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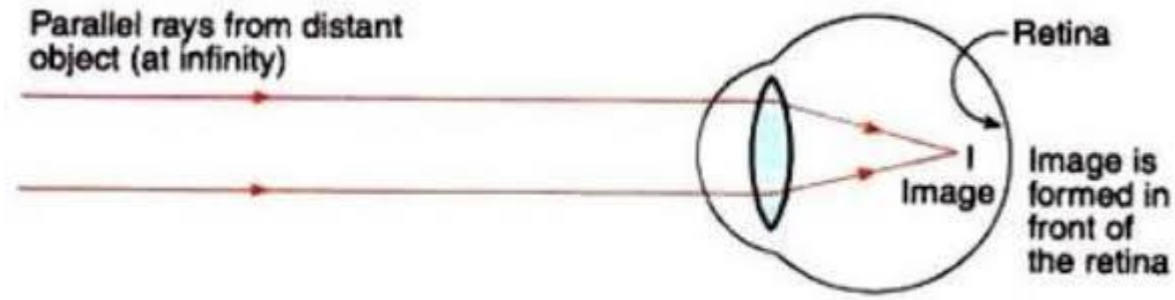
DEPARTMENT: NURSING

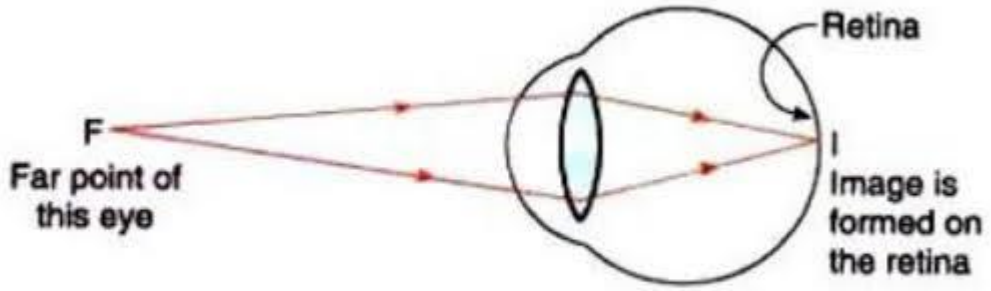
MATRIC NUMBER: 18/MHS02/013

EYE DEFECTS

1. Myopia (Short-sightedness or Near-sightedness)



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



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

Myopia (or short-sightedness) is that defect of vision due to which a person cannot see the distant objects clearly (though he can see the nearby

objects clearly). The far point of an eye suffering from myopia is less than infinity. Such a person can see clearly only up to a distance of few meters (or even less)

The defect of eye called myopia (or short-sightedness) is caused by:

(1) Due to high converging power of eye-lens (because of its short focal length)

In an eye suffering from myopia, the ciliary muscles attached to the eye-lens do not relax sufficiently to make the eye- lens thinner to reduce its converging power. So, due to the greater converging power of the eye-lens in myopic eye, the image of a distant object is formed in front of the retina and hence the eye cannot see it clearly.

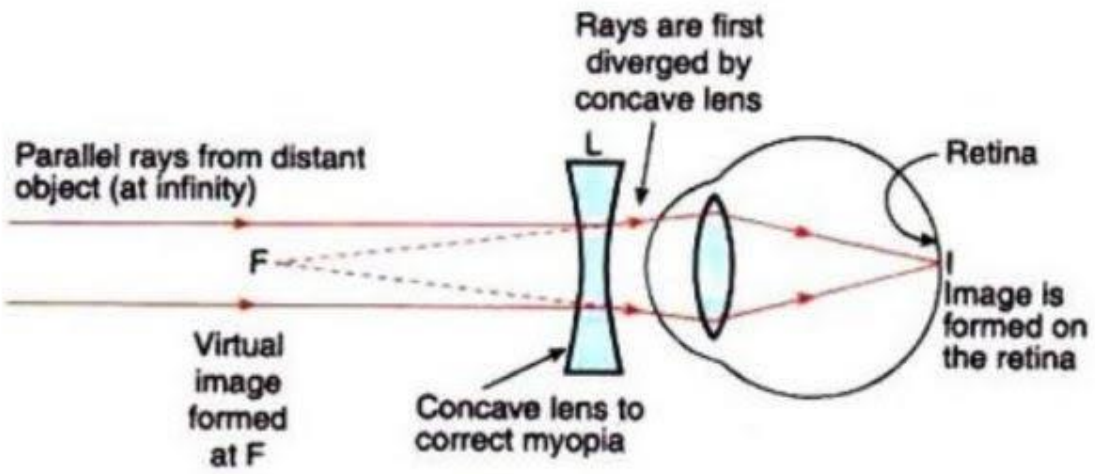
(2) Due to eye-ball being too long

In the eye suffering from myopia, the eye-ball is too long due to which the retina is at a larger distance from the eye-lens. This condition also results in the formation of the image of a distant object in front of the retina (even though the eye-lens may have correct converging power)

The parallel rays of light coming from the distant object O (at infinity) are converged to form an image in front of the retina due to which the eye cannot see the distant object clearly. The image is formed in front of the retina either due to high converging power of eye lens or due to eye ball being too long.

