

2.1 Refractive errors

Plan

Lenses

- Convex/plus

- Concave/minus

Refractive errors

- Emmetropia

- Myopia

- Hypermetropia

- Astigmatism

- Presbyopia

Amblyopia

Correction of refractive errors

- Glasses

- Contact lenses

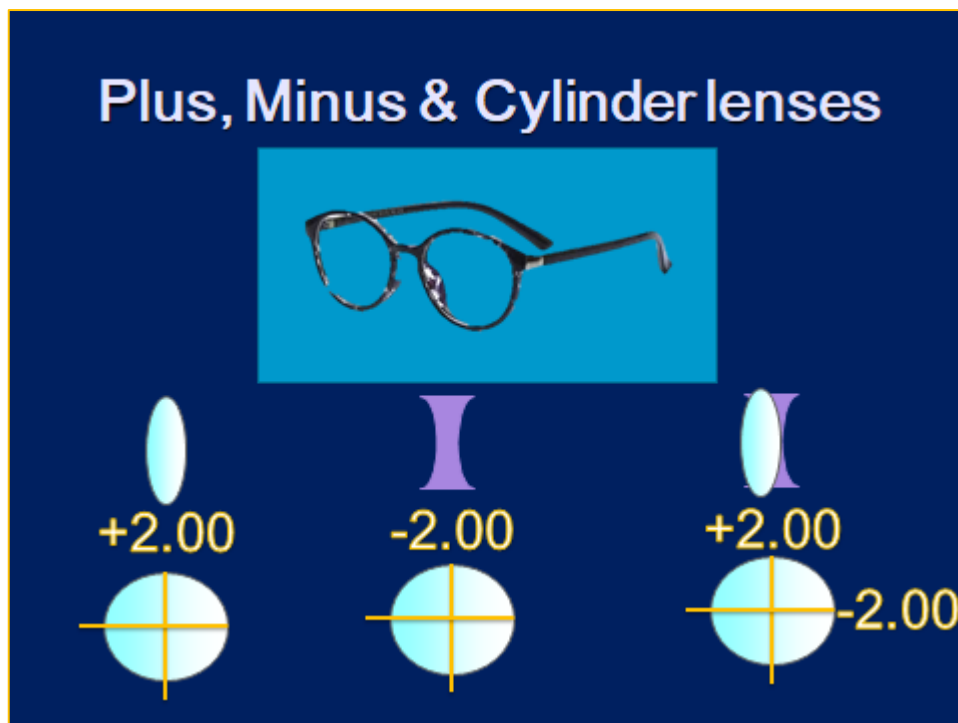
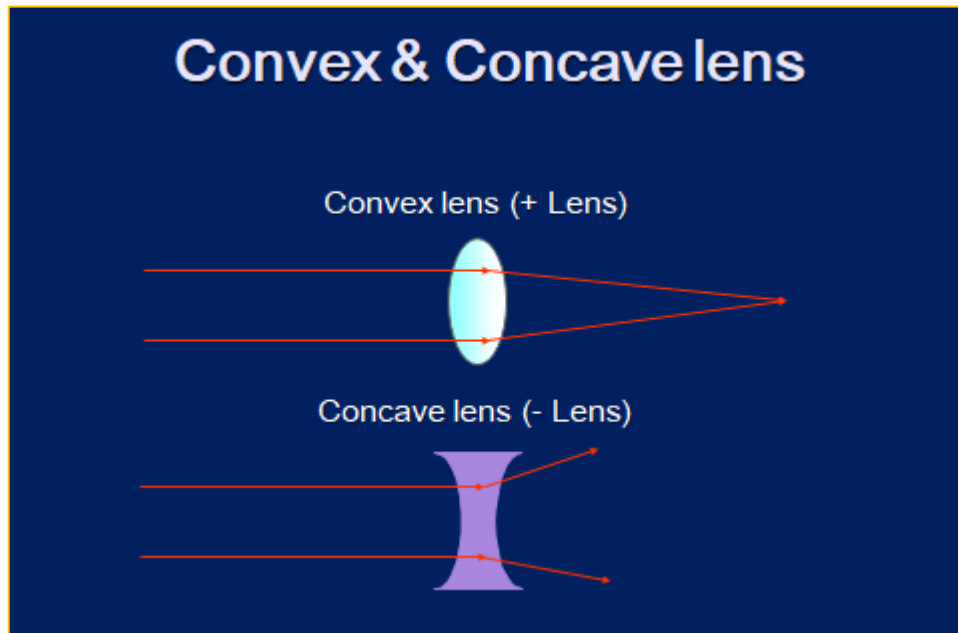
- Refractive laser surgery

Lenses

Convex lenses converge light and called plus lenses. They are used in hypermetropia & presbyopia.

