Ophthalmology

Collected and organized by

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Second Year

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Acknowledgments

This two-year curriculum was developed through a participatory and collaborative approach between the Academic faculty staff affiliated to Egyptian Universities as Alexandria University, Ain Shams University, Cairo University , Mansoura University, Al-Azhar University, Tanta University, Beni Souef University , Port Said University, Suez Canal University and MTI University and the Ministry of Health and Population(General Directorate of Technical Health Education (THE). The design of this course draws on rich discussions through workshops. The outcome of the workshop was course specification with Indented learning outcomes and the course contents, which served as a guide to the initial design.

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توصيف مقرر دراسى

1- بيانات المقرر		
الرمز الكودى :	اسم المقرر : أمراض العيون **Ophthalmology**	الفرقة /المستوى : الثانية
التخصص : البصريات	عدد الوحدات الدراسية : 2 نظرى 0 عملى	

2- هدف المقرر:	To provide training for the Ophthalmic Technician in general concepts and main principles related to eye diseases and systemic diseases related to the eye to be able to examine vision and eye under the appropriate direction or supervision of an ophthalmologist.
3- المستهدف من تدريس المقرر :	
ا. المعلومات والمفاهيم :	**By the end of this course the trainee will be able to:** ● State different parts of the eye. ● Describe frequently encountered ophthalmic conditions affecting different parts of the eye. ● Define different ophthalmic terms. ● Describe the ocular manifestations of common systemic diseases.
ب- المهارات الذهنية :	**By the end of this course the trainee will be able to:** ● Identify a normal eye from an abnormal pathological entity. ● Distinguish between different pathological entities of the eye. ● Explain the relation between common systemic disease and the eye. ● Select the appropriate investigation procedure for different ocular conditions.
ج- المهارات المهنية الخاصة بالمقرر:	**By the end of this course the trainee will be able to:** ● Take medical history and identify high risk patients. ● Test and record visual acuity appropriately for patients with all levels of acuity. ● Use proper technique for external eye examination, pupillary examination and Slit-lamp Biomicroscopy. ● Provide instructions to preoperative and postoperative care
د- المهارات العامة :	**By the end of this course the trainee will be able to:** ● Identify problems ● Communicate properly information to physician and patient.
4- محتوى المقرر:	**1- Introduction to Ophthalmology:** ● **Basic Anatomy of the eye and adnexa.** **2- Clinical examination of the eye:** ● **History taking** ● **Visual Acuity measurement and confrontation visual field assessment.** ● **Clinical assessment of the eye and its adnexa: Penlight**

examination, Slit-lamp examination. **3- Errors of refraction:** • **Myopia** • **Hypermetropia** • **Astigmatism** • **Presbyopia** • **Aphakia** • **Anisometropia** **4- Common Ocular diseases involving:** • **Lids** • **Lacrimal system** • **Conjunctiva** • **Cornea** • **Lens** • **Orbit** • **Vitreous** • **Retina** • **Optic nerve** • **Uvea** • **Trauma**	

• **Academic Lectures.** • **Assignments.** • **Practical hands–on training.**	5- أساليب التعليم والتعلم
• **Supportive feed-back.** • **Involve in projects and helpful assignments.** • **Forming peer support groups.**	6- أساليب التعليم والتعلم للطلاب ذوى القدرات المحدودة.
اختبارات نظرية اختبارات عملية	7- تقويم الطلاب
اختبارات نظرية (**Essay & MCQ**) اختبار عملي على صور وسائط متعددة (**Slide show**)	أ- الأساليب المستخدمة
Mid-term assessment (MCQ) by 7th week **Final assessment (Essay, MCQ & Slide show) by 15th week**	ب- التوقيت
النهاية العظمى 100 درجة والصغرى 60 درجة اعمال سنة 20 درجة اختبار تحريري 80 درجة	ج- توزيع الدرجات
8- قائمة الكتب الدراسية والمراجع : • **The Ophthalmic Assistant, 9th Edition, (H.A. Stein, R.M. Stein and M.I. Freeman, Eighth Edition, 2013, Elsevier Inc.)** • **Fundamentals for Ophthalmic Technical Personnel, (B. Cassin, 1995, W.B. Sanders Company.**	
-----	أ- مذكرات
-----	ب- كتب ملزمة
• **Certified Ophthalmic Assistant Exam Review Manual, (J. K. Ledford, Slack.)** • **Ophthalmic Medical Assisting, An Independent Study**	ج- كتب مقترحة

Course, (E. Newmark & M.A. O'Hara, 6th Edition, 2012, AAO).	
▪ **International Council of Ophthalmology website: www.icoph.org/resources.html** ▪ **American Academy of Ophthalmology website: Eyewiki.aao.org** ▪ **American Academy of Optometry website and journal: www.aaopt.org**	د- دوريات علمية أو نشرات ..... الخ

Contents

Course overview

Week	Theory	Practice
1st week	**Introduction 1:** - Anatomy of the eye.	----------
2nd week	**Clinical examination of the eye 1:** - History taking - Vision assessment	----------
3rd week	**Clinical examination of the eye 2:** - Clinical examination of the eye.	----------
4th week	**Errors of refraction 1:** - Refraction - Myopia	----------
5th week	**Errors of refraction 2:** - Hypermetropia - Astigmatism	----------
6th week	**Errors of refraction 3:** - Presbyopia - Aphakia - Anisometropia	----------
7th week	**Mid-term Assessment**	----------
8th week	**Ocular diseases 1:** - Lids - Conjunctiva - Cornea	----------
9th week	**Ocular diseases 2:** - Cornea (continued) - Uvea - Lens	----------
10th week	**Ocular diseases 3:** - Vitreous - Retina	----------
11th week	**Ocular diseases 4:** - Optic nerve	----------
12th week	**Ocular diseases 5:** - **Orbit**	----------
13th week	**Ocular diseases 6:** - **Trauma**	----------
14th week	**Revision**	----------
15th week	**Final Examination**	----------

Chapter 1

Basic Anatomy of the eye

The eyeball has three coats (Layers) (Figure 1).

A. Outer layer

- Sclera
- Cornea

B. Middle layer (uvea)

- Iris
- Ciliary body
- Choroid

C. Inner layer

- Retina

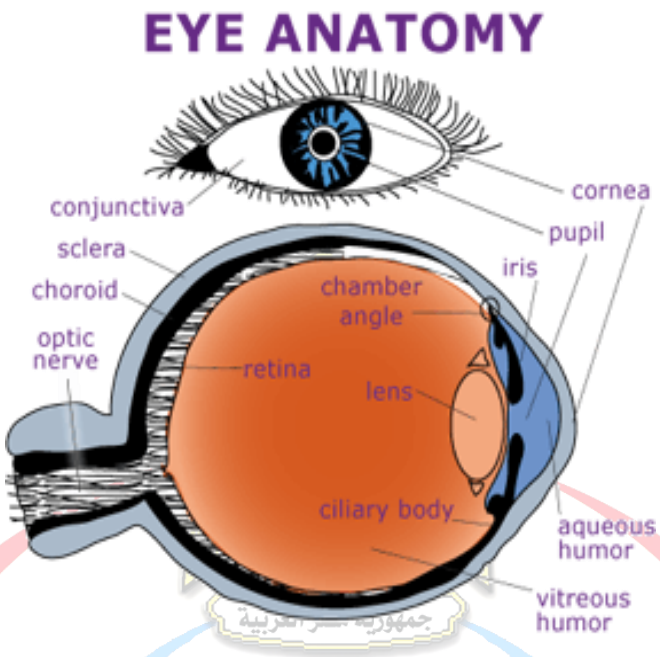


Figure 1

Sclera & Cornea

Sclera

- Consists largely of collagen.
- Provides support and protection, and maintains shape of eye.

Cornea

- Transparent anterior part of eye, the most powerful optical component of the eye.
- Lacks blood vessels, gets oxygen directly from the air and the aqueous humor.
- Very sensitive nerve endings, responds rapidly to injury.

Uvea: Iris

Uvea

- Highly vascularized, provides nutrition to various elements of the eye.

Iris

- The colored part of the eye.
- The iris muscles control pupil size which regulates the amount of light entering the eye.
- It influences sharpness of retinal image.

Uvea: Ciliary Body & Choroid

Ciliary body

- Produces aqueous humor (function: nourishes the cornea and lens).
- Ciliary muscle plays a major role in accommodation (change in lens shape to focus at distance or near).

Choroid

- Provides nourishment to the retina.

Other Ocular Structures

- Crystalline lens
- Vitreous humor
- Canal of Schlemm
- Fovea
- Optic Nerve

Crystalline Lens

- It provides ~1/3 of the power of the eye.
- Accommodation: this is the ability of the lens to change its shape to focus at different distances. The lens loses this ability to change shape easily above the age of 40 years, decreasing the eye's ability to focus near objects i.e. presbyopia.
- Also with age, lens becomes less transparent and eventually develops opacification i.e. cataract.

Vitreous Humor

- It consists primarily of collagen and hyaluronic acid and has a gel-like structure.
- The vitreous gel provides structural support to the eye and helps nourishes the retina.
- With age, may liquefy causing floaters.

Canal of Schlemm

- It provides drainage for the aqueous humor.
- Canal of Schlemm is located at the angle of the eye (where the iris inserts into the ciliary body).
- Production and drainage of aqueous humor help maintain the intraocular pressure (IOP).

Optic Nerve

- It is formed from the axons of the ganglion cells (leaving the eye).
- Optic nerve head, or optic disc: the part of the fundus where the axons of ganglion cells exits the eye.
- No photoreceptors in optic disc, therefore no perception of light forming the physiological blind spot.

Retina

- A sheet of neural tissue, ~0.2 to 0.4 mm thick.
- 5 classes of neurons: photoreceptors, bipolar cells, ganglion cells, horizontal cells and amacrine cells. Each of these classes has subtypes, as well.

Fovea

- It is a Part of the macula (area centralis) (Figure 2).
- Specialized area of the retina that provides sharpest vision.
- Foveal pit: neural elements of inner retina piled up on the side of pit.
- The Macula contains Xanthophyll pigment that absorbs blue light, thus giving the macula a yellowish appearance (Macula lutea = Yellow spot)

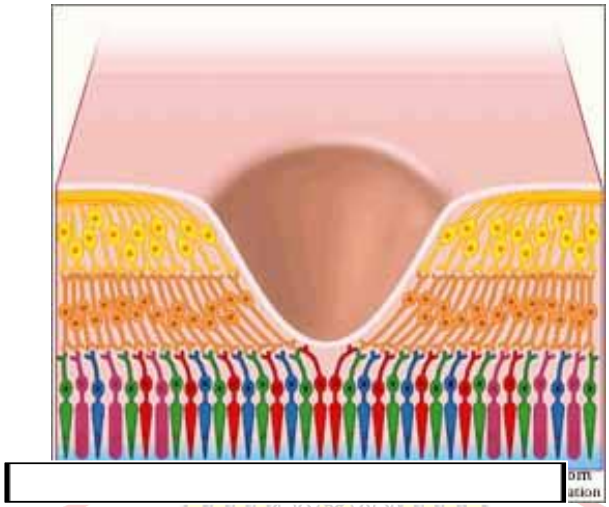


Figure 2 - Fovea.

Photoreceptors

- 2 classes of photoreceptors: rods and cones.
- Rods: night-time vision, very sensitive at dim light level, no rods in the fovea.
- Cones: daytime vision, not as sensitive as rods but work well in bright light, most densely packed in the fovea. Three cone types provide trichromatic (color) vision.