The far point of eye having myopia (or short-sightedness) is at point F which is less than infinity. The rays of light coming from the person's far point F can just be focused by his eye on the retina. If the distant object can be made to appear as if it were at the far point F of this eye, then the eye can see it clearly. This is done by putting a concave lens in front of the eye.

Myopia (short-sightedness or near- sightedness) is corrected by using spectacles containing concave lenses.



(c) *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

The parallel rays of light coming from the distant object O (at infinity) are converged to form an image I in front of the retina due to which the eye cannot see the distant objects clearly.

The image is formed in front of the retina either due to high converging power of eye-lens or due to eye-ball being too long.

The far point of eye having myopia is at point F which is less than infinity. The rays of light coming from the person's far point F can just be focused by his eye on the retina. If the distant object can be made to appear as if it were at the far point F of this eye, then the eye can see it clearly. This is done by putting a concave lens in front of the eye.

Myopia is corrected by using spectacles containing concave lenses. When a concave lens L of suitable power is placed in front of the myopic eye. Then the parallel rays of light coming from the distant object are first diverged by the concave lens.

Due to this the concave lens forms a virtual image of the distant object at the far point F of this myopic eye. Since the rays of light now appear to be coming from the eye's far point (F), they can be easily focused by the eye-lens to form an image on the retina. The concave lens used for correcting myopia should be of such a focal length (or power) that it produces a virtual image of the distant object (lying at infinity) at the far point of the myopic eye.

The concave lens used here decreases the converging power of the eye-lens and helps in forming the image of distant object on the retina of the myopic eye.

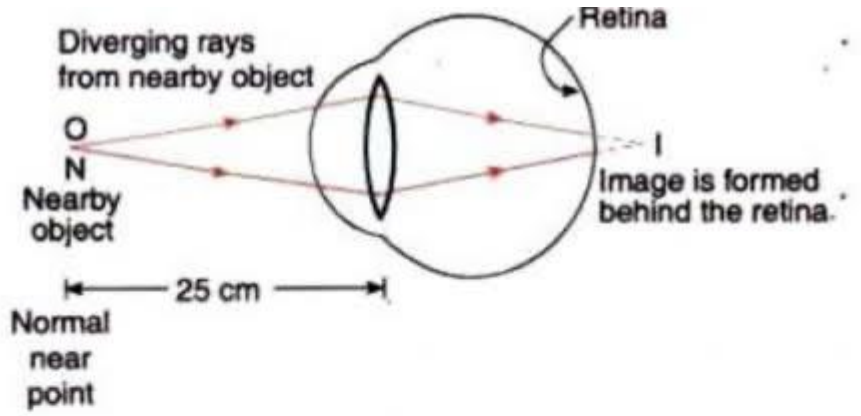
Calculation of Power of Concave Lens to Correct Myopia

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

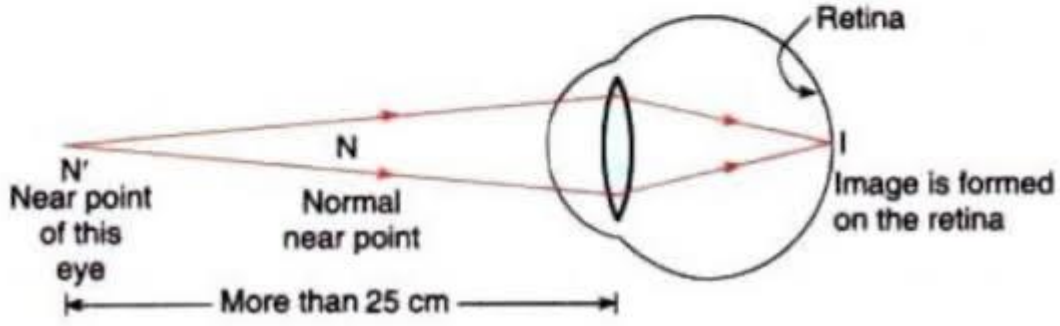
The focal length of concave lens needed to correct myopia (or short-sightedness) in a person is calculated by using the lens formula:

The object distance u is to be taken as infinity (∞), and the image distance v will be the distance of person's far point. Knowing the focal length of the concave lens, we can calculate its power.

