

## **Myopia (Short-sightedness)**

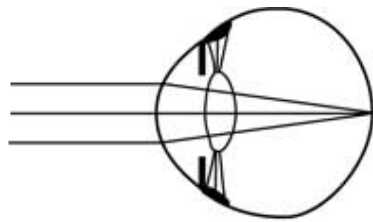
The medical name for short-sightedness is myopia. Eyesight problems, such as myopia, are also known as refractive errors. Short-sightedness leads to blurred vision when looking at things at a distance, whilst close vision is usually normal. Short-sightedness is a very common problem that can be corrected by glasses, contact lenses, or laser eye surgery.

### **What is myopia (short-sightedness)?**

Myopia (also known as short-sightedness or near-sightedness) is a refractive error that occurs when light coming from distant objects is 'overfocused', so that the point of focus is in front of the retina.

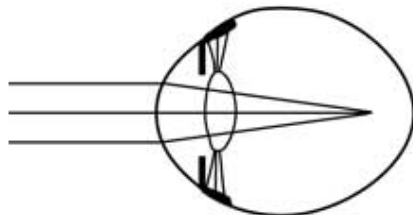
It occurs because either the eyeball is too long or, less commonly, because the cornea is too curved. Despite maximum flattening of the lens, the eye is not able to focus the light rays further back and on to the retina.

In myopia, the eye focuses light from near objects more effectively than light from objects further away. This means that short-sighted people can see close objects clearly because the light rays from these objects enter the eyes at an angle and focus correctly on the retina. In contrast, distant objects appear more blurry as their light rays do not focus properly in the eye.

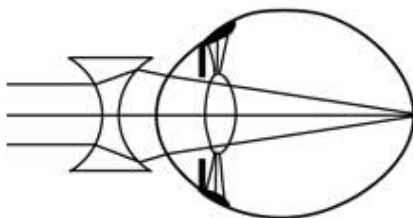


Normal eye

### **Myopia**



Light focused in front of retina



Corrected with concave lens

The diagram above shows the differences in focusing between a normal and a short-sighted (myopic) eye.

## **What are the symptoms of myopia (short-sightedness)?**

The main symptom is difficulty with seeing things that are far away. The younger short-sightedness starts, the more severe it is likely to become.

By the time early adulthood is reached, the level of myopia has usually reached its peak. This means that the vision does not generally become any worse after the age of mid to late twenties.

Some children do not realise that their vision is not as good as it should be. They may be able to read books and do close work well. However, seeing distant objects such as the board at school may become difficult. They may think this is normal and not tell anyone. A child's teacher may notice that children are having difficulties reading the board in class. Schoolwork may suffer for a while before the condition is identified and treatment provided.

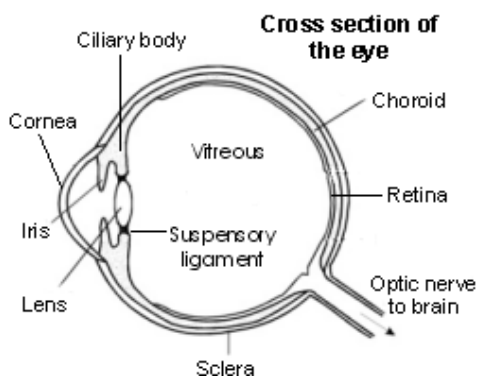
Children usually have a routine preschool or school-entry vision check but if there is any suspicion that a child has problems with his or her sight, an appointment should be booked with an optician. Even very young children can have eye tests at most high street opticians.

## What causes myopia (short-sightedness)?

- Short-sightedness tends to start in childhood and early teenage years.
- It is likely to result from a combination of genes and lifestyle factors (such as spending long periods of time doing close-up work or indoors). It often runs in families.
- Temporary short-sightedness can also occur with certain illnesses – for example, in [diabetes](#).

## What is a refractive error?

A refractive error is an eyesight problem. Refractive errors are the most common reason worldwide for reduced levels of eyesight (visual acuity).



Refraction refers to the bending of light, in this case by the eye, in order to focus it. A refractive error means that the eye cannot focus light on to the retina properly.

This usually occurs either due to abnormalities in the shape of the eyeball, or because age has affected the workings of the parts of the eye that have the job of focusing light.

