What causes astigmatism?



Astigmatism occurs due to the irregular shape of the cornea or the lens inside the eye. The cornea and lens are primarily responsible for properly focusing light entering your eyes allowing you to see things clearly.

The curvature of the cornea and lens causes light entering the eye to be bent in order to focus it precisely on the retina at the back of the eye. In astigmatism, the surface of the cornea or lens has a somewhat different curvature in one direction than another. In the case of the cornea, instead of having a round shape like a basketball, the surface of the cornea is more like a football. As a result, the eye is unable to focus light rays to a single point causing vision to be out of focus at any distance.

Sometimes astigmatism may develop following an eye injury or eye surgery. There is also a relatively rare condition called [keratoconus](#) where the cornea becomes progressively thinner and cone shaped. This results in a large amount of astigmatism resulting in poor vision that cannot be clearly corrected with spectacles. Keratoconus usually requires contact lenses for clear vision, and it may eventually progress to a point where a corneal transplant is necessary.

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How is astigmatism diagnosed?



Astigmatism can be diagnosed through a [comprehensive eye examination](#). Testing for astigmatism measures how the eyes focus light and determines the power of any optical lenses needed to compensate for reduced vision. This examination may include:

- **Visual acuity**—As part of the testing, you'll be asked to read letters on a distance chart. This test measures visual acuity, which is written as a fraction such as 20/40. The top number is the standard distance at which testing is done, twenty feet. The bottom number is the smallest letter size you were able to read. A person with 20/40 visual acuity would have to get within 20 feet of a letter that should be seen at forty feet in order to see it clearly. Normal distance visual acuity is 20/20.
- **Keratometry**—A keratometer is the primary instrument used to measure the curvature of the cornea. By focusing a circle of light on the cornea and measuring its reflection, it is possible to determine the exact curvature of the cornea's surface. This measurement is particularly critical in determining the proper fit for contact lenses. A more

sophisticated procedure called corneal topography may be performed in some cases to provide even more detail of the shape of the cornea.

- **Refraction**—Using an instrument called a phoropter, your optometrist places a series of lenses in front of your eyes and measures how they focus light. This is performed using a hand held lighted instrument called a retinoscope or an automated instrument that automatically evaluates the focusing power of the eye. The power is then refined by patient's responses to determine the lenses that allow the clearest vision.

Using the information obtained from these tests, your optometrist can determine if you have astigmatism. These findings, combined with those of other tests performed, will allow the optometrist to determine the power of any lens correction needed to provide clear, comfortable vision, and discuss options for treatment.

How is astigmatism treated?

Persons with astigmatism have several options available to regain clear vision. They include:

- eyeglasses
- contact lenses
- orthokeratology
- laser and other refractive surgery procedures



Eyeglasses are the primary choice of correction for persons with astigmatism. They will contain a special cylindrical lens prescription to compensate for the astigmatism. This provides for additional lens power in only specific meridians of the lens. An example of a prescription for astigmatism for one eye would be $-1.00 -1.25 \times 180$. The middle number (-1.25) is the lens power for correction of the astigmatism. The " $\times 180$ " designates the placement (axis) of the lens power. The first number (-1.00) indicates that this prescription also includes a correction for nearsightedness in addition to astigmatism.

Generally, a single vision lens is prescribed to provide clear vision at all distances. However, for patients over about age 40 who have the condition called [presbyopia](#), a bifocal or progressive addition lens may be needed. These provide different lens powers to see clearly in the distance and to focus effectively for near vision work.

A wide variety of lens types and frame designs are now available for patients of all ages. Eyeglasses are no longer just a medical device that provides needed vision correction. Eyeglass frames are available in a many shapes, sizes, colors and materials that not only allow for correction of vision, but also enhance appearance.

For some individuals, [contact lenses](#) can offer better vision than eyeglasses. They may provide clearer vision and a wider field of view. However, since contact lenses are worn directly on the eyes, they require [regular cleaning and care](#) to safeguard eye health. Soft contact lenses conform to the shape of the eye, therefore standard soft lenses may not be effective in correcting astigmatism. However, special toric soft contact lenses are available to provide a correction for many types of astigmatism. Because rigid gas permeable contact lenses maintain their regular shape while on the cornea, they offer an effective way to compensate for the cornea's irregular shape and improve vision for persons with astigmatism and other refractive errors.

[Orthokeratology \(Ortho-K\)](#) involves the fitting of a series of rigid contact lenses to reshape the cornea, the front outer cover of the eye. The contact lenses are worn for limited periods, such as overnight, and then removed. Persons with moderate amounts of astigmatism may be able to temporarily obtain clear vision without lenses for most of their daily activities. Orthokeratology does not permanently improve vision and if you stop wearing the retainer lenses, your vision may return to its original condition.

Astigmatism can also be corrected by [reshaping the cornea](#) using a highly focused laser beam of light. Two commonly used procedures are photorefractive keratectomy (PRK) and laser in situ keratomileusis (LASIK).

PRK removes tissue from the superficial and inner layers of the cornea. LASIK does not remove tissue from the surface of the cornea, but only from its inner layer. To do this, a section of outer corneal surface is cut and folded back to expose the inner tissue. Then a laser is used to remove the precise amount of tissue needed and the flap of outer tissue is placed back in position to heal. Both procedures allow light to focus on the retina by altering the shape of the cornea.

Individuals with astigmatism have a wide range of options to correct their vision problem. In consultation with your optometrist, you can select the treatment that best meets your visual and lifestyle needs.