Chapter 2

Ophthalmic History taking and clinical examination

History taking:

1- Start by introducing yourself
2- **Personal history:**
    a. Name, age, marital status, address, occupation
    b. Smoking habits: how many cigarettes/day, for how many years (toxic amblyopia, atherosclerosis, smoking worsens diabetic retinopathy, age-related macular degeneration, thyroid exophthalmos)
3- **Complaint:**
    a. Use patient's own words, do not lead the patient
4- **History of present illness:**
    a. Onset: sudden (minutes) , acute (hours- days), chronic
    b. Course: stationary, progressive, regressive
    c. Duration:
        i. Use since when you have a fixed date (since July, 2000)
        ii. Use ago when you have a vague date of onset (3 years ago)
5- **Past medical history:**
    a. Diabetes mellitus: how many years (duration related to complications), drug therapy, is blood glucose controlled or not (symptoms, does the patient monitor blood glucose at home ? do we have a reading on glycosylated hemoglobin?)
    b. Hypertension: duration, medications, control
    c. Trauma
    d. Allergy to medications
6- **Past surgical history**
    a. Did the patient do any surgeries before (ocular, non-ocular)
    b. Any complications of anesthesia

Clinical examination:

1- Visual acuity:

- Definition: this is a measure of the capability of visual system to resolve a target. It is measured by the smallest object which can be seen at certain distance from the eye and depends on
    i. Target illumination
    ii. Background illumination (best if in Photopic conditions for cone function)
    iii. Visual angle the target subtends at the nodal point of the eye

- Minimal angle of resolution (figure 1):
    i. This is the smallest angle subtended by 2 points at the nodal point of the eye
    ii. Snellen's letters or Landolt's broken rings subtend an angle of 1 minute of an arc at the specified distance

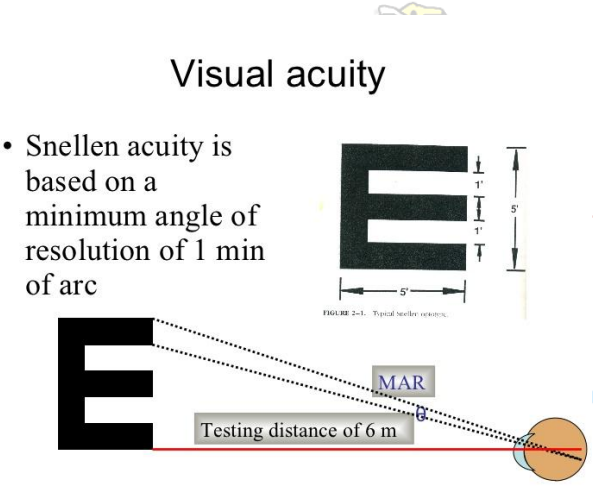


Figure 1: Minimal angle of resolution based on Snellen's chart

- How to measure VA (figure 2):
    i. Patient sits at 6 m from the chart
    ii. Lowest line that can be read is recorded (6/6 up to 6/60)
    iii. If patient does not see biggest ring (6/60), patient is asked to come closer to the chart to see the 6/60 target. The distance at which he sees the target is recorded if he sees it at 5 m distance is recorded as 5/60
    iv. When patient does not see target object at 1m (ie: 1/60) then we move to counting fingers
    v. CF: in good illumination, the patient is asked to count fingers till a distance of 10 cm in front of the eye and this is recorded (CF: 50 cm)
    vi. Hand movement: patient does not see CF at 10 cm , do HM
    vii. Light perception: If no HM → do LP and write:
        1. LP
        2. NLP
    viii. In HM , and LP vision, proceed to projection of light test:
        1. Patient is in a dim room and looking straight forward
        2. Ideally test is performed using the light of an indirect ophthalmoscope (6V)
        3. light comes from the 4 cardinal positions from the periphery towards the pupil, an patient is asked to point directions from which light is projected
        4. This is noted as :
            a. Good projection
            b. Bad projection

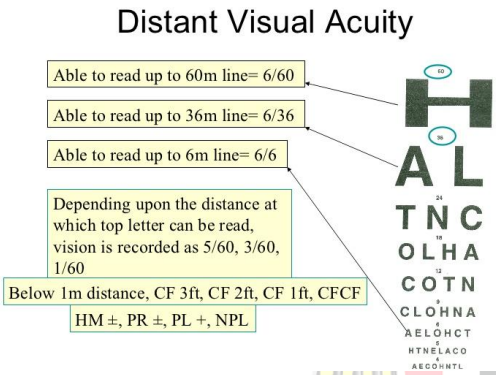


Figure 2: How to test visual acuity

ix. Testing near vision:
    1. By using targets for near (Allen cards)
x. Testing color vision (figure 3) :
    1. Important in optic neuritis (red color desaturation)
    2. Red-topped bottle is presented to the patient's eyes sequentially and patient is asked if top has same brightness or not

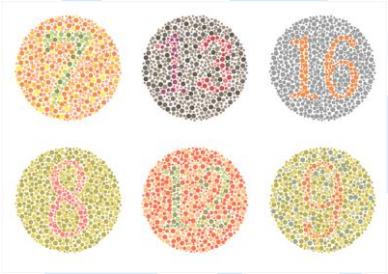


Figure 3: color vision testing

- How to assess macular function in opaque media (presence of mature cataract): :
    - **i. Macular function tests:**
        1. **VA:**
            - **a. ≥HM , indicates good prognosis if correlates with the degree of opacity**
            - **b. <HM indicates complicated cataract with worse prognosis**
        2. **Pupillary reaction: if sluggish indicates bad prognosis**
        3. **Color vision**
        4. **Form sense:**
            - **a. Black perforated disc is put in a trial frame**
            - **b. Light is thrown onto the disc**
            - **c. The patient is asked to count the number of holes in the disc**
            - **d. Maddox rod test : tests for form and color**
        5. **Potential acuity meter: a mini-Snellen's chart is projected on the fovea through the lens opacity**

6. **Laser interferometry: detects diffraction fringes projected on the fovea**

7. **Visual evoked potential:**
    a. **Light stimulation of the retina → waves recorded over occipital lobe**
    b. **It measures VA in children**
    c. **Macular function due to large area of representation at occipital lobe**

- **How to assess VA in babies:**
    1. Fixation and following: at 2-3 months. Useful colorful attractive objects. Test each eye separately and look for avoidance movements.
    2. Red reflex
    3. Fundus examination
    4. Optokinetic nystagmus: jerky nystagmus in response to a rotating drum
    5. Preferential looking: to patterned stimulus

2- Field of vision:

- Definiton: it is the part of the outer world that can be seen at one time by one or both eyes.
- **Tests for Visual fields:**
    1. **Condition: VA > 33 cm**
    2. **Light projection:**
        a. VA ≤ HM
        b. Patient is seated in a dark room, with the fellow eye covered
        c. Patient looks forward
        d. Light of an indirect ophthalmoscope (6Volts) is thrown onto the eye from the four cardinal positions.
        e. Each time the patient is asked to point the direction where the light is coming from

    3. **Confrontation method (figure 4):**
        a. Patient and examiner sit at 1 m distance
        b. Left patient's eye is covered and he looks into the observer's left eye (right observer's eye is closed
        c. The observer moves his finger between him and the patient in a plane from periphery to the center and asks the patient to report when he sees it
        d. Normally, both patient and examiner see the finger simultaneously

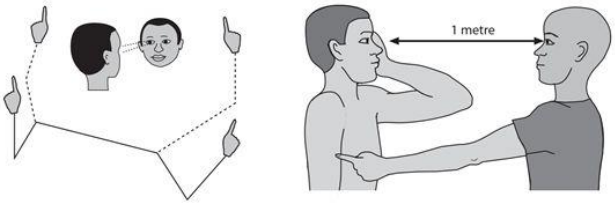


Figure 3: Confrontation method to detect gross visual field changes

Central VF changes:

1- These changes occur in the central 30° of the visual field

2- Evaluation:

* Bjerrrum's screen: this is a 1m x 1m screen placed at 1 meter from the patient.. Target tests vary in size and color

* Automated visual field testing: target tests vary in intensity, and size

PS: Changes in central VF are early and diagnostic and include:

a- Baring of the blind spot: exclusion of the blind spot from the central field

b- Seidel scotoma: superior or inferior extension of the blind spot

c- Bjerrum (arcuate) scotoma: an arcuate sotoma that is continuous with the blind spot and concentric with the point of fixation

d- Annular scotoma: fusion of 2 arcuate scotomas

Peripheral VF changes:

1- These changes occur in the peripheral field beyond the central 30°. Normal visual field is limited by (figure 4) :

- Inferiorly by the inferior orbital rim (70°)
- Superiorly by orbital tim and brow (60°)
- Nasally by the nose (60°)
- Temporally : 90°

2- Evaluation:

- Goldmann Perimeter
- Automated perimeter

3- Changes include:

a- Nasal contraction of VF

b- Roenne nasal step: nasal defect with sharp horizaontal border

c- Concentric contraction of VF (more on the nasal side)

d- Tubular field: the papillomacular bundle are the last to be lost

e- Total loss of VF (and vision) wjen the central and peripheral fields meet

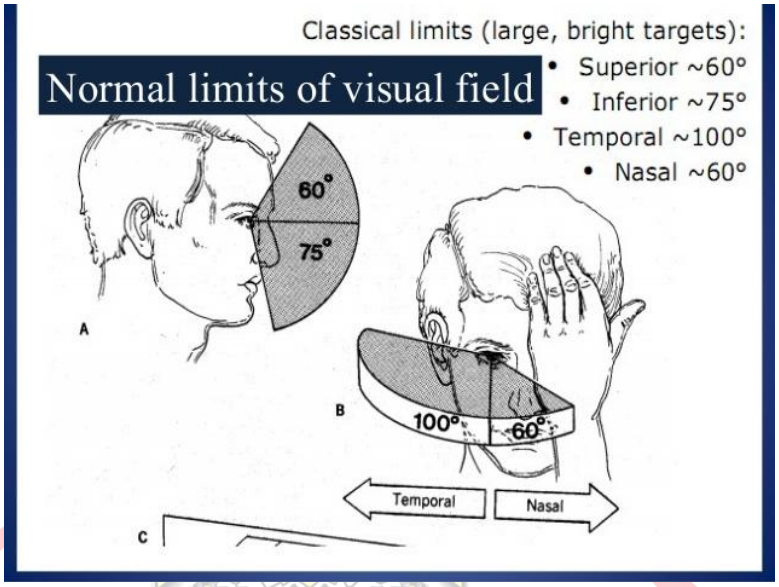


Figure 4: normal limitation of visual field

3- External examination:

- Used to examine the anterior segment of the eye and ocular adnexal
- General inspection:
    i. Use ambient light
    ii. Head posture, ptosis, proptosis, squint
- Oblique illumination: using a penlight
    i. Observe with the naked eye for diffuse corneal opacities, conjunctival lesions
    ii. Use magnifiers as corneal loupes
    iii. Use slit lamp biomicroscopy:
        1. Strong illumination
        2. Slit lamp allows to make sections in cornea, AC, lens, and anterior vitreous
- Gonioscopy:
    i. This is a method of evaluation of anterior chamber angle using special lenses : as Goldmann 3 mirrors lens or Zeis 4 mirror lenses
    ii. Used in evaluation of glaucomas

4- IOP measurement:

- Definition: it is the pressure that maintains normal ocular function
- Measurement of IOP:
    - Digital method: finger fluctuation test:
        a. Patient is asked to look down to the floor without closing his eyes
        b. Examiner's index fingers are placed on the upper lid above the tarsus
        c. One finger is held still and it is the recipient finger
        d. The other finger is gently applying pressure
        e. Compare the two eyes

f. Tension is expressed as:
    i. T_n = Normal
    ii. T_+= High
    iii. T_- = Low

- Tonometry:
    a. **Indentation Tonometry (figure 5):**
        i. Principle:

        The IOP is measured by finding the amount of indentation of the cornea produced by placing a known weight on it

        ii. Method:
        1. Patient lies supine
        2. Local anesthetic drops are instilled in conjunctival sac
        3. The lids are gently separated
        4. The Schiotz tonometer is applied on the cornea with its known weight
        5. Conversion tables are supplied with the tonometer to get the IOP

        iii. Advantages:
        1. Cheap
        2. Simple
        3. Portable

        iv. Disadvantages:
        1. Affected by scleral rigidity:
        2. Less reliable in myopes
        3. Less reliable in hypermetropes

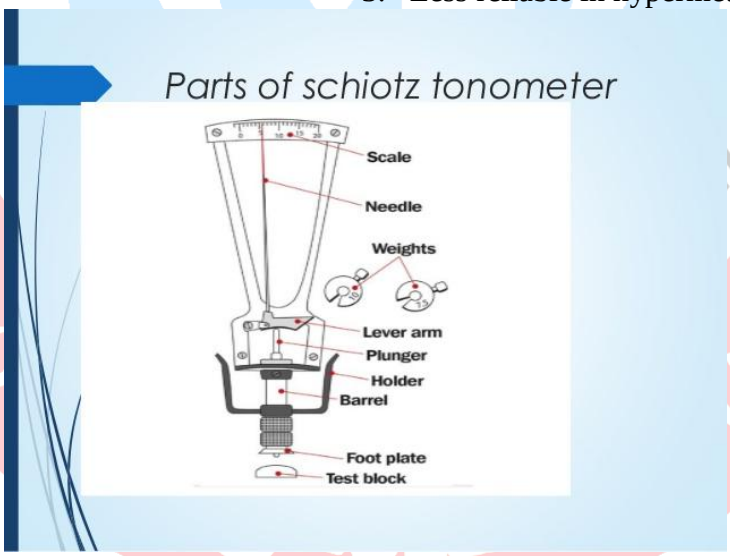


Figure 4: Schiotz indentation tonometer

b. Applanation tonometry (Figure 5):

i. Principle:

1. Measuring the IOP by finding the force needed to flatten an area of the cornea measuring 3.06 mm in diameter
2. An applanation cone is used

ii. Method:

1. Surface anesthesia drops
2. A fluorescein drop is instilled in lacrimal sac (Why? To be able to see the tear film as the RI of tears and cornea are the same)
3. The patient looks straight ahead with his eyes wide open
4. The applanation cone is gently applied to the cornea
5. The inner edges of the half circles (myres) should gently touch each other
6. The reading obtained is multiplied by 10

iii. Advantages: more accurate (less affected by scleral rigidity)

iv. Types:

1. Goldmann's applanation tonometry (SL)
2. Perkins applanation tonometry (portable)

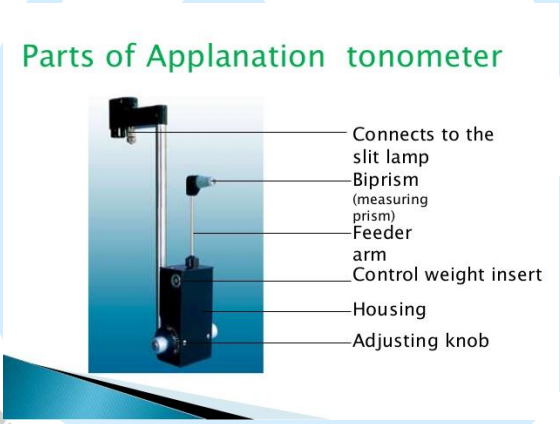


Figure 5: Goldmann's applanation tonometer

c. **Air Puff tonometers:** non-contact methods using an air puff to applanate the cornea

