

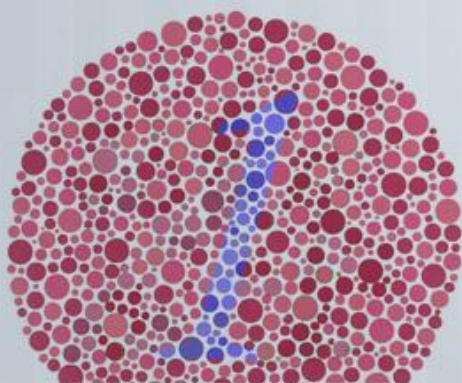
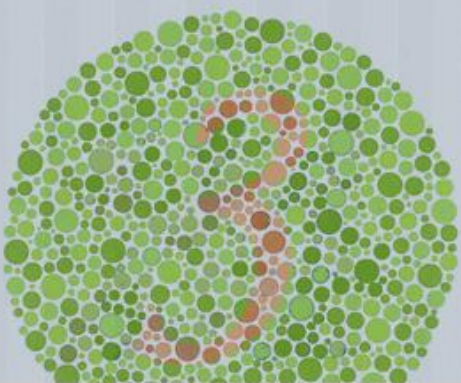
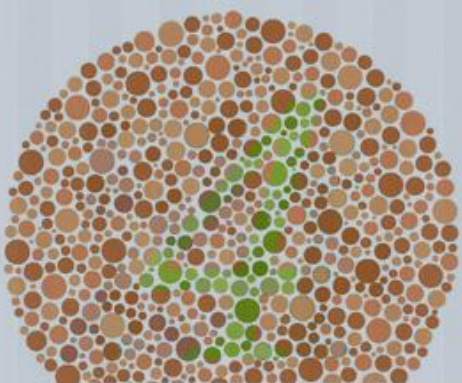
# LECTURE TITLE



**431**  
**Teams**  
medical students

*Ophthalmology Team*

Done By:  
Abdullah AlTurki



# Refractive Errors

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## Introduction

75% of blindness is avoidable and is due to 3 main reasons:-

- Uncorrected refractive error
- Cataract
- Trachoma

**Definition of Legal blindness: A visual acuity of 20/200 or a constricted visual field of 20 degrees or less.**

The normal refractive power of the eye is 60 diopters. The lens contributes for 1/3 of the refractive power, while the cornea 2/3.

Lens accommodation becomes weaker at the age of 40 and completely lost by the age of 60.

Lens accommodative power =  $15 - (\text{age}/4)$

eg: patients age is 60

$15 - (60/4) = 0$

Diopter =  $1 / \text{Focal length of the lens}$

Helm-holtz theory

-contraction of ciliary muscle --> decrease tension in zonule fibers --> elasticity of lens capsule mold lens into spherical shape --> greater dioptric power --> divergent rays are focused on retina

-contraction of ciliary muscle is supplied by parasympathetic **third nerve**

## Types of Refractive Errors

Three types of refractive errors:

Myopia (nearsightedness)

Hyperopia (farsightedness)

Astigmatism

### 1- Myopia

#### Causes of myopia

1. *Increased refractive power:*

a) Change in lens nucleus or shape:

Cataract, spherophakia, diabetes

b) Lens repositioning:

ciliary muscle shift e.g miotics

Lens movement e.g anterior lens dislocation

c) Ciliary muscle tone:

Excessive accommodation e.g medical students

d) Increase corneal power:

keratoconus, congenital glaucoma

2. *Increase axial length:*

Congenital glaucoma, posterior staphyloma

#### Myopia Forms:

–Benign myopia (school age myopia).