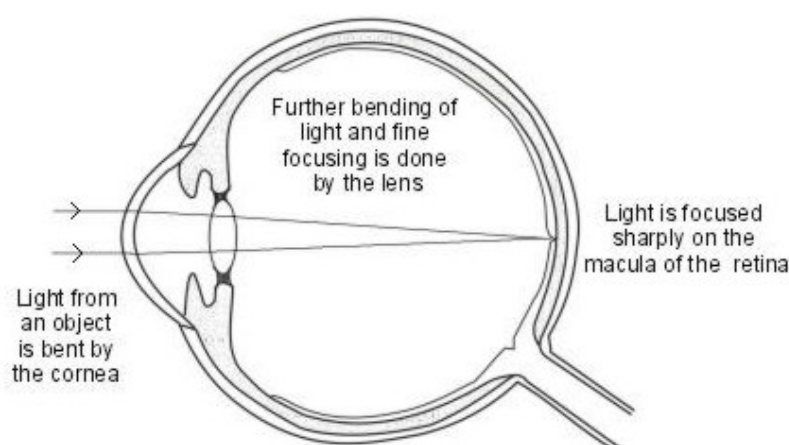
There are four types of refractive error:

- Myopia (short-sightedness).

- Long-sightedness (hypermetropia).
- Age-related long-sightedness (presbyopia).
- Astigmatism.

In order to understand refractive errors fully, it is useful to know how we see.

When we look at an object, light rays from the object pass through the eye to reach the retina. This causes nerve messages to be sent from the cells of the retina down the optic nerve to the vision centres in the brain. The brain processes the information it receives, resulting in an image that we can see.



Light rays come off an object in all directions, as they result from light bouncing back off the object. The part of this bounced light that comes into the eye from an object needs to be focused on a small area of the retina. If this doesn't happen, what we look at will be blurred.

The cornea and lens have the job of focusing the light. The cornea does most of the work as it bends (refracts) the light rays which then go through the lens, which finely adjusts the focusing. The lens does this by changing its thickness. This is called accommodation. The lens is elastic and can become flatter or more rounded. The more rounded (convex) the lens, the more the light rays can be bent inwards.

The shape of the lens is varied by small muscles in the ciliary body. Tiny string-like structures called the suspensory ligaments are attached at one end to the lens and at the other to the ciliary body. This is a bit like a trampoline with the central bouncy bit being the lens, the suspensory ligaments being the springs, and the ciliary muscles being the rim around the edge.

When the ciliary muscles in the ciliary body tighten, the suspensory ligaments slacken, causing the lens to become fatter. This happens for near objects. For looking at far objects, the ciliary muscle relaxes, making the suspensory ligaments tighten, and the lens thins out.

More bending (refraction) of the light rays is needed to focus on nearby objects, such as when reading. Less bending of light is needed to focus on objects far away.

## Complications with myopia (short-sightedness)

The vast majority of people with short-sightedness have no additional problems.

However, people with severe short-sightedness have a slightly increased chance of developing some other eye conditions. These include:

- Raised pressure in the eye ([glaucoma](#)).
- A [detached retina](#).
- [Cataracts](#).
- [Macular degeneration](#).

These are serious eye conditions, so regular eye checks are advisable and new or changing vision symptoms should be reported promptly to an optician.

## What is the treatment for myopia (short-sightedness)?

### Glasses

Short-sightedness can be corrected with glasses, which is the simplest, cheapest and safest way.

Concave prescription lenses (called minus lenses) are used to bend light rays slightly outwards to counteract the over-focusing tendency. As a result, the light rays focus further back in the eye on the retina.

### **Contact lenses**

These do the same job as glasses but they sit on the surface of the eye.

Many different types of contact lenses are available. Lenses may be soft or rigid. They can be daily disposable, extended wear, monthly disposable, or non-disposable.

Contact lenses tend to be more expensive than glasses. They provide good all-round vision and do not mist over (for example, while doing sports or in hot environments). They do, however, require more care and meticulous hygiene, and should not usually be worn whilst sleeping.

They are usually more suitable for older teenagers and adults, rather than very young children.