5- Pupil examination: for light reflex (figure 6)

- **Light Reflex:**

i. Definition:

When the light falls on the retina of one eye:

- The ipsilateral pupil constricts "Direct reflex"
- The contralateral pupil also constricts " Consensual reflex"

Pathway:

- ***Stimulus:*** *light*
- ***Receptors:*** *Rods and cones*
- ***Afferent:***
  - *Optic nerve*

- *Optic tract:*
  - *Temporal fibers → uncrossed*
  - *Nasal fibers → cross*
- *Midbrain:*
  - *Pretectal nucleus*
  - *Intercalated neurons → Edinger-Westphal nucleus on both sides*

- ***Center:***
  - *Edinger Westphal nucleus (part of 3rd CN) parasympathetic fibers travel in 3rd CN*
- ***Efferent:***
  - ***3rd N** → inferior division → nerve to inferior oblique → ciliary ganglion →synapse → short ciliary nerves → constrictor pupilllae muscle*

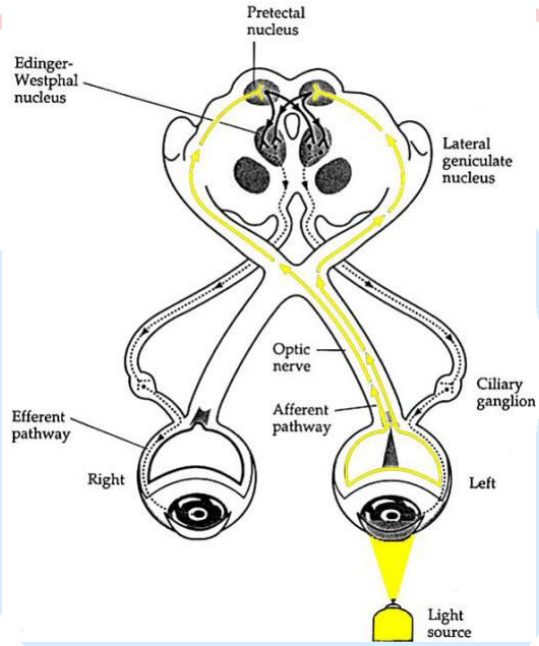


Figure 6: Light reflex pathway

6-Fundus examination:

Methods of detection of cataract:

1- **Oblique illumination: using**
   a. **Penlight**
   b. **Slit lamp: offers a strong illumination with magnification**

<u>Principle:</u> Iris shadow (Figure 7)

Definition: it is the shadow of the iris on the immature cataract.

How to elicit:

a- observer looks from the front and through the light on the pupil obliquely (45°)

b- A black crescent is seen at the pupillary border if a clear interval intervenes between the iris and the opacity (immature cortical cataract, hypermature cataract)

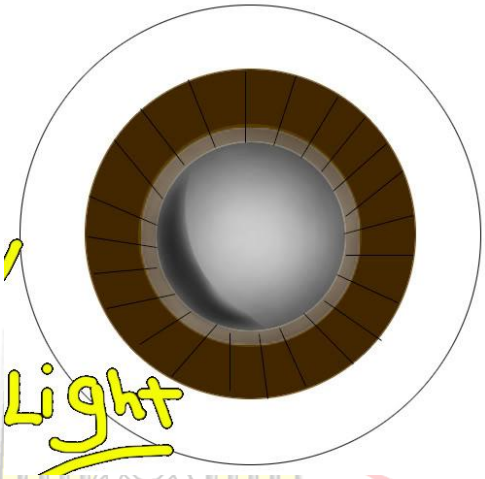


Figure7: Iris shadow

2- Red reflex method (figure 8):

a. A light source is located behind the left ear of the patient
b. The examiner holds a perforated plane mirror while sitting in fromt of the patient and at the same level
c. The examiner looks through the small whole throwing the reflected light at the patient's pupil
d. Examiner sees the reflected light from the chroidal circulation as a red reflex in clear ocular media
e. The lens opacity appears dark with clear areas inbetween
f. Used in retinoscopy
g. Diseases associated:
    i. Grey RR: retinal detachment
    ii. Whitish RR: Mature cataract, retinoblastoma
    iii. Yellowish RR: endophthalmitis
    iv. Black: vitreous hemorrhage, cataracta nigra

Figure 8: A: Red reflex. B: Gray reflex due to cataract

Fundus examination:

- **Ophthalmoscopy:**

	Direct	Indirect
Image	Erect	Inverted
Magnification	X15	X5

Field	Smaller	Larger
Binocularity	Uniocular	Binocular , good stereopsis
Uses:	Optic nerve and macula evaluation in non-high myopes	Retinal periphery examination

- **Slit lamp biomicroscopy:**
  - In conjunction with a contact lens (Goldmann 3 mirrors, or non-contactlenses: Volk 90)

<u>Methods of evaluation of ON:</u>
1- Slit lamp biomicroscopy using:
1. *Contact or non-contact lens (+78D)*
2. *Red free filter (evaluates nerve fiber layer)*

2- Serial ON drawings
3- Visual field defects
4- Nerve fiber layer analyzer
5- Confocal laser ophthalmoscopy
6- Optical coherence tomography (OCT)

- *Other tests in opaque media :*
  - *Ultrasongraphy:*
    a. *Sound waves of high frequency are transmitted through a probe in contact with the eye*
    b. *Sound waves are reflected from different tissues at different speeds*
    c. *The reflected sound waves are amplified and reflected as :*
       i. *Waves: A-scan: to detect axial length of the eye, and the spike indicates tissue density*
       ii. *Two dimensional picture: B-scan:*
           1. *detects RD*
           2. *IOFB*
           3. *Vitreous hemorrhage*
           4. *Intraocular tumors*

  2. *VEP:*
     a. *Light stimulation of the retina → waves recorded at occipital lobe*
     b. *Uses:*
        i. *Measure VA in children*
        ii. *Macular function tests (the macula has a large area of cortical representation)*

Chapter 3

Errors of Refraction

Definitions:

Emmetropia (Figure 1):

This is a refractive condition in which incident parallel rays come to a focus on the retina with accommodation **fully relaxed.** Rays coming out of the retina leave the eye parallel and meet at infinity. The retina and infinity are conjugate foci.

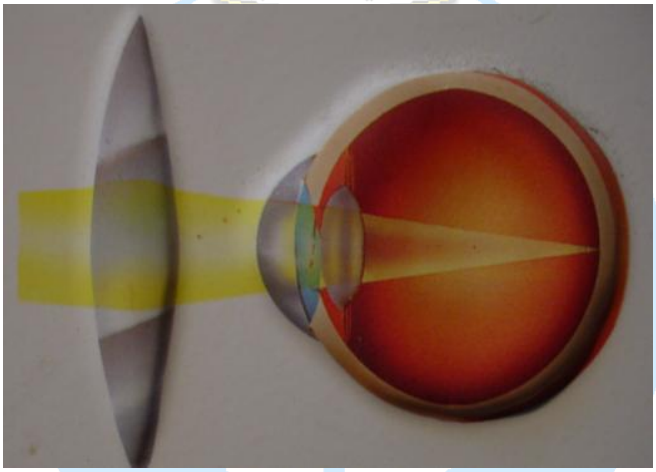


Figure 1: Emmetropia status

Ametropia:

This is a refractive condition in which parallel rays do not come to a focus on the retina with accommodation fully relaxed. This includes:

- Myopia, hypermetropia
- Astigmatism
- Aphakia and anisometropia

Factors affecting the eye as an optical system:

1- Axial length:

This represents the anteroposterior axis, which is usually 24 mm

2- Refractive power:

Which depends on the curvature of the cornea and lens as well as the refractive indices of different ocular structures

Accommodation

Definition:

It is the ability of the lens to increase its power to see near objects clearly.

Mechanism:

Contraction of ciliary muscles decreases the diameter of the ciliary ring resulting in relaxation of zonular fibers and increased convexity of the lens and its refractive power allowing the eye to focus on the near object.

Near point (Punctum proximum, Figure 2):

It is the nearest point on the line of sight which is seen clear when accommodation is fully active

Far point (Punctum remotum, Figure 2):

It is the furthest point on the line of sight which is seen clear when accommodation is fully relaxed. This point varies with the refractive condition of the eye:

- Emmetrope: it is located at infinity
- Myope: nearer than infinity
- Hypermetrope: point behind the eye

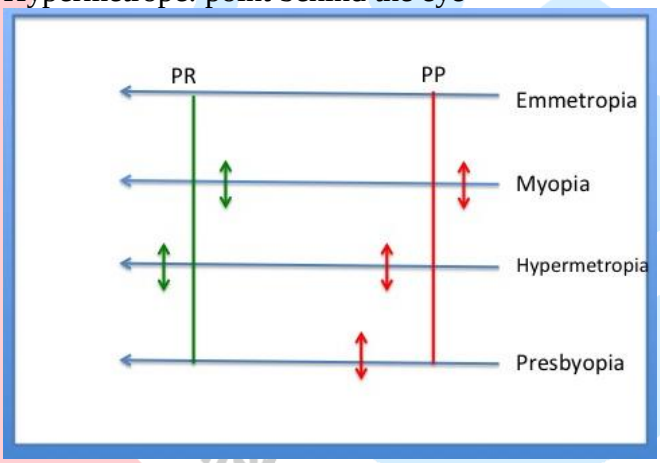


Figure 2: PP: Punctum remotum, PR: punctum proximum and relation to refractive status of the eye. PP is when accommodation is fully active.

Range of Accommodation:

It is the distance between the near point and the far point

Amplitude of Accommodation:

It is the total number of diopters which an eye can accommodate. It is the difference between accommodation for near (maximum) and accommodation for far (at rest).

Amplitude of accommodation = Refractive power for near – refractive power for far

Accommodation is strongest in early childhood and decreases with age. It may be weak or lost in the following conditions:

- Presbyopia
- Cycloplegic drugs: parasympatholytics: atropine, cyclopentolate, tropicamide

- Third nerve palsy
- Lens subluxation
- Aphakia

Presbyopia

Definition:

It is a physiological recession of the near point (punctum proximum, figure 2, 3) due to a decrease in accommodative power of the lens making near work uncomfortable

Aetiology:

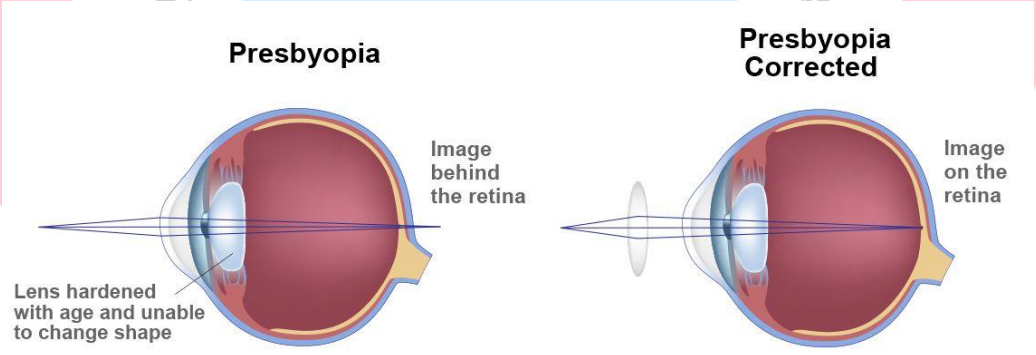
- Increase in lens sclerosis with age results in decrease in lens elasticity and decrease in accommodative power
- Decrease power of ciliary muscles
- Pathological presbyopia: in chronic simple glaucoma due to ischemia of ciliary muscle

NB: Presbyopia is not an error of refraction, it is an ageing process

CP:

1- Difficulty in near work
2- The patient holds the near object away to be able to read
3- Accommodative asthenopia
4- Age of onset: varies with refractive state of the eye:

- Emmetrope: around age of 45 yrs
- Hypermetrope: < 45 yrs
- Myope: > 45 yrs
-



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- Figure 3: Presbyopia and correction

Treatment:

Reading glasses:

1- Correct the error for far if present (eg: +1 D hypermetrope)
2- Measure near point (punctum proximum) by asking the patient to put the near object where he sees it (50 cm)

3- Estimate power of accommodation = 100/ punctum proximum in cm (100/50 = 2 D)
4- Keep 1/3 of accommodation in reserve (2 x 1/3 = 2/3 D reserve)
5- Allow patient to use 2/3 of accommodation (= + 1 1/3 D)
6- Add plus lenses to make the total sum (+3D) ie: the near distance at 33 cm
3- 1 1/3 = 1 2/3 D
7- Add this plus lens to patient far glasses = +1 + 1 2/3 D = 2 2/3 D near add

The near add can be given as:

- Separate pairs of glasses for distance and near vision
- A pair of bifocal lenses, where the near correction is added to the lower segment of the distance lens
- Varifocal lenses where the power of the lens gradually changes from the distance correction (in the upper part) to near correction (in the lower part). This provides sharper middle-distance vision.