•onset 10-12 years, myopia increase until the child stops growing in height

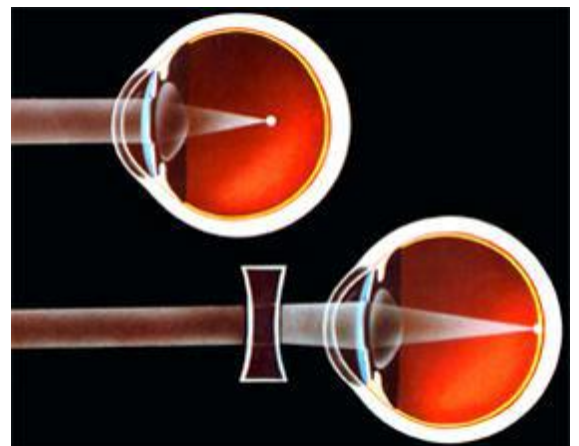
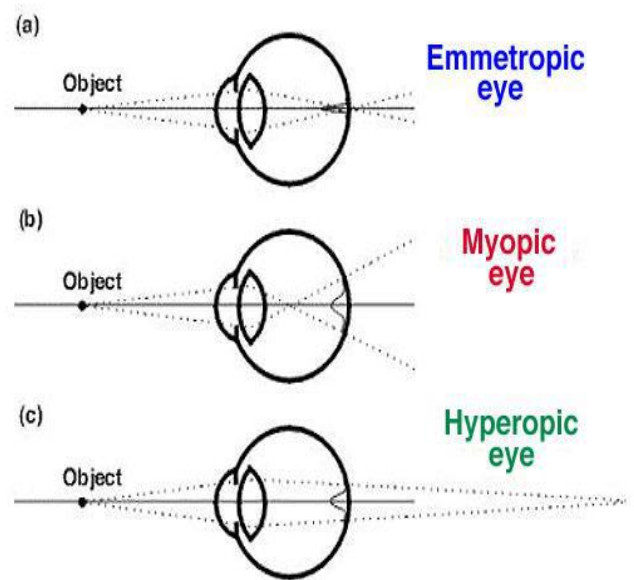
•generally tapers off at about 20 years of age.

–Progressive or malignant myopia.

•myopia increases rapidly each year and is associated with, fluidity of vitreous and chorioretinal change.

#### Symptoms:

–Blurred distance vision



- Squint in an attempt to improve uncorrected visual acuity when gazing into the distance
- Headache
- Amblyopia—uncorrected myopia > -10 D

*Corrected using a minus lens*

## 2- Hyperopia

### Causes of Hyperopia

1. *Decreased refractive power of the eye:*
  - a) absent (aphakia) or posteriorly repositioned lens
  - b) weak accommodation trauma, marijuana
2. *Decreased effective axial length (retina pushed forward):*  
tumor, orbital mass

### Symptoms:

- Visual acuity at near tends to blur relatively early “inability to read fine print”
- Asthenopic symptoms : eyepain, headache in frontal region
- Accommodative esotropia : because accommodation is linked to convergence -->ET
- Amblyopia—uncorrected hyperopia > +5D

*Corrected using a Plus lens*

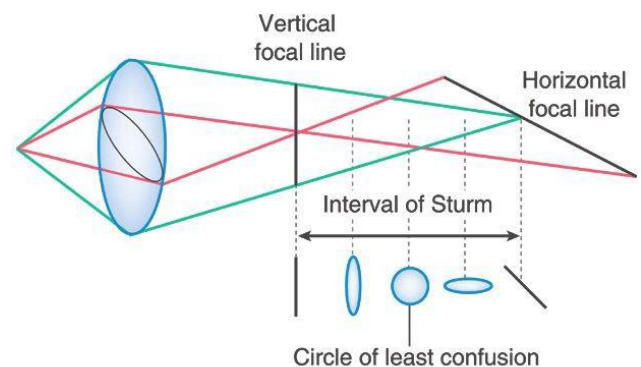
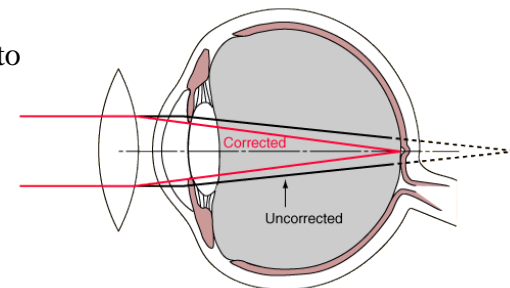
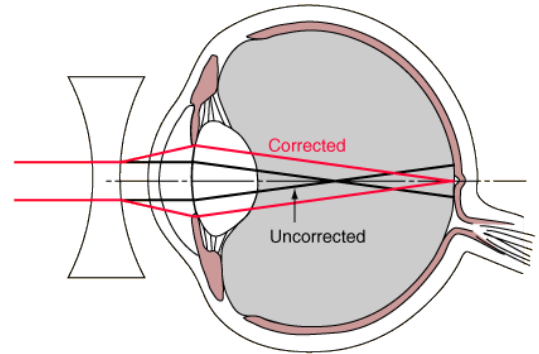
## 3- ASTIGMATISM

The cornea is usually shaped like half a football. In these eyes there will be no astigmatism.

In astigmatism the refractive media is not spherical-->refract differently along one meridian than along meridian perpendicular to it-->2focal

### Classification

- Regular astigmatism:* power and orientation of principle meridians are constant.
- Irregular astigmatism:* power and orientation of principle meridians change across the pupil.