Concave lenses diverge light and called minus lenses. They are used in myopia.

A combination of convex and concave lens is called cylinder lens and used in astigmatism.



Emmetropia

Emmetropia is normal eye when light focuses on fovea.

Myopia

Myopia= short sighted= uses minus or concave lenses (Myopia-Minus lens).

Myopia is refractive condition when light rays focused short of fovea.

In myopia patient can see at close objects so it is also called short sighted.

Myopia need minus or concave lenses in glasses for correction.

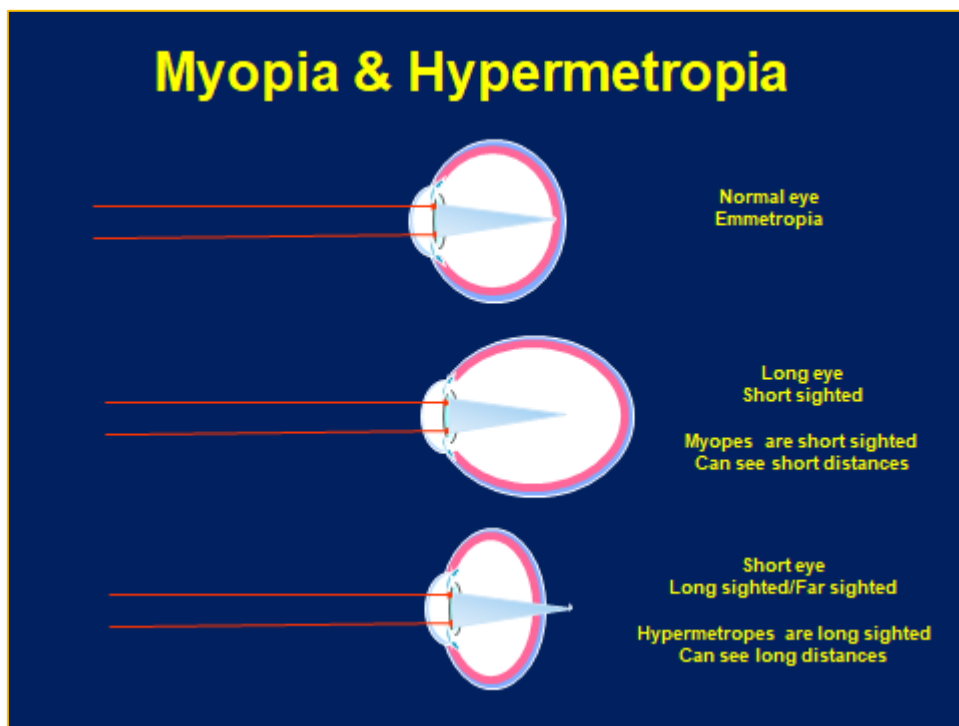
Hypermetropia

Hypermetropia= Hyperopia= Longsighted= uses plus or convex lenses

Hypermetropia is condition when light rays are focused behind fovea.

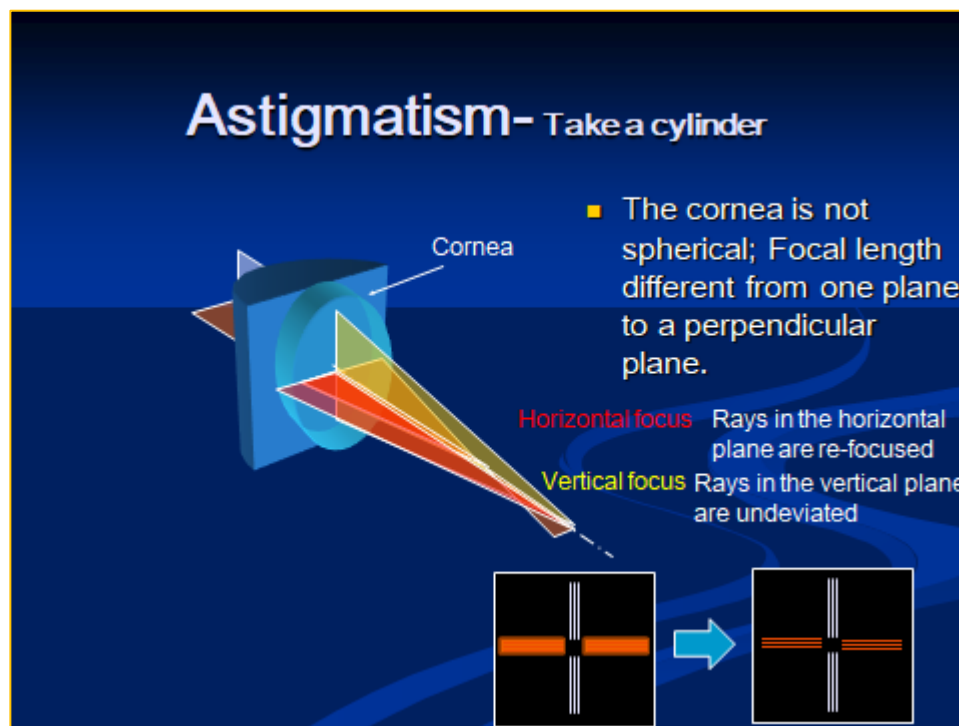
In hypermetropia patient can see long distance better than shot distance.

