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COURSECODE: PHS212

COURSE TITLE: PHYSIOLOGY

Question:

Discuss the defects of the eye

There are three common defects of vision. They are:

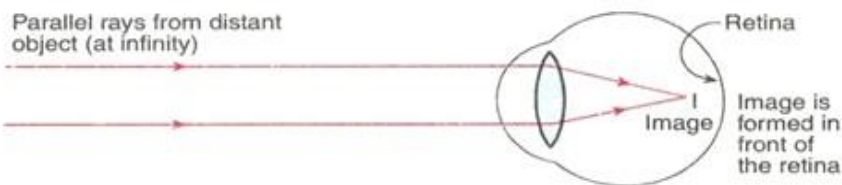
- 1) Myopia (Short-sightedness or Near-sightedness)
- 2) Hypermetropia (Long-sightedness or Far-sightedness)
- 3) Presbyopia

## Myopia

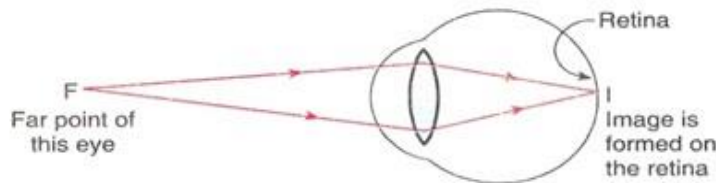
The defect of an eye in which it cannot see the distant objects clearly is called *myopia*. A person with myopia can see nearby objects clearly. Myopia is caused due to:

- High converging power of lens
- Eye-ball being too long

Due to high converging of the eye-lens the image is formed in front of the retina and a person cannot see clearly the distant objects. In another case, if the eye-ball is too long than the retina is at larger distance from the eye-lens. In this case also the image is formed in front of the retina even though the eye-lens has correct converging power.



In a myopic eye, image of distant object is formed in front of the retina (and not on the retina)

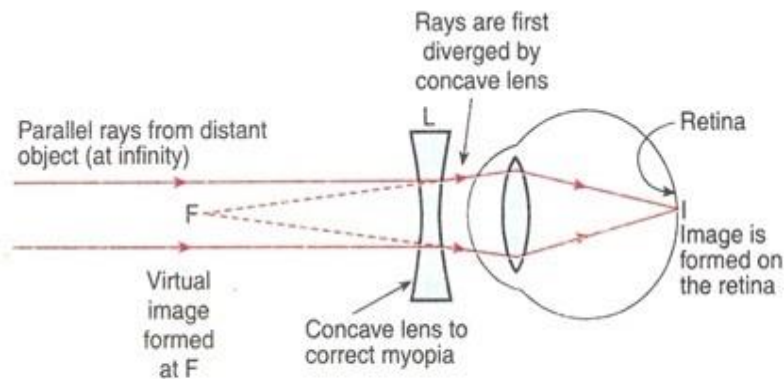


The far point ( $F$ ) of a myopic eye is less than infinity

*Myopia or short-sightedness can be corrected by wearing spectacles containing concave lens.*

This is because when a concave lens of suitable power is used for the myopic eye then the concave lens first diverge the parallel rays of light coming from distant object. Therefore, first a

virtual image is formed at the far point of the myopic eye. Now since the rays of light appear to be coming from eye's far point, they are easily focused by the eye-lens and image is formed on retina. Concave lens is used for myopic eye so as to decrease the converging power of the eye-lens.



*Correction of myopia.* The concave lens placed in front of the eye forms a virtual image of distant object at far point ( $F$ ) of the myopic eye

*Formula for calculating power of concave lens to correct myopia is:*

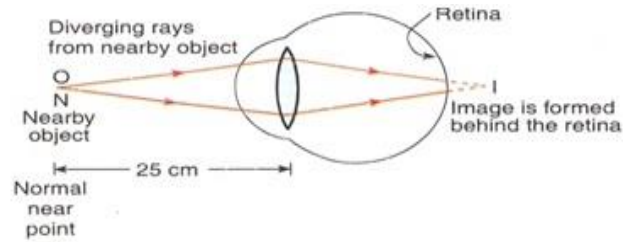
$$1/\text{image distance (v)} - 1/\text{object distance (u)} = 1/\text{focal length (f)}$$