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## Causes of astigmatism

*Corneal causes:*

- a) Simple corneal astigmatism
- b) Keratoconus
- c) Masses e.g lid tumor
- d) Ptosis

*Lenticular causes:*

Lens dislocation, lenticonus

## Symptoms

- asthenopic symptoms (headache, eyepain)
- blurred vision
- distortion of vision
- head tilting and turning
- Amblyopia—uncorrected astigmatism  $> 1.5 D$

## ANISOMETROPIA

Anisometropia means there is a difference in refractive error between the two eyes. Individuals can tolerate up to 2-3D of anisometropia before becoming symptomatic. When refraction is corrected it often leads to different image sizes on the 2 retinas (aniseikonia). Aniseikonia depends on degree of refractive anomaly and type of correction.

## Presbyopia

Presbyopia is the physiological loss of accommodation in advancing age. This is usually due to deposition of insoluble proteins in the lens with advancing age-->elasticity of lens progressively decrease-->decrease accommodation starts at around 40 years of age.

## Types of optical correction

### •Spectacle lenses

- Monofocal lenses: spherical lenses, cylindrical lenses.
- Multifocal lenses.

### •Contact lenses

- higher quality of optical image and less influence on the size of retinal image than spectacle lenses.
- indication: cosmetic, athletic activities, occupational, irregular corneal astigmatism, high anisometropia, corneal disease.
- disadvantages: careful daily cleaning and disinfection, expense.

–complication: infectious keratitis, giant papillary conjunctivitis, corneal vascularization, severe chronic conjunctivitis. (infection)

**•Surgical correction**

Not done before the age of 18 (because the eye is still changing before the age of 18)

Keratorefractive surgery:

•Refractive surgery –flattens corneal surface for myopia which will decrease its power.

•Improves unaided visual acuity but may have complications.

e.g PRK,LASIK,LASE

**•Intraocular surgery:**

–give best optical correction for aphakia, avoid significant magnification and distortion caused by spectacle lenses.

–clear lens extraction (with or without IOL), phakic IOL.

## Summery

Refractive Error	Myopia	Hyperopia	Astigmatism
Causes	<p><b>Increased refractive power:</b></p> <p>a) Change in lens nucleus or shape:                      b) Lens repositioning:                      c) Ciliary muscle tone:                      d) Increase corneal power:</p> <p><b>Increase axial length:</b>                      Congenital glaucoma, posterior staphyloma</p>	<p><b>Decreased refractive power of the eye:</b></p> <p>a) absent (aphakia) or posteriorly repositioned lens                      b) weak accommodation trauma, marijuana</p> <p><b>Decreased effective axial length (retina pushed forward):</b>                      tumor, orbital mass</p>	<p><b>Corneal causes:</b></p> <p>a) Simple corneal astigmatism                      b) Keratoconus                      c) Masses e.g lid tumor                      d) Ptosis</p> <p><b>Lenticular causes:</b>                      Lens dislocation, lenticonus</p>
Classification	<p>–<b>Benign myopia</b> (school age myopia).                      •onset 10-12 years, myopia increase until the child stops growing in height (<b>More common</b>)                      –<b>Progressive or malignant myopia.</b></p>	-	<p>–<b>Regular astigmatism:</b>                      power and orientation of principle meridians are constant.                      –<b>Irregular astigmatism:</b>                      power and orientation of principle meridians change across the pupil.</p>
Symptoms	<p>–Blurred distance vision                      –Squint in an attempt to improve uncorrected</p>	<p>Visual acuity at near tends to blur relatively early “inability to read fine print”</p>	<p>–asthenopic symptoms (headache, eyepain)                      –blurred vision</p>



	visual acuity when gazing into the distance –Headache –Amblyopia–uncorrected myopia > -10 D	–Asthenopic symptoms : eyepain, headache in frontal region –Accommodative esotropia : because accommodation is linked to convergence -->ET –Amblyopia–uncorrected hyperopia > +5D	–distortion of vision –head tilting and turning
Corrective lens	<i>Corrected using a minus lens</i>	<i>Corrected using a Plus lens</i>	-

Questions:-

Q1: at what age is lens accommodation completely lost?

- a) 40
- b) 50
- c) 60
- d) 70

Q2: Which one of the following is not a refractory error?

- a) Myopia
- b) Hyperopia
- c) Astigmatism
- d) Emmetropia

Answers :1C, 2D