Multifocal contact lenses
Multifocal intraocular lenses
Surgical correction of presbyopia: under investigation

Diopter:

It is the unit of lens power. It is defined as the power of a lens which brings parallel rays falling on it to a focus at a distance of 1 meter. (figure 4)

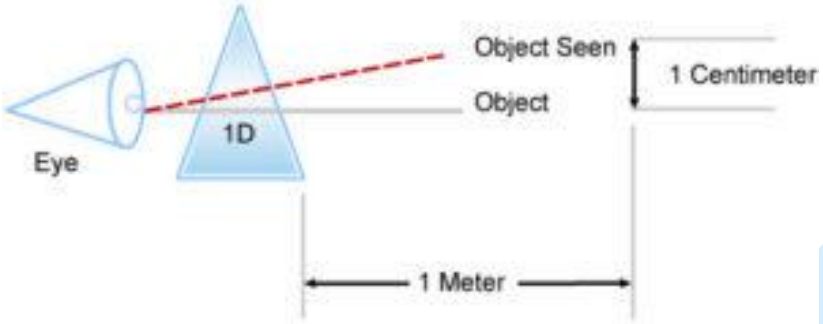


Figure 4: one diopter

Types of lenses:

1- Spherical lenses:

They represent segments of a sphere. They bring light rays to a point of focus. They my be convex or concave.

	Convex lenses	**Concave lenses**
Thickest at	Center	Periphery
Objects appears	Larger	Smaller
On moving the lens	Objects move in opposite direction of lens mvt	Objects move in same direction of lens movement

2- Cylindrical lenses:

- They represent segments of a cylinder
- Light rays passing in the plane of axis of the cylinder undergo no refraction
- Light rays passing in a plain perpendicular to the cylinder undergo refraction

How to estimate lens power ??

- By neutralizing with lenses of opposite kind and of known power
- Geneva lens meter
- Phacometer = lens meter = focimeter

Refraction

Determination of refractive correction can be done using objective or subjective methods.

1- **Objective Refraction (Retinoscopy):**
   - **a.** Manual Retinoscopy:
     - **i.** Patient is sitting in dim illumination **and is asked to look at a far point**
     - **ii.** Physician is sitting in front of the patient at a working distance of 75 cm
     - **iii.** Light is reflected on the pupil by either:
       1. Using a plain mirror with reflecting light from a source of light behind the patient
       2. Using a retinoscope
     - **iv.** Light is swept across the patient's pupil and the status of the reflex is noted:
       1. Against movement: myopia > -1 : use concave lenses to neutralize **the reflex (No movments is noted)**
       2. With movement:
          - **a.** Emmetropia
          - **b.** Hypermetropia
   - **b. Automated retinoscopy:**

2- **Subjective refraction:**
   - **a.** Depends on the patients response to different lenses in front of the eye placed in the trial frame
   - **b.** As a rule: the lowest minus and highest plus that achieve the best corrected vision are prescribed

3- Cycloplegic refraction:
   - **a.** Necessary in children and young adults with active accommodation
   - **b.** Aims at abolishing accommodation to determine full hyperopic refractive error using cycloplegic drugs:
     - **i.** Cyclopentolate 1%
     - **ii.** Atropine 1%

Myopia

Definition (Figure 5):

It is a refractive condition in which the optical power of the eye is too high so that with accommodation fully relaxed:

1- Incident parallel rays come to a focus in a point in front of the retina

2- Rays emerging from a point on the retina leave the eye converging to a point in front of the eye (Punctum remotum)

3- The distance of the punctum remotum from the eye will depend on the degree of myopia. The relation is inverse.

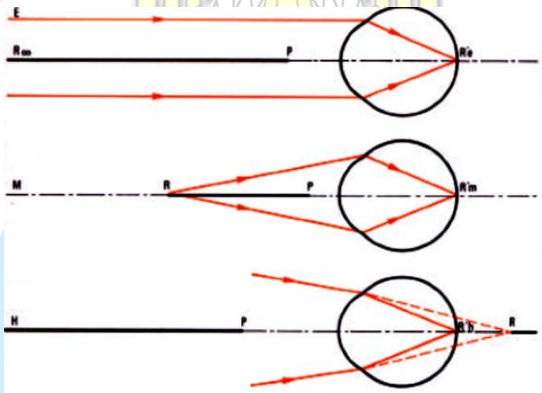


Figure 5: Refractive status in emmetropia, myopia and hypermetropia. Note the relation of punctum remotum.

Aetiology:

1- Axial Myopia:

It is due to increased axial length of the eye (commonest type). Classified into:

a- Simple

b- Degenerative: progressive

c- Congenital

	Simple Myopia	Degenerative myopia	Congenital myopia
Onset	Teenagers (14 yrs)	Children (7 yrs)	Since birth
Progression	Until age 25 yrs	Beyond 25 yrs	Stationary
Degree	< -6D	15-25 D	About –10D
Degenerative changes	Absent	Present	Less severe
Heredity	-	+	-

2- Refractive myopia:

It is due to ↑ refractive power of the eye. This includes:

a- Curvature myopia:

- ↑ curvature of the cornea (keratoconus)
- ↑ curvature of the lens (lenticonus)
- Anterior displacement of the lens

b- Index myopia:

- ↑ refractive index of the nucleus (nuclear cataract)
- ↓ refractive index of the cortex (uncontrolled DM)

Treatment:

1- Optical:

- **Glasses: (Concave or minus lenses, Figure 6)**
  - Simple myopia: give full correction= the least power leading to 6/6 vision
  - High myopia:
    - Children : full correction to allow for normal mental development
    - Adults: undercorrect. Two pairs of glasses for far and for near. As the patient is not accustomed to the small, sharp, and bright retinal image given by the high minus lens, leading to coular discomfort. For a myope of –20D, a –18 D correction is given for far and a –16D for near (weak ciliary muscle → weak accommodation)
- **Contact lenses:**
  - Better cosmetic appearance
  - Bigger field
  - No ↓ in retinal image size

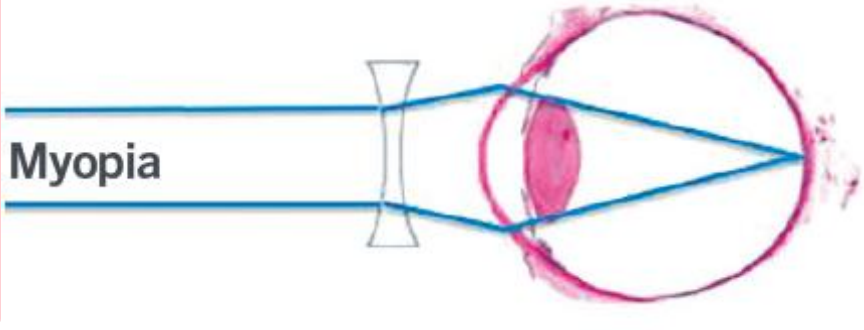


Figure 6: Concave lens correction of myopia

2- Surgical:

- **Laser procedures:**
  - **Excimer laser photorefractive surgery:** this flattens the corneal center by ablating the central part using excimer laser
  - **LASIK:** laser in situ keratomileusis: this involves removal of a corneal flap (150µ) using a microkeratome and ablating a central part of the cornea, then replacing the flaps

- **LASEK:** laser in situ epithelial keretmileusis: the flap consists only of epithelium with basement membrane (50µ) using alcohol 20% or femtosecond laser (Epilasik procedure).
- **Indications:**
  - **Low to moderate errors of refraction (up to -8D sphere, and -4D astigmatism)**
  - **Age more than 21 years (stable refraction)**

- **Surgical procedures:**
  - **High errors:**
    - **Anterior chamber phakic IOL implantation: in high errors**
    - **Implantable posterior chamber phakic lenses (ICL)**
    - **Clear lens extraction with implantation of an IOL in high minus errors: contraindicated in patients below 40 years of age as the incidence of rhegmatogenous retinal detachment is high in younger population**
    - **Complications of surgery:**
      - **Surgery carries a significant risk of rhegmatogenous retinal detachment specially in young ge (up to 20%)**

Hypermetropia

Definition

It is a refractive condition in which the optical power of the eye is too low, so that with accommodation fully relaxed (Figure 6):
1- Incident parallel rays come to a focus in a point behind the retina
2- Rays emerging from a point on the retina leave the eye diverging to a virtual point coming from behind the retina (Punctum remotum)
Accommodative effort will bring distant objects into focus by increasing the lens power. This will use up accommodative reserve for near objects leading to early fatigue (asthenopia)

Aetiology:

<u>1- Axial Hypermetropia:</u>

- Due to a small antero-posterior axis (small eyes). Commonly seen in children below age 7 as their eyes are not fully developed yet
- Acquired: if the retina is pushed forward as in central serous retinopathy or orbital tumors flattening the globe

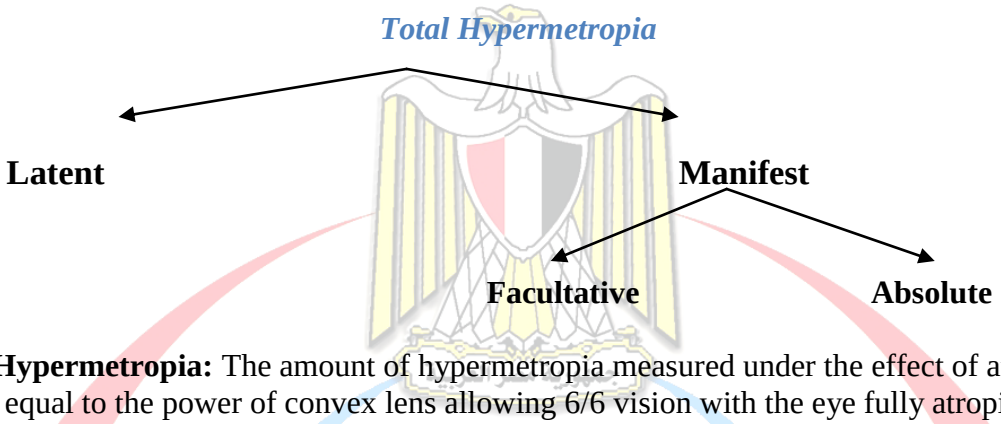
<u>2- Refractive Hypermetropia:</u>

Due to ↓ refractive power of the eye:

- Curvature Hypermetropia: cornea plana: flat cornea
- Index Hypermetropia: ↓ refractive index of the lens (immature cortical cataract)

3- Aphakia and posterior lens dislocation

Components of Hypermetropia:



Total Hypermetropia: The amount of hypermetropia measured under the effect of atropine. This is equal to the power of convex lens allowing 6/6 vision with the eye fully atropinized

Latent Hypermetropia: The amount of hypermetropia corrected by the tone of ciliary muscles (about 1D)

Latent hypermetropia = Total - manifest

Manifest hypermetropia: The amount of hypermetropia not corrected by the tone of ciliary muscle. Highest power convex lens that allows 6/6 vision without atropine

Facultative Hypermetropia: part of hypermetropia corrected by accommodation

Facultative hypermetropia = Manifest – Absolute

Absolute: remaining of manifest hypermetropia not corrected by accommodation. It is the least power convex lens giving 6/6 vision without atropine

Treatment:

Mild forms: no symptoms = no treatment

High degrees:

1- Optical correction:

- **Children:** give full correction
- **Adults:**
  - Highest tolerated convex lens (the patient cannot tolerate full correction due to spasm of the ciliary muscle) (figure 7)
  - After 6 months , the full correction is given
- **Elderly:**
  - Far correction: full correction
  - Near correction: add a +3D for near correction

2- Refractive surgery:

- Less successful than myopia

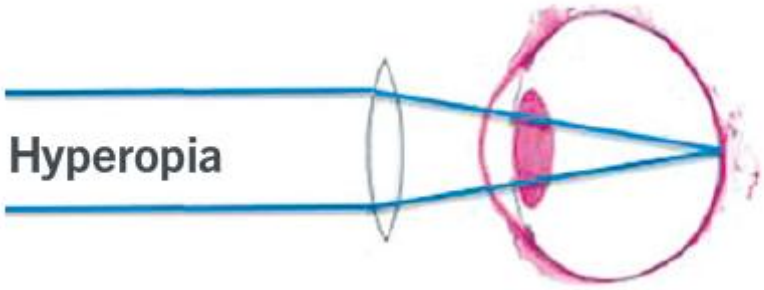


Figure 7: Optical correction of hypermetropia

Astigmatism

Definition:

It is a condition of refraction in which the eye does not have the same power of refraction in all meridia. Incident parallel rays do not come to a point focus on the retina and come to form a line (or a geometric figure called the conoid of Sturm) at varying distances from the retina (Figure 8).

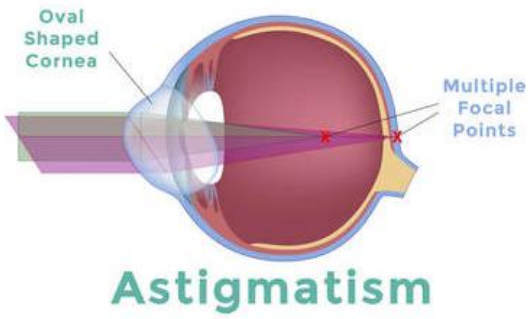


Figure 8: Astigmatism

Aetiology:

Astigmatism is due to irregularities in curvature of the cornea or the lens

1- Corneal astigmatism:

- Degenerative: Keratoconus
- Acquired: corneal opacity, keratectasia, following cataract surgery, keratoplasty

2- Lenticular astigmatism:

- Congenital: lenticonus
- Acquired:
  - Subluxation
  - Pressure on the lens by a ciliary body tumor

Types:

1- Regular:

Meridia of highest and lowest power are perpendicular to each other
Transition from the highest power to the lowest power is gradual.