## Hypermetropia

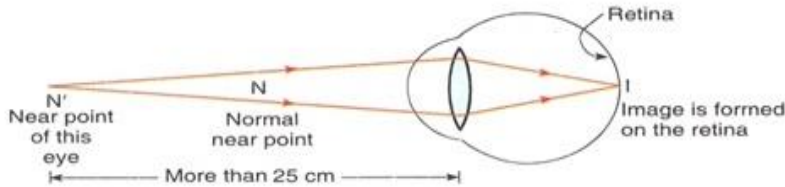
*Hypermetropia or long-sightedness* is a defect of an eye where a person cannot see nearby objects clearly. The near-point of hypermetropic eye is more than 25 cm away. This defect of eye is caused due to:

- Low converging power of eye-lens
- Eye-ball being too short

In case of hypermetropia the image of an object is formed behind the retina and therefore, a person cannot see clearly nearby objects.

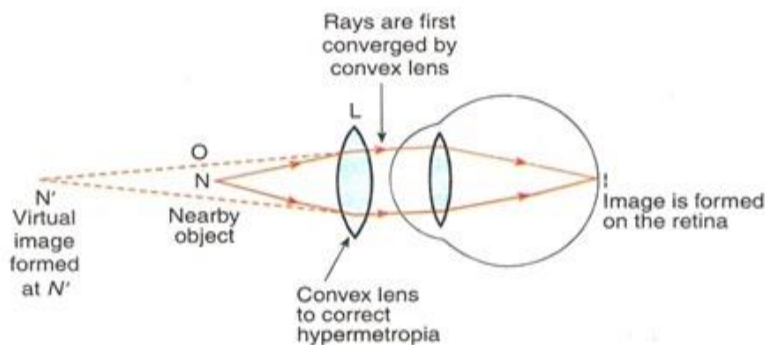


In a hypermetropic eye, the image of nearby object lying at normal near point  $N$  (at 25 cm) is formed behind the retina.



The near point  $N'$  of hypermetropic eye is farther away from the normal near point  $N$

The near-point of an eye having hypermetropia is more than 25 cm. *The condition of hypermetropia can be corrected by putting a convex lens in front of the eye.* This is because when a convex lens of suitable power is placed in front of the hypermetropic eyes, then the convex lens first converge the diverging rays of light coming from a nearby object at the near point of the eye at which the virtual image of the nearby object is formed. Since the light rays now appear to be coming from the eye's near point, the eye-lens can easily focus and form the image on retina. Convex lens is used for hypermetropia so as to increase the converging power of the eye-lens.



*Correction of Hypermetropia: The convex lens forms a virtual image of the object (lying at normal near point  $N$ ) at the near point  $N'$  of this eye.*

*Formula for calculating power of convex lens to correct hypermetropia is:*

$$1/v - 1/u = 1/f$$

In this formula, object distance that is  $u$ , is normal near point of the eye (25 cm).

**Presbyopia:** This defect of vision usually happens in old age when ciliary muscles become weak and can no longer adjust the eye-lens. The muscles become inflexible in this condition and cannot see nearby objects clearly.

The near-point of an old person having presbyopia is much more than 25 cm. Presbyopia can be corrected by wearing spectacles having convex lens.

**Cataract:** The medical condition in which the lens of the eye of a person becomes progressively cloudy resulting in blurred vision. It develops when the eye-lens of a person becomes cloudy due to the formation of a membrane over it. It decreases the vision of the eye gradually and can lead to total loss of vision of the eye. It can be restored after getting surgery. The opaque lens is removed and artificial lens is inserted in its place via operation. This defect cannot be corrected by any type of spectacle lenses.

**Astigmatism:** Instead of the cornea having a symmetrically round shape (like a tennis ball), it is shaped more like a rugby ball, with one meridian being significantly more curved than the meridian perpendicular to it

Astigmatism usually causes vision to be blurred or distorted to some degree at all distances.

Symptoms of uncorrected astigmatism are eye strain and headaches, especially after reading or other prolonged visual tasks

Astigmatism is usually combined with Myopia or Hyperopia

