

REFRACTIVE ERROR

A person who has a refractive error will need to wear spectacles (glasses) or contact lenses so that they can see clearly and comfortably.

This is because their eye is not the correct size and shape and light does not focus correctly on their retina.

If light from a distant or a near object does not focus properly on the retina, the person will have a problem seeing because they have a **refractive error**

There are four main types of refractive error: **myopia**, **hyperopia**, **astigmatism** and **presbyopia**.

The amount of refractive error that an eye has depends on:

- ✓ the steepness/flatness of the cornea
- ✓ the thickness/thinness of the crystalline lens
- ✓ the length of the eyeball

A person may have a combination of any of these three things which make the eye the wrong size or shape, and will stop light from focusing perfectly on the retina (Figure 1).

When an eye has the correct size and shape to focus light on the retina, we say that the eye is **emmetropic**

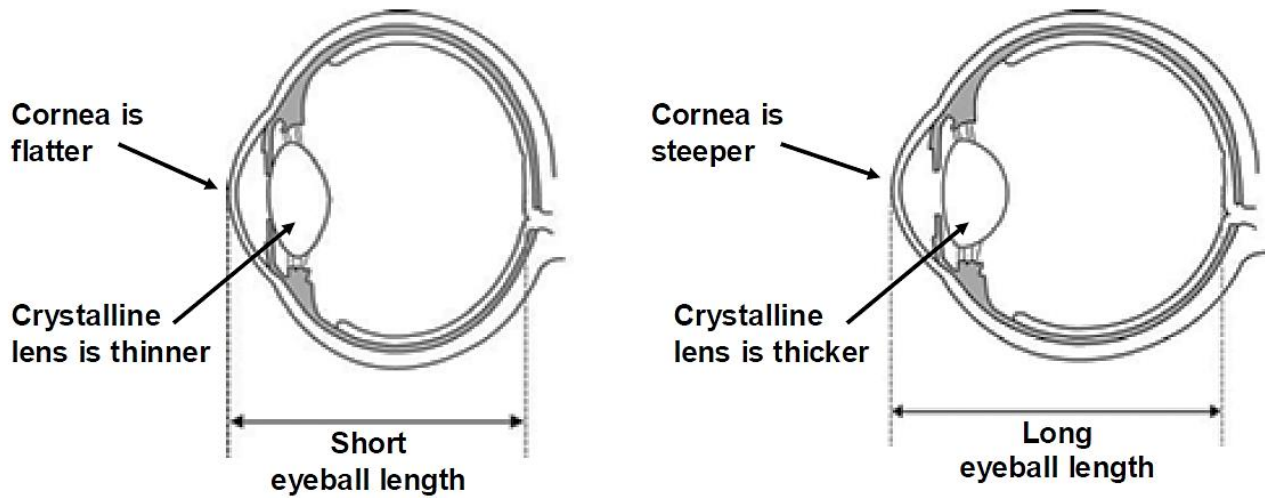


Figure 1: Possible differences in eyeball length, shape of the cornea, and shape of the lens.