When the two-principle meridia are not the vertical and horizontal, this is known as **oblique astigmatism**

It includes:

- Simple Astigmatism: One meridian is emmetrope and the other ametrope:
  - Simple myopic astigmatism
  - Simple hyperopic astigmatism
- Compound astigmatism: both meridia are ametrope and of the same type:
  - Compound myope astigmatism
  - Compound hypermetrope astigmatism
- Mixed astigmatism (figure 9):
  - One meridian is myope and the other hypermetrope

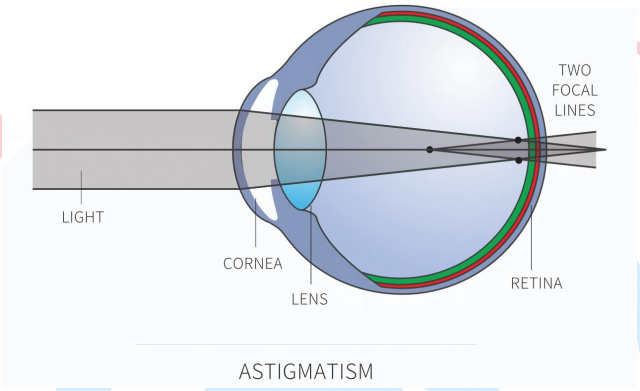


Figure 9: Mixed astigmatism

2- Irregular Astigmatism (Figure 10)

Meridia of highest and lowest power are not perpendicular to each other
Transition from the highest to the least is not regular

Figure 10: No, regular and irregular astigmatism

Rule of Astigmatism:

- **Physiological astigmatism (Figure11): i**n emmetropia: the vertical meridian is more curved than the horizontal meridian due to pressure of the lids on the cornea, resulting in a more myopic (more powerful) vertical meridian. The diameter of the horizontal meridian is 12 mm while the vertical is 11 mm. The eye doesn't suffer

from physiological astigmatism as the retina is stretched on the sclera, which is also oval.

- Astigmatism with the rule: vertical meridian is more myopic
- Astigmatism against the rule: vertical meridian is less myopic (horizontal meridian is more myopic)

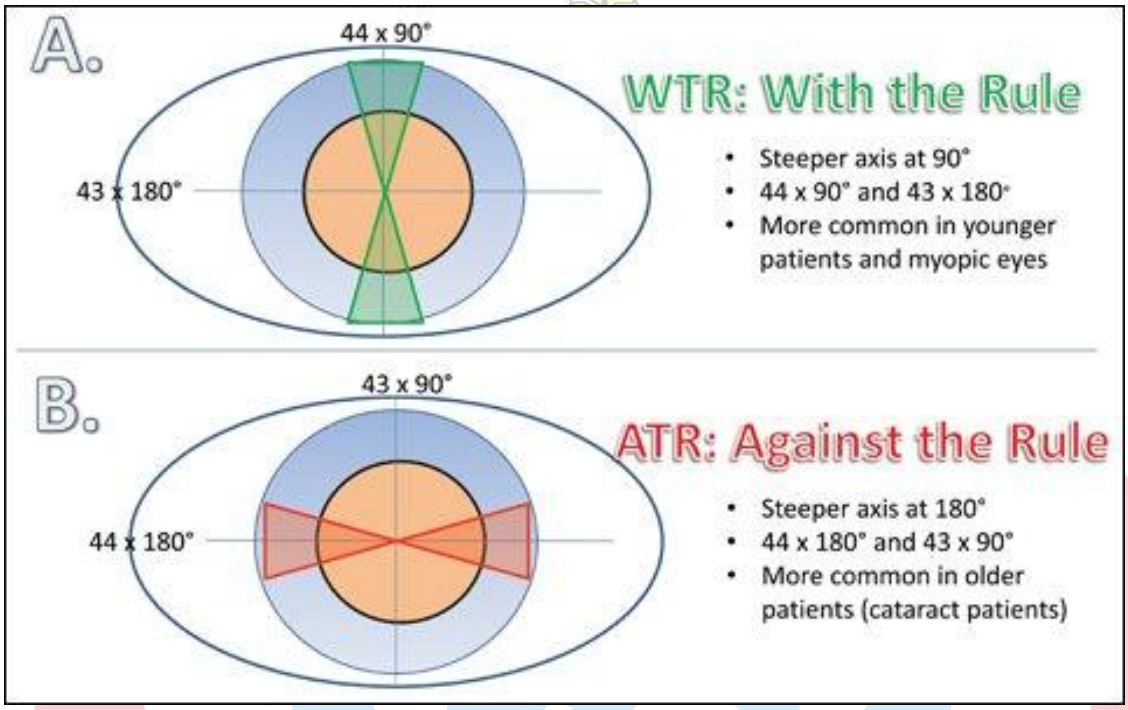


Figure 11: With and against the rule astigmatism

CP:

1- Symptoms:

- Accommodative asthenopia (small errors)
- Indistinct vision for near and far (high errors)
- Distorted objects

2- Signs:

- Signs of aetiology: Keratoconus, corneal opacity, subluxation
- Retinoscopy
- Signs of pathology:
    - Landolt's chart: some of the openings of the **Cs** are not seen
    - Astigmatic fan: some lines are sharp and black, others are blurred and grey
    - Placido's disc: shows irregular circles
    - Keratometry: measures the curvature and power of different corneal meridia
    - Retinoscopy: measures the diopteric power of each meridian
    - Corneal topography
    - Fundus picture:

- Oval optic disc
- Retinal blood vessels running in different planes are not focused simultaneously

Treatment:

1- Regular astigmatism:

Corrected by glasses (figure 12) or hard type contact lenses

- **Simple:**
  - **A cylindrical lens is given with axis perpendicular to the ametropic meridian**

- **Compound or mixed: sphero-cylindrical lenses**

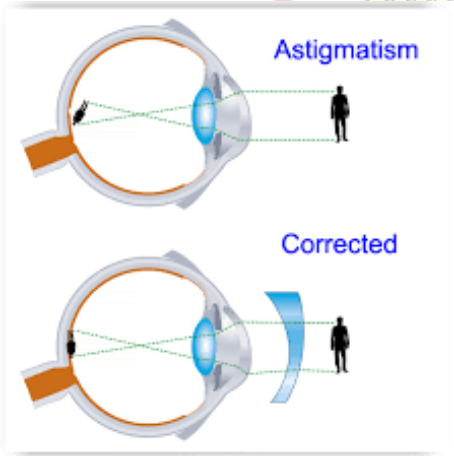


Figure 12: Cylindrical and sphero-cylindrical lenses in treating astigmatism

- **Irregular astigmatism:**
  - **Hard CL: the hard CL cancels the irregular corneal surface and the refraction exerted by the cornea is transmitted to the anterior lens surface**
  - **Keratoplasty.**

Anisometropia

Definition:

It is a condition of refraction in which the difference in refractive power between the two eyes is > 4 Diopters

Aneisokonia: it is the difference in size of retinal images. On correcting the error, minus lenses will minify the size of the retinal image and plus lenses will magnify it. When the difference between the sizes of the retinal image is >4 D, the brain will not fuse the images of marked size difference

Aetiology:

- Congenital
- Acquired: unilateral aphakia

CP:

1- Small degrees of anisometropia are very common and causing no problems
2- Accommodative asthenopia
3- Binocular diplopia : due to inability of the brain to fuse the images
4- Amblyopia: the image of the more ametropic eye will be suppressed by the brain leading to amblyopia of the eye (**amblyopia ex-anopsia)**
5- Divergent squint

Treatment:

- Contact lenses: reduce the difference in retinal image size to about 6%, allowing the brain to fuse both images to obtain a single binocular vision
- IOLs: reduce the difference to less than 1%
- Refractive corneal surgery: epikeratophakia

Asthenopia:

Definition:

Eyestain noticed specially after close work including eye ache, frequent blinking, lacrimation and periorbital headache.

Aetiology:

- **Accommodative asthenopia:**
  - Hypermetropia
  - Astigmatism
  - Presbyopia
  - Anisometropia
- **Muscular asthenopia:**
  - Disproportion between convergence and accommodation (hypermetropia)

Aphakia:

Definition:

Absence of the crystalline lens

Aetiology:

- Cataract extraction
- Trauma:
  - Lens dislocation

- Ruptured lens capsule and lens matter absorption
- Congenital: rare

CP:

Symptoms:

- Loss of accommodation
- Blurred vision: an emmetropic patient transforms into hyperope of about +10D when aphakic

Signs:

- Signs of aetiology: limbal wound, trauma
- Signs of aphakia:
  - Deep anterior chamber
  - Iridodonesis
  - Jet black papillary reflex
  - Purkinje-Sanson image (Figure 12):
    - When reflecting a penlight on the anterior surface of the eye, the following images are formed:
      - First image: on anterior corneal surface and is virtual and erect **(moves in same direction of penlight)**
      - Second image: on anterior lens surface and is also virtual and erect **(moves in same direction of penlight)**
      - Third image: on posterior lens surface and is true and inverted **(moves in opposite direction of penlight)**

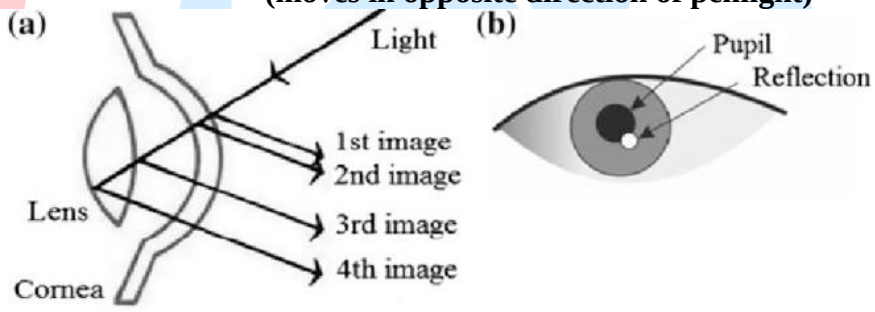


Figure 12: Purkinje-Sanson image

- **In aphakia, there is loss of the 2 images belonging to the lens.**

Correction of aphakia:

- Strong plus glasses are to be given to correct the aphakia
- Strong plus glasses magnify the retinal image x1.6 times the size of the image on the fellow normal eye (Aneisokonia)
- The brain cannot fuse a normal and a magnified image due to aneisokonia → binocular diplopia
- Management includes correction of unilateral aphakia using contact lenses or IOL implantation to decrease the size of the magnified image on the retina

Contact lenses

Definition:

They are special types of plastic lenses applied directly to the cornea

Principle:

Abolishes the cornea as a refractive surface and replaces it by "**contact lens-fluid lens interface"**

Indications:

1- Optical :

a- High errors: high myopia
b- Unilateral aphakia
c- Irregular astigmatism
d- Anisometropia

2- Therapeutic:

a- Neuroparalytic keratitis, resistant ulcers
b- Keratitis metaherpetica
c- Prophylaxis against symbepharon (Simmond's hard lenses)
d- Aniridia: guards against excessive

3- Cosmetic: colored CL hide dense corneal opacities

4- Occupational

5- Diagnostic:

a- Gonioscopy lenses
b-LASER delivery CL

Types:

1- Soft contact lenses:

Formed of plastic material with pores in it allowing oxygenation through the lens itself. The duration of use depends on water contents of the lens and its thickness. It is recommended that any type of lenses should be removed before sleep.

2- Hard CL

Made of PMMA.Used for high degrees of astigmatism

3- Gas permeable CL:

It is a type of hard CL, but allow more corneal oxygenation, so that the ocular tolerance and time of use is greater

Advantages:

1-Larger field: no frame, move with the eye
2- No anisokonia: absent binocular diplopia
3- Cosmetically better
4- Avoid spherical, and chromatic aberrations of spectactles

Disadvantages:

1- Intolerance

2- Corneal abrasions, keratitis: from overwear

4- Lens infection and deposits: if not properly cleaned

Chapter 4

Ocular diseases

The Eyelid

Diseases of the Eyelid

I. Congenital (defects present at birth)

- Coloboma
- Epicanthus
- Blepharophimosis

II. Anomalies of position of lashes and lid margin

- Entropion
- Ectropion
- Ptosis
- Lagophthalmos

III. Inflammatory disorders

- Blepharitis
- Chalazion
- Hordeolum internum
- Hordeolum externum

IV. Lid Tumors

- Benign
- Malignant

V. Lid Injuries

- Lacerations
- Penetrating injuries
- Chemical burns

Trichiasis

Definition: The direction of eye lashes are changed towards the eye causing irritation, watering and corneal abrasions.

Cause

- Chronic Blepharitis
- Herpes Zoster infection
- Trachoma

Treatment

Epilation or removing eyelash with forceps.

Blepharitis

Definition : It is inflammation of the eyelid margins. (Fig. 1)

Figure 1 - Blepharitis

Causes

- Seborrhea (dandruff)
- Staphylococcal infection
- Poor hygienic conditions
- Uncorrected refractive errors
- Diabetes

Symptoms and signs

- Itching
- Watering (lacrimation)
- Photophobia
- Hyperemia and Scales on lid margin

Treatment

- Improvement of general health
- Treatment of dandruff
- Lid hygiene
- Antibiotic eye ointment
- Correction of refractive error
- Screening for diabetes in adults and treating if present.