### **Laser eye surgery**

Laser eye surgery is an option for some people with short-sightedness. Generally, this type of surgery is not available on the NHS and can be expensive. Many private companies advertise laser eye surgery.

Complete and permanent resolution of the refractive error is possible in a number of people. Others have a significant improvement even though perfect vision is not achieved and glasses or contact lenses may still be needed.

Refractive surgery must be carried out in premises registered with the Care Quality Commission (CQC) in England, or the equivalent regulator in Scotland, Wales and Northern Ireland.

Several types of laser surgery have been developed. Three main types are used in the UK: LASIK<sup>®</sup>, surface laser treatments (PRK<sup>®</sup>, LASEK<sup>®</sup> and TransPRK<sup>®</sup>) and SMILE<sup>®</sup>.

They are all similar, typically taking about ten minutes per eye and aiming to reshape the cornea by using the laser to remove a very thin layer of corneal tissue. The reshaping of the cornea allows the refraction of the eye to be corrected.

## **LASIK®**

- LASIK stands for **L**aser-**A**ssisted **I**n situ **K**eratomileusis. This is the most popular type of laser eye surgery.
- The surgery is done with two lasers; the first laser creates a thin flap of cornea, which is moved aside to allow the second laser to reshape the cornea.
- This reshaping involves flattening the cornea so that light rays coming from an object can be focused further back and on to the retina.
- The flap is then replaced, and sticks by itself to the underlying cornea without the need for stitches. The flap serves as a natural bandage, keeping the eye comfortable as it heals and allowing healing to occur relatively quickly.
- Vision recovery time is said to be around 24 hours. People may be able to return to work the day after LASIK surgery, but need to wait for at least one month before doing any contact sports.

## **Surface laser treatments (PRK®, LASEK® and TransPRK®)**

- PRK stands for **P**hoto-**R**efractive **K**eratectomy.
- LASEK stands for **L**AsEr **S**ub-**E**pithelial **K**eratomileusis.
- In these types of treatments, no flap is created but, instead, the very thin layer of cells at the surface of the eye (epithelium) is either removed or displaced, and a laser is applied directly to the cornea underneath to reshape it. The epithelium will grow back naturally but, while it is doing this, the eye will be very sore.
- All surface layer treatments produce similar results, and the only difference between them is the way in which the thin surface layer (epithelium) is removed. In PRK and LASEK it is removed by the surgeon. In TransPRK it can be done by the laser as part of the reshaping treatment.

- Visual recovery tends to be slower after surface laser treatments than after LASIK, and patients may take a week or longer to reach the driving standard. However, patients can return to contact sports sooner than after LASIK.

## **SMILE®**

- SMILE stands for **S**mall **I**ncision **L**enticule **E**xtraction.
- With the help of a laser, the surgeon cuts and removes a disc-shaped piece of cornea through a small hole created at the surface of the eye. This reshapes and flattens the cornea – a bit like LASIK but without the flap and also with a thicker piece of cornea taken from deeper within the cornea.
- Results from SMILE are similar to LASIK and surface laser treatments.

Side-effects of all laser surgery include:

- Discomfort.
- Blurred vision.
- Glare and haloes around lights (particularly at night).
- Red marks on the white of the eyes caused by burst small blood vessels (subconjunctival haemorrhages).

These usually get better over time. Over-correction or under-correction of short-sightedness can also happen.

Complications include eye infection and dry eyes. Permanent loss of vision is very rare; if this happens, around 1 in 5,000 people need a corneal transplant to restore their vision. Up to 1 in 10 patients may need additional surgery to get the best result.

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## **Lens surgery**

### **Phakic intraocular lens implantation (PIOL)**

- Phakic intraocular lenses (PIOLs) are clear, synthetic plastic lenses that are implanted into the eye without removing the eye's own natural lens – a bit like a permanent contact lens.