THE NORMAL EYE

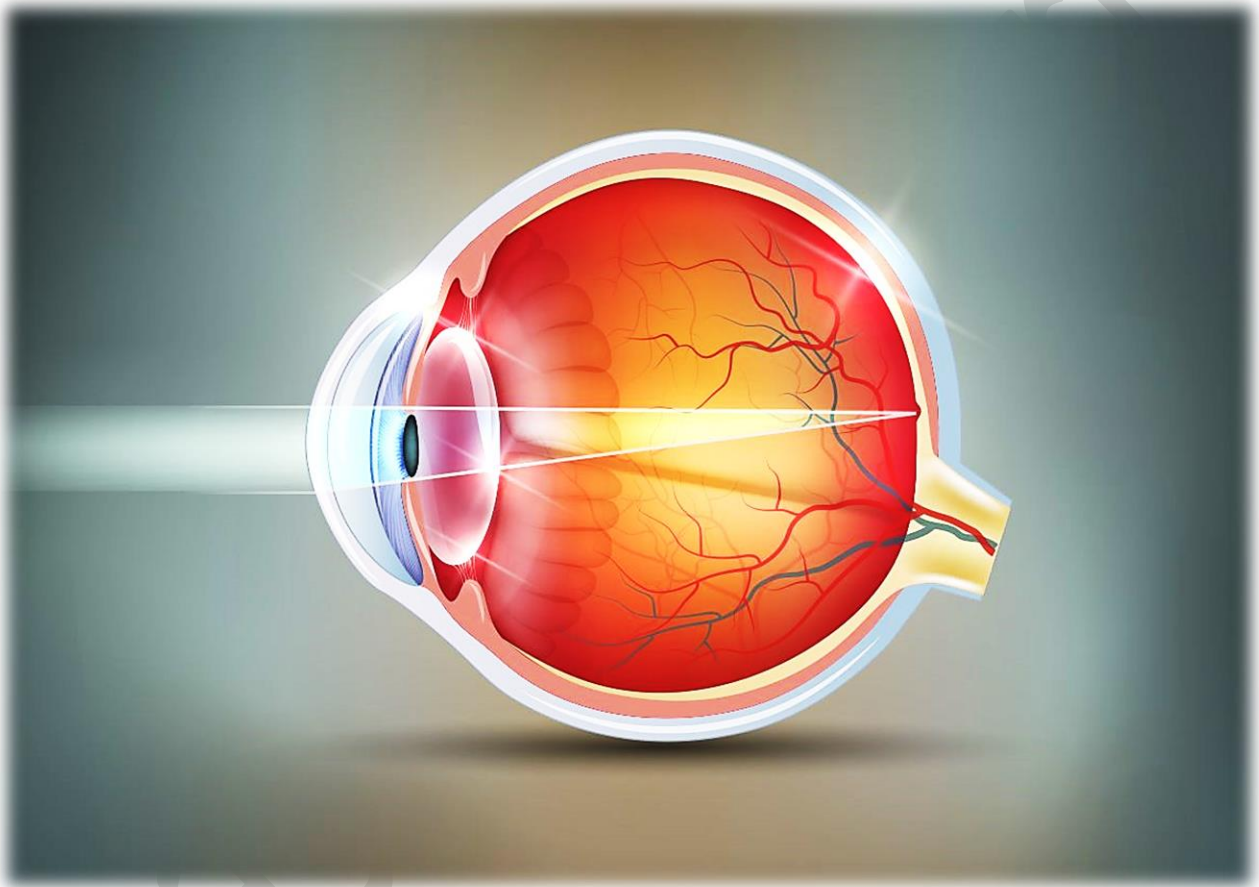
Light Entering the Eye

- Light rays entering the eye pass through the tear film, cornea, anterior chamber, pupil, crystalline lens and vitreous, before they reach the retina.
- Light rays are converged (focused) by the cornea and the crystalline lens.
- If the light rays focus correctly on the retina, a clear image will be formed.
- Light is changed at the retina into electrical signals (nerve messages).
- Information received by the retina is sent to the brain via the optic nerve.

Focusing Light in the Eye

In a normal eye, light that enters the eye is focused on the retina because:

- the cornea and the lens are the correct shape.
- the eyeball is the correct length.



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MYOPIA

(also known as shortsightedness or nearsightedness)

People with myopia (sometimes called “myopes”) can not see far away, but depending on the amount of myopia they have, their near vision might be good.

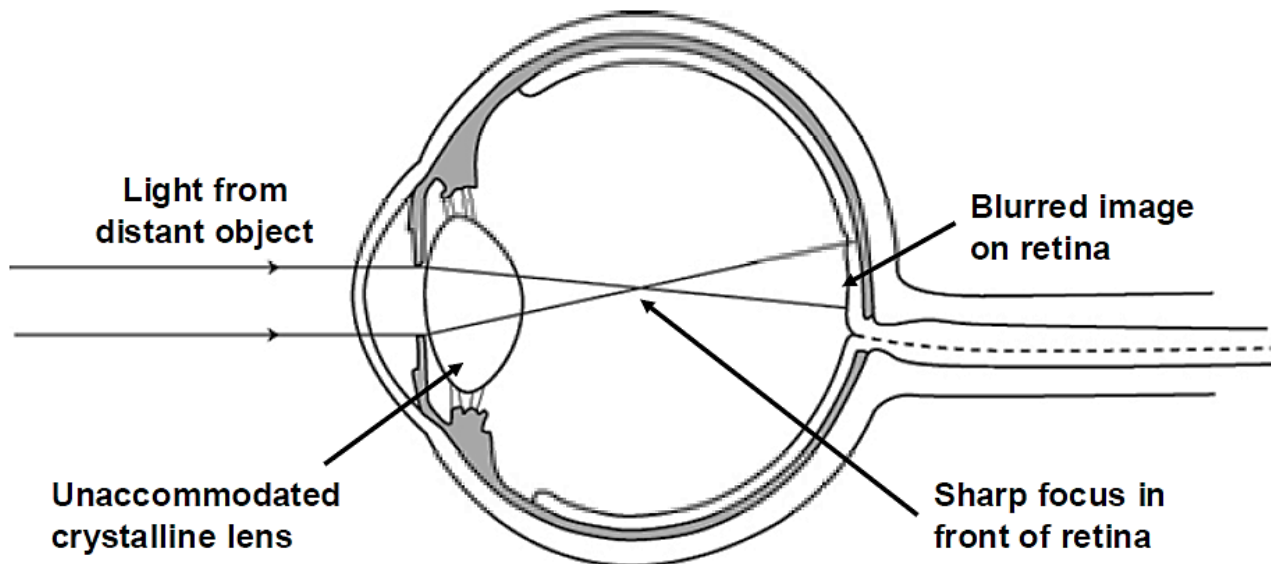


Figure 2: A myopic eye - light rays from a distant object focus in front of the retina

Causes of Myopia

❖ Based on Anatomical Features

1. Axial Myopia

- It is due to relatively long axial length.
- 1 mm axial length lengthening will cause -3.00 D of myopia.