Stye (Hordeolum Externum)

Definition

Inflammation of follicle of the eyelash including the gland of Zeis.

Causative organism

Staphylococcus (a bacterial infection)

Risk factors

- Children and young adults
- Diabetes
- Very sick patients
- Uncorrected refractive errors

Symptoms and signs

- Pain and swelling of the lid margin
- Edema of lids
- Tenderness

Treatment

- Hot fomentation
- Antibiotic eye ointment
- Analgesic
- Treatment of refractive errors, blepharitis, diabetes.

Acute Chalazion (Hordeolum Intermum

Definition

Acute inflammation of the meibomian gland.

Causative organism

Staphylococcus

Risk factors

Same as hordeolum externum

Symptoms

Same as hordeolum externum but more severe

Signs

- Point of maximum tenderness is ***away from lid margin***
- Pus points on the tarsal conjunctiva

Treatment

Same as hordeolum externum

Chronic Chalazion

Definition

Chronic inflammation of the meibomian gland (Figure 2)

Figure 2 - Chalazion

Causes

- Blepharitis
- Chronic conjunctivitis
- Diabetes in adults
- Errors of refraction

Symptoms

Painless nodular swelling in the eye lid

Signs

- Well defined swelling
- Firm and not tender
- Eversion of the lid shows purplish discoloration of conjunctiva

Treatment

1. Hot fomentation
2. Antibiotic eye ointment
3. Incision and curettage

Ectropion

Definition

Rolling in out of the margin of thelower eye lid (Figure 3).

Figure 3– Ectropion

Types

Senile - Old age
Paralytic - Paralysis of orbicularis seen in facial palsy
Congenital - Present since birth
Mechanical - Due to weight of swelling in the lower lid
Cicatrical - Chemical burns

Symptoms

- Epiphora : Because punctum is not apposed to the globe.

- Excoriation of skin around the lid

Treatment

- ***Temporary***
  - Antibiotic ointment
  - Adhesive tape to close the lid at night
- ***Permanent***
  - Surgical corrections
  -

Entropion

Definition

Rolling in of the lid margin with its lashes (Figure 4)

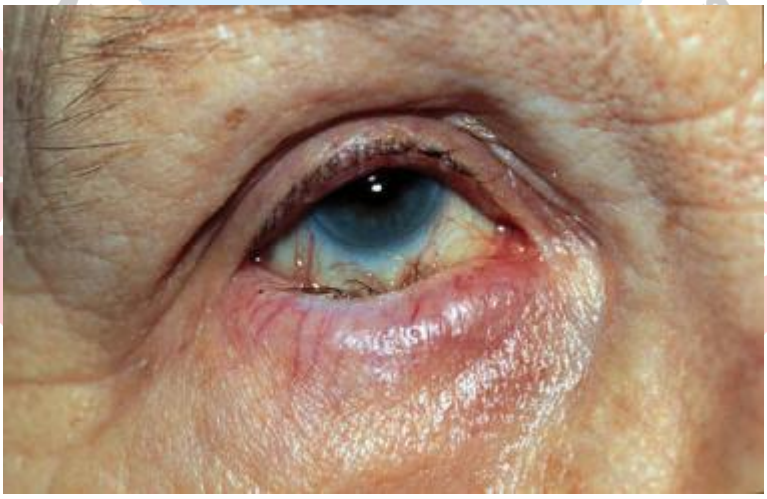


Figure 4 – Entropion

Types

Senile - old age
Spastic - excessive contraction of orbicularis oculi
Cicatrical - due to scarring (trachoma, chemical burns)
Congenital - present since birth
Mechanical - due to weight of the swellings in the lid

Symptoms

- Foreign body sensation
- Pain
- Lacrimation

Complications

- Corneal ulceration
- Corneal opacities

Treatment

Temporary procedures

- Adhesive tape : pulling the skin out with strip of plaster
- Cautery : over skin below lashes
- Soft contact lenses

Permanent procedures: **Surgical**

Lagophthalmos

Definition

Inadequate closure of eyelids when an attempt is made to close them.

Causes

- Facial nerve palsy
- Proptosis
- Patient in coma
- Deformity of upper lid

Complications

- Dryness of conjunctiva and cornea
- Exposure keratitis

Treatment

Temporary

- Artificial tear drops at day time
- Antibiotic ointment at night time
- Closure of lids with adhesive tape
- Soft contact lenses to prevent corneal damage

Permanent

Surgery: Tarsorrhaphy

Ptosis

Definition

Drooping of the upper eye lid (Fig. 5)

Figure 5 – Ptosis of the Right upper eyelid.

Causes

- Old age
- Abnormalities in the development of muscles
- Malfunctioning of the nerves
- Injury or trauma in the eye
- Inflammation, diabetic, stroke, tumors, cancers, zaneurysms
- Mechanical

Congenital

Present from birth

Acquired

Due to nerve damage	- 3rd nerve palsy
Muscle disease	- Myasthenia gravis
Mechanical	- Tumors, chalazion etc. pulling the lid down
Traumatic	- Following injury

Treatment

- Neostigmine tablets are given for myasthenia disease
- Surgical correction is done in most cases

Tumors of the Eyelids

Benign

- Papilloma
- Molluscum contagiosum
- Naevus
- Xanthelesma
- Warts
- Hemangioma
- Neurofibroma

Malignant

- Rhodent ulcer (Basal cell carcinoma)
- Squamous cell carcinoma
- Meibomian gland carcinoma

Diseases of the Lacrimal System

Lacrimal apparatus diseases are divided into 2 groups

Diseases of Lacrimal Gland

Infection: Acute dacryoadenitis
Tumors : Adenoma carcinoma, adenoma

Diseases of Lacrimal sac

Infection - Dacryocystitis
Tumors - Very rare e.g.: papilloma

Dacryocystitis

Definition

Acute or chronic inflammation of lacrimal sac.

Causative organisms

- Pneumococcus (most common)
- Streptococcus
- Staphylococcus
- Mycobacterium etc.

Causes

- Congenital deformation of the lacrimal drainage system
- Diseases of nose : deviated nasal septum
- Nasal polyps
- Infection spreading from naso-pharynx
- Trauma causing distortion of anatomy and stagnation of tears

Sequence of events

Obstruction at the junction of the lower end of lacrimal sac and the upper end of naso-lacrimal duct Stagnation of tears in the sac Predisposing to infection

↓

Stagnation of tears in the sac

Predisposing to infection

Dacryocystitis

Types

- Acute dacryocystitis
- Chronic dacryocystitis
- Congenital dacryocystitis

Symptoms

Acute

- Sudden onset of pain, redness and swelling in the sac area
- Watering of the eyes
- Sometimes redness of the eyes
- Congenital - watering of one or both eyes since birth

Chronic

- Watering of the eyes
- Sometimes discharge
- Pus like material coming from lacrimal puncta when pressing over the sac area.

Diagnosis

- **Acute :** Syringing contraindicated
- **Chronic :** On syringing, fluid will regurgitate through the same punctum or upper punctum, Mucus or pus may also be seen in the regurgitant fluid.
- **Congenital:** 1-2 drops of 2% fluorescent dye instilled in the eye and after some time, a cotton swab is introduced in the nostril to see whether the dye has drained into the nose.

Complications

- Chronic conjunctivitis
- Can lead to infection within the eye after surgery in the eye
- Promote bacterial corneal ulcers
- Acute dacryocystitis may progress to orbital cellulitis, lacrimal fistula [skin opening in sac area].

Treatment

I. Acute Dacryocystitis

- Hot compresses: 3-4 times / day
- Broad spectrum systemic antibiotics
- Topical antibiotics: 4 - 6 times / day

- DCT (dacryocystectomy) or dacryocysto -rhinostomy (DCR) done after inflammation subsides.

II. Chronic dacryocystitis

- In younger age DCR is done
- In old age DCT is done

III. Congenital dacryocystitis

- Massaging and antibiotic drop instillation
- Probing : probe is passed down naso-lacrimal duct
- DCR if the above procedures fail to open lacrimal passages after 3 years

Dry Eyes

It is one of the most common problems treated by ophthalmologist.

Definition

There is decreased secretion of tears or deficiency in the composition of tears.

Causes

- Aging
- Hot, dry or windy climates
- High altitude
- Air conditioning
- Cigarette smoking
- Working on computer for long time
- Contact lens wearers

Symptoms

- Itching
- Burning
- Irritation
- Redness
- Blurred vision that improves with blinking
- Excessive tearing
- Increased discomfort after reading, watching TV, or working on a computer
- F.B sensation

Diagnosis

Schirmer test is done

Treatment

No permanent cure, can only relieve symptoms

I. Preservation of existing tears

- Reduction of room temperature
- Humidifiers
- Punctual occlusion

II. Supplementation of tears

1. Drops - Methyl Cellulose
   - Hydroxy ethyl cellulose
   - Hyper mellose
2. Ointments - HPMC gel at bed time

Diseases of the Conjunctiva

The most common conjunctival disease is conjunctivitis which is infective. Others being pterygium, pinguecula and subconjunctival haemorrhage.

Conjunctivitis

Definition

Infection of the conjunctiva

Classification

Infections

Bacterial

- Staphylococus aureus
- Haemophillus
- Gonococcal (Ophthalmic Neonatorum)
- Mycobacterium

Viral

- Adenovirus
- Varicella
- Herpes Zoster
- Mumps
- Influenza

Chalamydial (*Trachoma*)

- Causative organism is *Chlamydia trachomatis*

Table : 1

	Conjunctival congestion	**Ciliary congestion**
i. Site	Fornices	Limbus
ii. Color	Bright red	Violet
iii. Depth	Vessels superficial	Vessels deep
iv. Branching	Dichotomously	Radially
v. 1.1000 epinephrine test	Whitens conjunctiva	No effect
vi. Disease	Conjunctivits	Iridocystitis, Glaucoma

Allergic

- Simple allergic conjunctivitis
- Vernal catarrh

Trauma

Infective conjunctivitis

Symptoms

- Discomfort and foreign body sensations due to engorgement of blood vessels
- Sticking together of eye lashes due to discharge
- Photophobia and watering of the eye
- Defective vision due to thin layer of discharge on the cornea
- Haloes around light due to thin layer of discharge on the corneal surface.

Signs

- **Discharge :** causes sticking together of eyelashes especially when waking up in the morning
- **Congestion :** should be differentiated from other causes of congestion (redness) (Table:1).
- **Subconjunctival hemorrhage:** more common in viral conjunctivitis. Rupture of tiny conjunctival vessel.
- **Follicles:** Round swellings (0.5 - 2 mm) surrounded by tiny blood vessel in the tarsal conjunctiva, more commonly seen in viral conjunctivitis and allergic conjunctivitis.
- **Papillae :** Round swelling with blood vessels in the centre over the tarsal conjunctiva more commonly seen in vernal conjunctivitis.
- **Pre Auricular Lymphadenopathy:** Seen in viral, chlamydial infection

Treatment

- Frequent wash with luke warm saline solution to clear crusting and discharge
- Use dark glasses to prevent photophobia
- Broad spectrum antibiotic drops are used
    - E.g.,: ciprofloxacin dosage hourly to 4 times depending on severity.
    - Ointment: Tetracycline / gentamycin/ Chloramphenicol at bed time

Prophylaxis (Prevention)

- Patient must keep his hands clean and avoid touching around the eye.
- Personal belongings of the patient like towel, handkerchief, and pillow should be kept separately.
- Other family members if infected should be treated simultaneously.

Simple allergic conjunctivitis

Definition

Allergic reaction due to large amount of allergens reaching the conjunctiva

Causes

- Pollen grains
- Certain topical drugs e.g.. Neomycin
- Contact with pet animals
- Dust, cosmetics, chemicals

Treatment

- Removal of allergen
- Antihistamine tablets & drops
- Topical 2% Sodium chromoglycolate to prevent recurrence
- Corticosteroid drops in severe cases

Vernal conjunctivitis

Definition

Hypersensitivity reaction of conjunctiva to exogenous allergens

Causes

Age - 6-20 yrs, usually males
Seasonal variation - Prevalent in summer
Exciting factors - Dust, dry heat, pollens

Symptoms

- Intense itching
- Discharge
- Photophobia, burning and foreign body sensation

Signs

- Cobble stone appearance due to papillary hypertrophy in the palpaberal conjunctiva
- Multiple small nodules around the limbus
- Trantas spots superficial white spots scattered around the limbus.

Treatment

- Cold compresses
- Disodium chromoglycolate 4 times / day reduces itching
- Topical steroids like dexamethasone 4 times daily and tapering dose depending on the severity. Long term use of steroids can cause cataract and glaucoma.

Ophthalmia neonatorum

Definition

Bilateral purulent conjunctivitis occurring in new born within first 3 weeks of life.

Causative organisms

- Gonococcus (Most common)
- Chlamydia

Mode of Infection

- Before birth - very rare
- During birth - face presentation is the most common
- After birth - from soiled linen

Clinical picture

Watering, redness & discharge.

Treatment

1) Prophylaxis

- Proper antenatal care of mother. Any vaginal discharge should be treated meticulously.
- Crede's prophylaxis: 1% silver nitrate is instilled into the baby's eyes immediately after birth.

2) Curative

Swab taken for culture and sensitivity
Gonococcal - Ciprofloxacin hourly for 3-5 days
Chlamydial - 1% tetracycline 2 times/day

Pterygium

Definition

It is a triangular growth on the conjunctiva encroaching on the cornea in the horizontal meridian, in the palpaberal fissure, either from the nasal or temporal side of bulbar conjunctiva or from both sides.