Hypermetropia needs plus or convex lenses in glasses for correction.



Astigmatism

In astigmatism eye is not spherical like football but eye is like rugby ball. Eye is rounder on one side and flatter on other side. Astigmatism is condition in which light focuses at two points. A combination of plus and minus lens is used for correction and such lens is called cylinder lens.



Presbyopia

We have ability to focus on distance and near objects with ease. This is because our natural lens in eye has ability to change its shape and becomes more convex for near.

This ability to focus on near objects is called accommodation.

During accommodation our natural lens becomes more convex and helps to focus for reading.

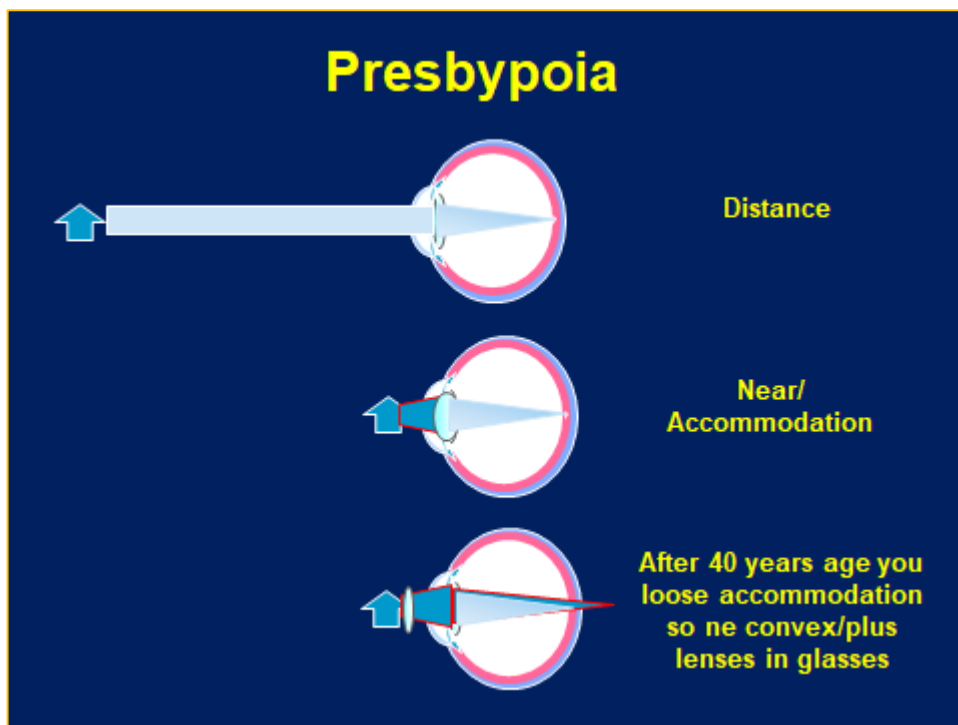
This ability to accommodate for near decreases with age and this decrease ability of accommodation is called presbyopia.

This happens near age of forty and we need help of convex or plus lenses at this age for close work.

In the slide upper picture showing that object can focus perfectly for distance.

In middle picture natural lens becomes more convex to focus near near object and we call it accommodation.

In bottom picture patient loses some of its ability to accommodate and need extra convex/plus lenses in glasses to be able to focus for close work.



Amblyopia

Sometimes patient has refractive or squint which remains uncorrected. Because of these reason image does not fall on fovea. This causes maldevelopment of vision areas in brain.