Hypermetropia (Long- sightedness or Far- sightedness)



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



(*b*) The near point *N'* of hypermetropic eye is farther away from the normal near point *N*

Hypermetropia (or long-sightedness) is that defect of vision due to which a person

cannot see the nearby objects clearly (though he can see the distant objects clearly).

For example: A person having the defect hypermetropia cannot read a book clearly and comfortably though he can read the number of a distant bus clearly.

The near-point of a hypermetropic eye is more than 25 cm away. Such a person has to hold the reading material (like a book or newspaper) at an arm's length, much beyond 25 cm from the eye for comfortable reading.

The defect of eye called hypermetropia (or long-sightedness) is caused by:

(1)Due to low converging power of eye-lens (because of its large focal length)

The ciliary muscles attached to the eye- lens become weak and cannot make the eye-lens thicker to increase its converging power. So, due to the

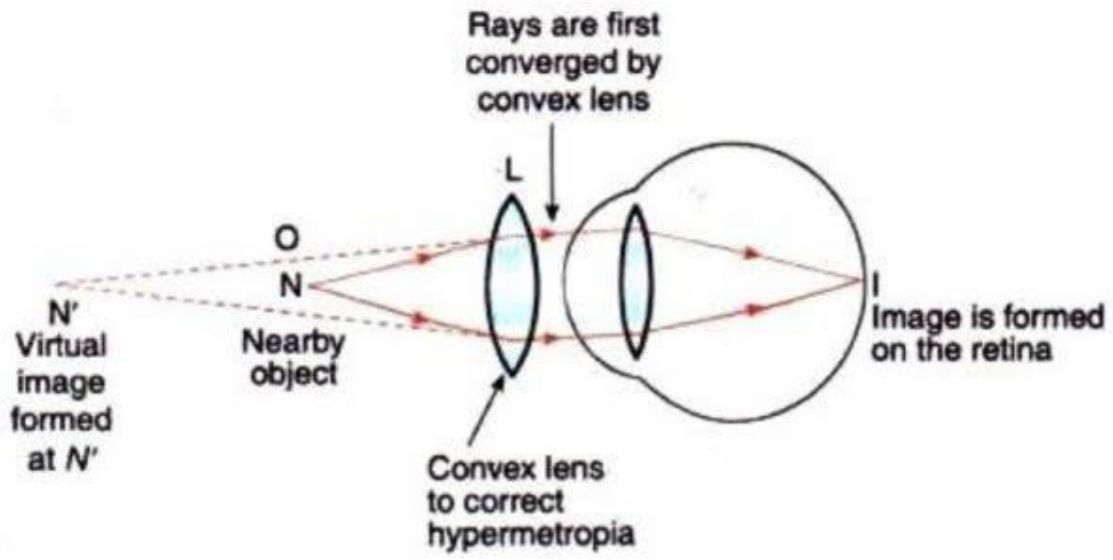
low converging power of eye-lens in an eye suffering from hypermetropia, the image of nearby object is formed behind the retina and hence the eye cannot see it clearly.

(2) Due to eye-ball being too short

In an eye suffering from hypermetropia, the eye-ball is too short due to which the retina is at a smaller distance from the eye-lens. This condition also results in the formation of the image of a nearby object behind the retina.

The diverging rays of light coming from a nearby object O placed at the normal near point N are converged to form an image I behind the retina due to which the eye cannot see the nearby object clearly. The image is formed behind the retina either due to low converging power of eye-lens or because of eye-ball being too short.

Hypermetropia (long-sightedness or far-sightedness) is corrected by using spectacles containing convex lenses



(c) *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.

When a convex lens (converging lens) L of suitable power is placed in front of the hypermetropic eye, then the diverging rays of light coming from the nearby object are first converged by this convex lens. Due to this, the convex lens forms a virtual image of the nearby object at the near point N' of the hypermetropic eye.

The convex lens used for correcting hypermetropia (or long-sightedness) should be of such a focal length (or power) that it forms a virtual image of the object, at the near point N of the hypermetropic eye.

The whole purpose of using a convex lens here is to increase the converging power of the eye-lens.

Calculation of the Power of Convex Lens to Correct Hypermetropia

The focal length of convex lens needed to correct hypermetropia (or long- sightedness) can be calculated by using the lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

In this formula, the object distance u is to be taken as the normal near point of the eye and the image distance v will be the distance of the near point of the length of the convex lens, its power can be calculated.