2. Curvature Myopia

- It is due to the decreased radius of curvature of the refractive surfaces, i.e. cornea and lens.
- 1 mm steepening will cause -6.00 D of myopia.
- It is found in keratoconus, lenticonus and megalocornea

3. Index Myopia

- It is due to increase in refractive index of the lens nucleus which occurs in nuclear sclerosis.

4. Displacement of Refractive Element

- It is due to forward displacement of lens.

Symptoms of Myopia اعراض قصر البصر

- A person with myopia has blurry distance vision, also have blurry near vision (but their distance vision will always be worse).
- Eye strain or asthenopia
- Exophoria or Latent divergent squint
- Floaters and/or flashes of light in front of the eyes
- Photophobia and impaired vision at night.

Signs of Myopia علامات قصر البصر

- Prominent eyes
- Large pupil and deep anterior chamber



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Correction of myopia

- **Eyeglasses:** Prescription glasses with minus (concave) spherical lenses.

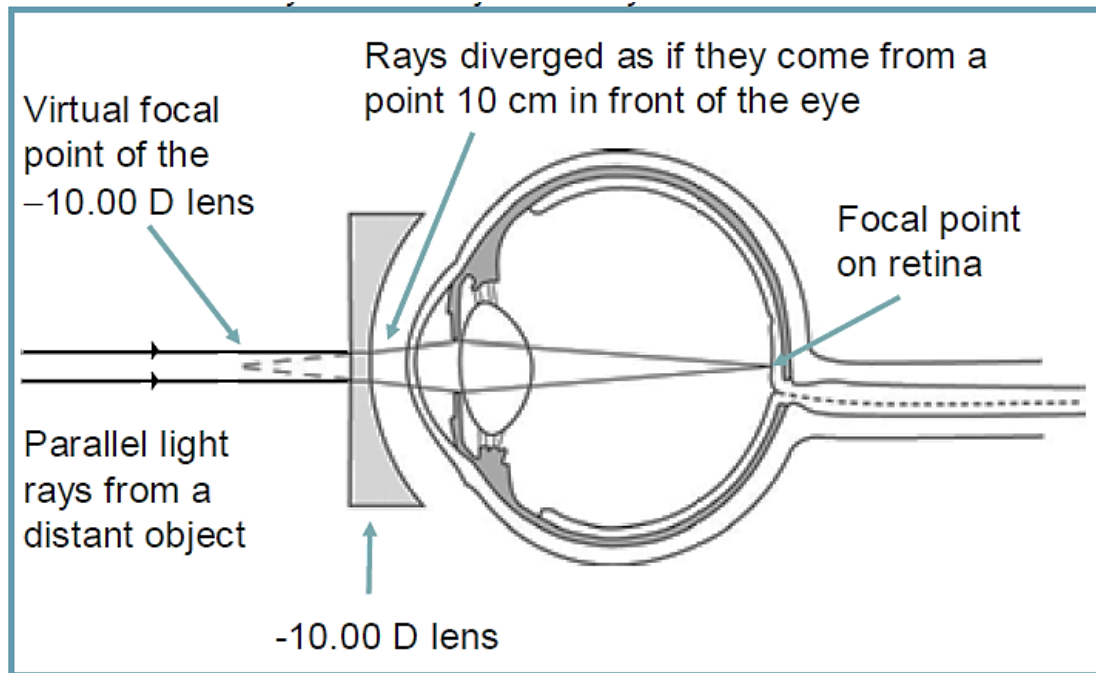


Figure 3: You can see that the -10.00 D lens diverges the light rays before they reach the eye – as if they were coming from a point 10 cm in front of the eye.

- **Contact Lenses:** Soft or rigid gas-permeable contact lenses can be used to correct myopia without the need for glasses.

Refractive Surgery:

- **LASIK (Laser-Assisted In Situ Keratomileusis):** This surgery reshapes the cornea using a laser to correct refractive errors, including myopia.
- **PRK (Photorefractive Keratectomy):** Similar to LASIK, but without creating a flap on the cornea. It is often recommended for individuals with thinner corneas.

- **SMILE (Small Incision Lenticule Extraction):** A minimally invasive form of refractive surgery that removes a small piece of tissue from the cornea to correct vision.
- **Orthokeratology (Ortho-K):** This involves wearing specially designed gas-permeable contact lenses overnight. They reshape the cornea temporarily, providing clear vision during the day.
- **Bifocal or Progressive Eyeglasses:** These lenses have different zones for near and distance vision correction. They can be used for individuals with myopia and presbyopia.



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