Though the patient has normal eye but patient can not see and condition is called amblyopia or lazy eye. If the condition treated early then vision can be improved but improvement almost impossible at adult stage.

Treatment includes correction of refractive error and squint if present.

If eye is affected then normal eye is patched few hours a day so affected eye improves.

Amblyopia / Lazy eye

- Patient has uncorrected refractive error or squint
- Uncorrected refractive error or squint causes maldevelopment of vision centers
- Partially improves with refraction
- May be in one or both eye

Treatment of refractive errors

How to correct Myopia

Light focusing short of retina in myopia

Minus lens diverging light and helping it to focus on retina

Convex lens (+ Lens)

Concave lens (- Lens)

Long eye
Short sighted

Myopes are short sighted
Can see short distances
Myopia - Myopes Minus lenses

Short eye
Long sighted/Far sighted

Hypermetropes are long sighted
Can see long distances
Hypermetropes Plus lenses

How to correct Hypermetropia

Light focusing behind retina in hypermetropia

Plus lens converging light and helping it to focus on retina

Convex lens (+ Lens)

Concave lens (- Lens)

Long eye
Short sighted

Myopes are short sighted
Can see short distances
Myopia - Myopes Minus lenses

Short eye
Long sighted/Far sighted

Hypermetropes are long sighted
Can see long distances
Hypermetropes Plus lenses

Treatment of refractive errors

We use concave or minus lenses for myopia and

Convex or plus lenses for hypermetropia.

Cylinder (combination of plus & minus) lenses for astigmatism

Convex or plus lens for presbyopia

Glasses:

Glasses are most common and effective mode of treatment.

They are cheaper, time tested and with no side effects.

Contact lenses:

Contact lenses serve same purpose as glasses.

Advantages are good cosmetic look and easy to use in sports.

Disadvantages are allergic reactions and infections which can damage vision.

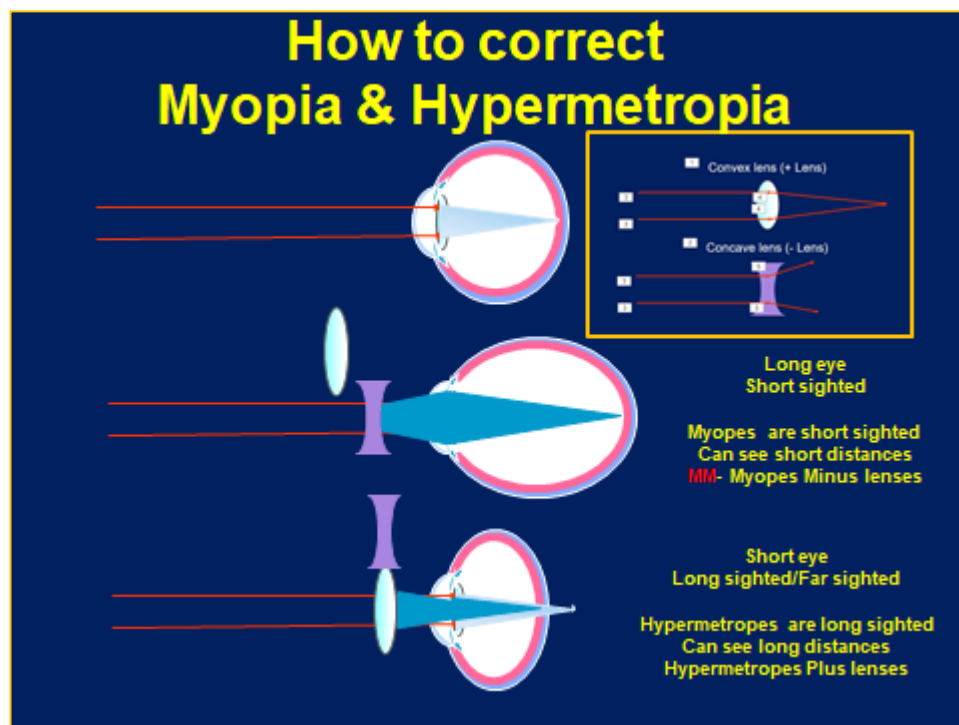
Laser surgery:

Laser surgery makes you free of glasses or contact lenses.

Disadvantages are possible loss of part of vision or loss of all vision in rare cases.

There are three main types of laser surgery.

- PRK: In PRK laser is applied directly on cornea to reshape it.
- LASIK: In LASIK a flap of epithelium and superficial stroma is lifted, laser is applied for correction and flap is replaced.
- SMILE: In SMILE a pocket in stroma is made and piece of stroma is removed.



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