Cause

- Prolonged exposure to the sun (UV radiation)
- Exposure to hot, sandy and dusty weather

Symptoms

- Appearance of lesion on nasal or temporal side
- Dimness of vision due to obstruction of visual axis
- Redness and burning sensation.

Signs

1. Decreased visual acuity
2. Triangular fold of conjunctival fleshy growth encroaching upon the cornea

Treatment

- Stationary pterygium - no treatment (If inflamed - NSAIDS or steroids eye drops)
- Progressive pterygium - excision
- Recurrent pterygium - mitomycin C, Beta radiation
- Pterygium in the pupillary area - Excision of pterygium and keratoplasty

Subconjunctival Haemorrhage

Definition

Spontaneous rupture of conjunctival blood vessels

Clinical picture

Sectoral red patch under the conjunctiva where blood collects.

Causes

- Trauma

- Diabetic and hypertensives
- Sneezing
- Coughing
- Straining
- Lifting heavy weight
- Vomiting

***Treatment*:**

None

Reassurance to the patient

Glaucoma

It is a condition characterized by an abnormal increase in the intraocular pressure (IOP) with subsequent changes in the optic nerve head and the visual field. The pressure is normally between 11mm to 20mm of Hg. If the pressure increases it affects the optic nerve and gradually causes loss of vision.

Types of glaucoma

- ***Open angle glaucoma (POAG)or chronic simple glaucoma:***
  - The most common type.
  - The angle between the iris and the cornea is normal but the trabecular meshwork get blocked from inside.
  - In this type the patient is asymptomatic until late (called silent thief of sight).
  - First, the peripheral field of vision is lost.
  - In course of time central vision is also affected..
- ***Angle closure glaucoma.***
  - This disease causes headache, severe pain, watering and redness of the eye and loss of sight suddenly.
  - The patients will see rainbow like circles, halos, around lamps.
  - The patient is usually seen in the emergency department.
- ***Other types of glaucoma:***
  - ***Congenital type:***
    - The infant at birth will have big eyes. This is called Buphthalmos.
    - The cornea will be large. Photophobia, redness and watering of the eye will be seen.
    - The child usually needs to be examined under anesthesia to measure the IOP.
  - Other causes may be secondary to trauma, inflammation and Cataract.

Diagnosis

- Visual Acuity
- Slit lamp examination
- Tonometry
- Fundus examination
- Gonioscopy
- Testing visual fields by computerized field analysis (Perimetry).

Risk factors for POAG

- Generally above 40
- Family history
- Diabetic patients
- African heritage

- Myopia

Treatment

- ***Medical treatment:***
  - Some patients suffering from glaucoma may be treated with eye drops and tablets.
  - Depending on the severity of the intraocular pressure, one or two types of eye drops are used. Some may require tablets also.
  - It is important that the treatment is continued according to the physician's directions.
- ***Laser treatment***:
  - They are called laser trabeculoplasty and Laser Iridotomy.
  - Patients do need not stay long in the hospital.
- ***Surgery***: If the medical and laser treatments are not effective, surgery is the only alternative.

Glaucoma patients should be advised to

- Follow instructions of the ophthalmologist.
- Eye drops must be used without fail
- Eye drops must be applied to the eye
- Must not stop treatment without doctor's advice
- People in the family and relatives must get themselves examined
- Must inform about it to other doctors when consulted
- It is not possible to cure glaucoma completely. But it is possible to control it and keep the vision by continuous treatment

Diseases of the Cornea

A) Corneal ulcers

- Bacterial ulcer
- Fungal ulcer
- Viral ulcer
- Parasitic ulcer

B) Degenerative Conditions

- Arcus Senelis
- Band Shaped Keratoplasty

C) Dystrophies

- Granular
- Macular
- Lattice

D) Corneal opacities

- Nebula
- Leucoma (adherent/ non-adherent)
- Anterior Staphyloma.

A) Corneal ulcers

Definition

It is defined as a break in the corneal epithelium with added infection

Source of infection

Exogenous route - From outside source
Secondary route - From adjacent structures like conjunctiva, sclera, uvea
Endogenous route - Systemic sources

Causative organisms

Bacteria	**Fungal**	**Parasitic**	**Virus**
1.Staphylococcus aureus	Candida Albicans	Acanthamoeba	Herpes simplex
2.Pseudomonas	Aspergillus		Herpes zoster
3. Streptococcus	Fusarium		
4. E.Coli			
5. Klebsciella			

Symptoms

- Lacrimation (watering)
- Photophobia
- Pain
- Defective vision

Signs

- Edema of lids and blepharospasm
- Circum ciliary congestion
- +ve flooурescein staining (Figure)
- Localised area of necrosis (Figure)
- Vascularisation of cornea
- Hypopyon may be present (Figure)

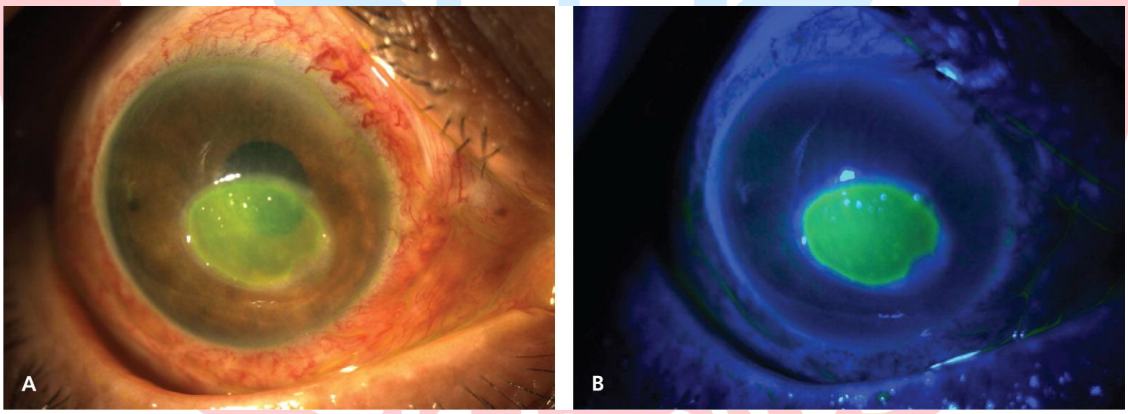


Figure – Corneal ulcer stained with fluorescein stain. A- with normal illumination, B- with cobalt blue filter.

Figure – infective corneal ulcer with hypopyon.

Investigations: Corneal Scraping

Done under local anesthesia by the ophthalnmologist. The material obtained is used for the following investigations.

- Gram and Giemsa stains for bacteria
- 10% KOH wet preparation for fungus
- Culture on blood agar for aerobic organisms
- Culture on Sabouraud's dextrose agar for fungus

Features	**Bacterial ulcer**	**Fungal ulcer**
i. History of Injury	Non specific	With Vegetable matter
ii. Predisposing factors	Non specific	Immunocompromised, steroids
iii. Course	Rapid	Slow
iv. Symptoms and signs	Proportionate	Sign out of proportionto symptoms
v. Satellite lesions	Absent	Present
vi. Margins	Well defined	Feathery
vii. Hypopyon	Usually not seen	Usually seen

Complications

- Perforation - (Hole in cornea)
- Corneal opacities
- Endophthalmitis or panophthalmitis
- Secondary glaucoma

Treatment

a. Control of infections

- Antibiotics are used until the ulcer heals - e.g., fortified gentamycin, Cefazolin, Ciprofloxacin
- Antifungal - e.g.,: Natamycin, Nystatin etc.

b. Rest to the eye

- Cycloplegics: atropine 1% eye ointment 2 times / day gives rest to eye by paralysing the ciliary muscle
- Dark glasses: protect the eye from irritating effect of strong light

c. Relief of pain

- Hot compresses
- Oral pain killers

d. Removal of any septic focus in the neighbourhood

- If sac is infected, it is to be removed without delay

e. Improve general health condition

- By control of diabetes and improving nutrition.

Don'ts in a case of corneal ulcer

- No Bandage
- No Steroid drop
- No Schiotz Tonometer.

Viral ulcer (Dendritic ulcer)

Definition

Ulcer with a branched appearance caused by herpes simplex virus.

Symptoms

Pain, watering and photophobia

Clinical signs

- The ulcer appears as star shaped or branched pattern
- Absent corneal sensation
- Enlarged and tender pre auricular lymph nodes

Treatment

- Antiviral drops or ointment (e.g.,: acyclovir eye ointment 3%)
- Steroids to suppress the host response
- Antibiotic eye drops to prevent secondary infection

B) Degenerative conditions

Keratoconus

Definition

Bilateral conical protrusion of central part of the cornea due to thinning

Symptoms

Defective vision due to irregular myopic astigmatism and watering due to rupture of hydrops

Signs

1. Munson 's sign: bulging of the lower lid when patient looks down.
2. Retinoscopy: scissoring reflex
3. Ophthalmoscopy: oil drop sign
4. Slit lamp:
    - Thinning of cornea at the centre
    - Prominent corneal nerves
    - Fleischer ' s ring - iron deposits at the base of cone
5. Keratometry ('K' reading) showing high astigmatism

Complications

Acute hydrops: rupture of Descemet 's membrane and seepage of aqueous in the corneal stroma and epithelium

Treatment

- Hard contact lens
- Penetrating keratoplasty.

Arcus senilis

- Corneal degeneration normally seen at peripheral cornea.
- Lesion: starts as crescent grey line around 12o clock and 6 o clock and finally it becomes circular.

- Site: periphery of cornea parallel to limbus. There is clear space seen between the lesion and the limbus
- Does not affect vision or vitality of cornea.

C) Corneal dystrophies

Definition

Condition in which cornea loses its clarity due to deposition of materials in various layers of the cornea

Features

1. Usually inherited
2. Not caused by outside factors like injury or diet
3. Progresses gradually
4. Occurs in otherwise healthy people

Symptoms

- Some detected on routine examination
- Some cause visual impairment
- Some cause repeated episodes of pain without visual loss

Types

1. Epithelial dystrophy - Map-dot finger print dystrophy
2. Stromal dystrophy - granular dystrophy, macular dystrophy and lattice dystrophy
3. Endothelial dystrophy - Fuch's dystrophy

D) Corneal opacities

- **Nebula:**
  - Peripheral: correct irregular astigmatism by
    - Glasses
    - Hard contact lens
  - Central:
    - Lamellar keratoplasty
- **Leucoma non-adherent:**
  - **Non-seeing eye:**
    - Tinted contact lens
    - Tattoing
  - **Seeing eye:**
    - Peripheral: use glasses or hard CL to correct irregular astigmatism

        - **Central opacity:**
            - Postmydriatic test: Measure vision after dilating drops:
                - Marked improvement: do a visual iridectomy
                - No or little improvement: do penetrating keratoplasty (PKP)
- **Leucoma adherent:**
    - **Non-seeing eye:**
        - Blind:
            - Tinted contact lens
            - Tattoing
        - Blind and painful:
            - Enucleation
    - **Seeing eye: Measure IOP:**
        - High IOP:
            - Do glaucoma surgery initially then manage as leucoma non-adherent
            - Simultaneous glaucoma surgery and penetrating keratoplasty can be combined in one surgery
        - Normal IOP:
            - Manage as leucoma non-adherent
- **Anterior staphyloma:**
    - Partial:
        - Combined glaucoma surgery and PKP
    - Total:
        - Enucleation for a blind, painful, cosmetically disfiguring eye

Diseases of the Lens

Cataract

Definition:

It is the opacification of the lens or its capsule (Figure)

Classification:

1- Aetiological Classification

a. Congenital
b. Acquired:
   i. Traumatic
   ii. Complicated
   iii. Senile

2- Anatomical Classification:

a. Capsular:
   i. Anterior
   ii. Posterior
b. Cortical:
   i. Anterior
   ii. Posterior
c. Nuclear

3- According to the consistency of the lens:

	Soft cataract	**Hard cataract**
Age	<25 years	>25 years
Aetiology	Congenital Traumatic Complicated	Senile Traumatic Complicated
Hard Nucleus	-	+
Lens proteins	Soluble crystalline proteins	Insoluble albuminoid ptns
Ruptured lens capsule	Proteins absorbed by AH enzymes	Nucleus not absorbed by AH enzymes (Aftercatatract)
Treatment	Irrigation/Aspiration Lensectomy	ICCE ECCE Phacoemulsification

Figure – Cataract in the left eye.

Subluxation / dislocation of the lens

Definition

- ***Subluxation***: partial displacement of the lens from its normal position but remains behind the pupil
- ***Dislocation:*** total displacement of the lens either
  - Forward - into the anterior chamber (can block the pupil and cause glaucoma)
  - Backward - into the vitreous
- ***Ectopia lentis*** - congenital bilateral, subluxation or dislocation of the lens

Causes

- Congenital (ectopia lentis)
- Acquired
- Excessive stretching of zonules - trauma
- Degeneration of zonules - pseudo exfoliation

Clinical features

Mono ocular diplopia

- Unequal depth of AC
- Iridodonesis
- Phacodonesis

Figure – Subluxated lens

Lens induced glaucoma

Phacolytic glaucoma

Hypermature cataract

Leakage of lens material

Macrophages engulf lens material

Obstruct trabecular meshwork

Secondary open angle glaucoma

Phacomorphic glaucoma

- Intumescent cataract (swollen white lens)
- Shallow anterior chamber
- Secondary angle closure glaucoma
- Fixed dilated pupil

Note: (Pupil should never be dilated)

Diseases of the Retina and Vitreous

Diseases of vitreous

Some common problems of the vitreous are

1. Floaters
2. Vitreous hemorrhage

1. Floaters

They are various kinds of opacities moving in front of the eye. They are due to presence of opacities in the vitreous which cast a shadow on the retina. They are a common complaint and are usually harmless.