- Depending on which PIOL is used, it either sits in front of, or behind, the pupil. It is inserted into the eye via small cuts on the eye surface that will heal by themselves without the need for stitches.
- PIOLs are very effective at correcting both short-sightedness and **astigmatism**, can correct a wider range of glasses prescriptions than laser surgery, and may be safer in people who have problems with their cornea or eye surface.
- PIOLs tend to be offered to younger people who are not suitable for laser eye surgery.
- The operation typically takes about 20 minutes per eye, is performed with eye-drop anaesthetics, and you can go home the same day. The second eye is usually done a day or more after the first eye.
- Side-effects include discomfort, blurred vision, glare and haloes around lights (particularly at night), and red patches on the white of the eyes, caused by burst small blood vessels (subconjunctival haemorrhages). These usually get better over time.
- Risks include permanent serious loss of vision (which is rare), the earlier development of cataracts, and the need for additional surgery (for example, to reposition the lens). The risks depend on the type of PIOL used and you should seek full information about these from your operating surgeon.

### **Refractive lens exchange (RLE)**

- In this procedure, the eye's natural lens is replaced by a clear synthetic implant called an intraocular lens. (IOL). It is essentially the same process as modern cataract surgery.
- There are two types of IOL: **monofocal** IOLs aim to improve distance vision and **multifocal** IOLs aim to improve distance, intermediate, and close (near) vision.
- The old lens is removed and a new lens is inserted via small cuts on the eye surface that will heal by themselves without the need for stitches.
- About four out of five patients are completely free of glasses after RLE.

- RLE is suitable for people over the age of 50 years who have a prescription that is higher than the normal range for laser eye surgery. RLE can correct almost any level of short-sightedness. It is generally preferred in older people because, as people age, the eye's natural lens becomes less flexible and less clear, so there is more benefit in replacing it. It also eliminates the need to have cataract surgery later in life. However, other treatments may still be suitable in older people with a healthy eye surface and no signs of cataracts.
- The operation typically takes about 20 minutes per eye and is performed with eye-drop anaesthetics.
- Side-effects include eye discomfort, visual effects (such as blurring of vision, haloes around lights, and shadowing or shimmering arcs around the edges of vision), and subconjunctival haemorrhages. These usually get better over time.
- Permanent, serious loss of vision is much more common after RLE than after laser eye surgery or PIOL surgery. It affects approximately 1 in 500 patients. Other risks of the operation include bleeding, infection, and retinal detachment.
- After RLE, vision may deteriorate over time due to gradual clouding over of the membrane behind the implanted lens, but this can be corrected with a one-off laser procedure.

**Other techniques:** corneal grafts are options in very severe or specialised cases of myopia.

## How often do I need an eyesight test?

The NHS recommends that most people should get their eyesight tested every two years. Children will routinely be offered eye checks at various stages from birth to school age.

People at higher risk of sight problems need more frequent eyesight checks. An optician will usually recommend more regular check-ups in people with:

- [Diabetes.](#)
- [Raised pressure in the eye \(glaucoma\).](#)
- [Macular degeneration.](#)

- A family history of these conditions.

People over the age of 70 years and children who wear glasses may also need more frequent eye tests.

Any changes in vision should be checked by an optician. Some opticians offer a home visiting service to carry out sight tests for people who are permanently housebound.

***Dr Mary Lowth is an author or the original author of this leaflet.***

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## Further reading

- [Corneal implants for the correction of refractive error](#); NICE Interventional Procedure Guidance, July 2007
- [Professional Standards for Refractive Surgery](#); Royal College of Ophthalmologists (Dec 2021)
- [Myopia](#); Nature reviews disease primers
- [The Complications of Myopia: A Review and Meta-Analysis](#); Investigative Ophthalmology and visual Science – an ARVO Journal
- [Li SM, Kang MT, Wang NL, et al; Wavefront excimer laser refractive surgery for adults with refractive errors. Cochrane Database Syst Rev. 2020 Dec 18;12\(12\):CD012687. doi: 10.1002/14651858.CD012687.pub2.](#)
- [What Is Small Incision Lenticule Extraction?](#); American Academy of Ophthalmology (AAO)
- [Laser Vision Correction](#); Royal College of Ophthalmologists Patient Information Leaflet
- [Phakic Intraocular Lens Implantation](#); Royal College of Ophthalmologists Patient Information Leaflet
- [Refractive Lens Exchange](#); Royal College of Ophthalmologists Patient Information Leaflet
- [Moshirfar M, Bennett P, Ronquillo Y; Laser In Situ Keratomileusis \(LASIK\).](#)

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