Causes

- Blood in vitreous
  - Diabetic retinopathy
  - Vein occlusion
  - Trauma
- Degeneration of the vitreous
  - High myopia
  - Aging
- Inflammatory exudates
  - Retinitis
  - Uveitis
  - Optic neuritis

Synchysis scintillans- cholesterol crystals in the vitreous

Management

Treatment is that of the cause in most cases.

Vitreous Hemorrhage

Definition: bleeding into the vitreous

Source of hemorrhage: blood vessels in the retina

Causes

- Trauma to the eye
- Diseases of the blood vessels
- Diabetic retinopathy
- Retinal vein occlusions
- Inflammation of the retinal veins
- Diseases of retina
- Retinal tears
- Retinal detachment

Management

- Blood usually gets absorbed over a few months, hence observation initially
- Vitrectomy: surgical method of removing vitreous if blood does not get absorbed

Diseases of the retina

Some of the common and important diseases are;

1. Diabetic retinopathy
2. Hypertensive retinopathy
3. Retinal vein occlusions
4. Retinitis pigmentosa
5. Retinal detachment
6. Central serous retinopathy (CSR)
7. Retinoblastoma

Diabetic retinopathy

It is one of the most important ocular manifestations of diabetes. It is now a major cause of blindness in developed countries and is rapidly becoming an important cause of preventable blindness in developing countries.

Definition

It is a change seen in the retina of patients suffering from diabetes mellitus. Control of blood sugar level decreases the risk of developing severe diabetic retinopathy.

Classification

1. Non proliferative diabetic retinopathy Ophthalmoscopic features

- Micro aneurysms
- Hemorrhages
- Hard exudates
- Retinal oedema

2. Proliferative diabetic retinopathy

Ophthalmoscopic features

- New vessels at the disc (NVD)
- Fibrovascular bands
- Vitreous detachment
- Vitreous hemorrhage

Investigation

- Urine and blood sugar examination
- FFA (fundus flourescein angiography)

Management

- **Medical treatment:** good diabetic control,
- **Laser treatment:** photocoagulation- to stop leaking from retinal vessels and bleeding from new vessels
- **Surgical treatment:** vitrectomy is done in case of vitreous hemorrhage, traction retinal detachment

2. Hypertensive retinopathy

vascular changes in the retina associated with systemic hypertension

Clinical features

Grade I - mild generalised narrowing of arterioles, particularly of small branches
Grade II - marked generalized narrowing associated with focal narrowing of arterioles
Grade III - grade II changes and also hemorrhages, cotton-wool spots and hard exudates
Grade IV - all changes of grade III plus papilloedema

Management

No special management is required for the retinopathy as most of the changes are reversible with adequate control of blood pressure.

Retinal vein occlusion

More common than the artery occlusions, it affects elderly patients in sixth or seventh decades of life.

Risk factors

- Hypertension
- Diabetes
- Arteriosclerosis

Clinical features

- Sudden loss of vision
- Oedema and hemorrhages all over the fundus including the macula

Complications

- Neovascular glaucoma: occurs in 50% of cases within three months (so called 90 days glaucoma)
- Vitreous hemorrhage
- Proliferative retinopathy

Treatment

- Proper control of diseases like hypertension, diabetes etc.
- Laser photocoagulation: for macular oedema and new vessels

Retinitis Pigmentosa

Definition: It is a hereditary condition of the retina affecting the rods

Clinical features

- Night blindness (nyctalopia)
- Tubular vision: advanced cases

Fundus changes

- Waxy pallor of disc
- Narrowed vessels
- Bony spicule pigmentation

Treatment

- No permanent cure at present
- Supportive treatment
- Vitamin A
- Low vision aids - night vision devices, field expanders etc.
- Visual rehabilitation
- Genetic counselling- no consanguineous marriage (marriage among relatives)and affected individuals educated about possibility of affected kids.

Retinal Detachment

Definition: Separation of the retina from the retinal pigment epithelial layer

Risk factors

- Myopia
- Retinal degeneration
- Trauma

Symptoms

- Floaters

- Flashes of light (due to excitement of retina by vitreous movements)
- Early stages - field defects
- Sudden painless loss of vision - (in large and central detachments)

Signs

- Direct ophthalmoscopy: shows grey reflex instead of normal pink reflex
- Indirect ophthalmoscopy: detached retina is grey, wavy and moves with eye movements -retinal break is seen

Treatment

Surgery: scleral buckling procedure

Central Serous Retinopathy (CSR)

Definition: It is due to detachment of retina in the macular region due to accumulation of fluid resulting in defective vision

Causes: not known

Symptoms

- Sudden onset of painless loss of vision
- Central scotoma (dark area)
- Micropsia (objects appears small)
- Metamorphopsia (irregularity of the objects)

Signs

- Ophthalmoscopy
- Mild elevation of macular area
- Foveal reflex is absent

Treatment

- Reassurance to the patient (usually resolves spontaneously without any treatment)
- Long standing cases (more than 4 months) : laser photocoagulation

Retinoblastoma

Definition: it is a malignant tumour of the retina occurring in children under 5 years. It is the most common intraocular malignant tumour of childhood.

Symptoms

- White reflex over the pupil (leukocoria)
- Squint

Signs

Indirect ophthalmoscopy: elevated fungating mass with satellite lesions seen in the retina.

Treatment

- Radiation therapy, chemotherapy
- Photocoagulation
- Cryotherapy
- Enucleation / excentration

Diseases of Orbit

The eye along with its surrounding structures like connective tissue, nerves, blood vessels, fat, muscles and glands have the potential to give rise to virtually any known neoplasm anywhere in the body. Certain types of tumors are more common and specific to this organ. A brief discussion of the more important tumors follows.

Common orbital diseases of children

- Orbital cellulitis
- Rhabdomyosarcoma
- Capillary hemangioma
- Dermoid and epidermoid cysts
- Leukemia
- Lymphangioma
- Psueudotumor
- Optic nerve glioma
- Metastatic neuroblastoma
- Neuro fibroma

Common orbital diseases of adults

- Thyroid related ophthalmopathy
- Pseudo tumour
- Cavernous haemangioma
- Lacrimal gland tumour
- Lymphoma
- Lymphangioma
- Meningioma

Proptosis

Definition: forward protrusion of the eyeball beyond the orbital margin.

Causes

Inflammatory

- Acute - orbital cellulitis
- Chronic - pseudotumor

Neoplastic

- Benign - dermoid
- Malignant - rhabdomyosarcoma

Parasitic

- Cysticercosis
- Hydatid cyst

Vascular- retrobulbar haemorrhage

- Orbital varices
- Aneurysm

Systemic diseases

- Thyroid ophthalmopathy
- Leukaemic deposits

Measurement of proptosis: Exophthalmometry

Investigations

- Thyroid function test
- X-ray orbit

- USG
- CT and MRI
- Biopsy

Treatment

- Medical - for orbital cellulitis, thyroid disease.
- Radiotherapy- for secondary deposits and malignant tumours
- Surgical a. tarsorrhaphy: to protect the exposed cornea, b. orbitotomy to remove the tumour

Thyroid ophthalmopathy

It is the most common cause of both unilateral and bilateral proptosis in adults.

Ocular manifestations

- Retraction of eyelids
- Lid lag
- Lagophthalmos - incomplete closure of eye lids
- Infrequent blinking
- Increased lid pigmentation
- Extra ocular muscle palsies

Investigations

- Thyroid function test: T3 and T4 levels
- USG: shows enlargement of extra ocular muscles
- CT scan: enlargement of muscles
- Optic nerve compression can be demonstrated.

Orbital cellulitis

Definition: infection of the fat and cellular tissues of the orbit.

Causes

- Sinus infection
- Penetrating orbital injury
- Thrombophlebitis
- Post operative: following enucleation of the globe
- Dental or naso-pharyngeal infection. Causative organism: streptococcus, staphylococcus, haemophilus

Types

- Preseptal
- Orbital

Symptoms

- Pain and swelling of the lids
- Lacrimation and photophobia
- Diplopia due to limitation of movements
- Impairment of vision at later stages
- Frequently associated with fever

Signs

- Lid oedema and tenderness
- Conjunctival congestion
- Proptosis
- Limitation of ocular movements
- Ophthalmoscopy: features of optic neuritis in severe cases

Complications: cavernous sinus thrombosis

Treatment

- Admit the patient
- Broad spectrum antibiotics systemically

Neuro ophthalmology

Some of the common and important diseases in neuro ophthalmology are

1. Optic neuritis
2. Papilloedema
3. Optic atrophy
4. Cranial nerve palsies

Optic neuritis

Definition: Inflammation of the optic nerve

Causes

- Idiopathic
- Childhood infection (e.g.,: measles, mumps)
- Viral infection (e.g.,: encephalitis, herpes zoster)
- Systemic diseases (e.g.,: syphilis, tuberculosis)
- Local inflammations (e.g,: sinusitis, meningitis, orbit)
- Intraocular inflammation

Symptoms

- Uniocular sudden loss of vision
- Pain behind the eye ball particularly while moving

Signs

- Visual acuity may be 6/60 or less
- Pupil: relative afferent pupillary defect
- Colour vision: defective
- Field defect: central, centrocaecal scotoma

Fundus

- Hyperemia of the disc
- Oedema of the disc
- Small hemorrhages on the disc

Treatment: systemic and oral steroids

Papilloedema

Definition: Non-inflammatory swelling of the optic disc produced by raised intracranial pressure.

Causes

- Congenital: e.g.,: aqueductal stenosis
- Space occupying intracranial lesions
- Head injury
- Infection: meningitis and encephalitis
- Malignant hypertension

Symptoms

a. General symptoms:

1. Headache
2. Vomiting

b. Ocular symptoms

1. Visual acuity normal

2. Transient blackout of vision for few seconds
3. Fields: enlargement of blind spot

Signs

1. Blurring of disc margin
2. Disc hyperemia
3. Dilated vessels
4. Hemorrhages on disc

***Treatment*:** Given according to the cause of the disease.

Optic atrophy

Definition: death of the optic nerve fibres characterized by pallor of the disc.

Causes

- Glaucoma
- Trauma
- Retinitis pigmentosa
- Central retinal artery occlusion
- Papilloedema
- Optic neuritis

Symptoms

- Sudden or gradual loss of vision
- Defective color vision

Signs

- Visual acuity impaired
- Relative afferent pupillary defect (RAPD)

Fundus

- Pallor of disc
- Narrowing of blood vessels

Treatment: The specific cause should be treated before the onset of optic atrophy. The damaged part of optic nerve cannot be recovered.

Cranial Nerve Lesions

Third Nerve Palsy

- Ptosis (falling down of upper eyelid) - levator muscle paralysis
- Restriction of adduction- medial rectus paralysis
- Restriction of elevation- superior rectus paralysis
- Restriction of depression - inferior rectus paralysis

Fourth Nerve Palsy

- Double vision on looking down
- Paralysis of superior oblique muscle

Sixth Nerve Palsy

- Double vision on looking to the side of lesion
- Paralysis of lateral rectus muscle

Diseases of the uvea

Uveitis

Definition: inflammation of the uvea (iris, ciliary body and choroid)
Inflammation of iris - Iritis
Inflammation of ciliary body - Cyclitis
Inflammation of choroid - Choroiditis

Classification

- Anterior uveitis (irido-cyclitis) : inflammation of the iris and the ciliary body.
- Intermediate uveitits - inflammation of ciliary body.
- Posterior uveitis: inflammation of the choroid with or without cyclitis.
- Pan uveitis : iritis + cyclitis + choroiditis

Anterior uveitis

Causes

- Bacteria - tuberculosis, leprosy
- Virus - herpes simplex, herpes zoster
- Fungus - histoplasmosis
- Parasite - toxoplasmosis, toxocariasis
- Systemic diseases - joint diseases
- Trauma

Symptoms

- Pain
- Redness
- Defective vision
- Photophobia
- Watering

Signs

- Vision diminished
- Conjunctiva - circumciliary congestion
- Cornea - oedema keratitic
    - Keratitic precipitates (KP 's): cells that stick to the back surface of cornea (endothelium)
- Anterior chamber
    - Cells : inflammatory cells
    - Flare : due to increased protein content of the aqueous
    - Hypopyon: large accumulation of inflammatory cells in the lower part of anterior chamber.
- Pupil - small and irregular (sluggish pupillary reaction)
- Synechiae
    - Sticking of iris to the lens capsule (posterior synechiae)

Treatment

Mydriatics: e.g., Atropine eye drop or ointment (1%)

Steroids

- Topical : dexamethosone - 1 drop hourly to 4 times per day - eye ointment at bed time
- Subconjunctival - 0.5 ml per day dexamethasone
- Oral - 1mg prednisolone per kg per day and tapered as condition improves, Painkillers - paracetamol or ibuprofen

Complications

- Band keratopathy
- Complicated cataract
- Retinal detachment
- Optic neuritis

Posterior Uveitis (Choroiditis)

Symptoms

- Defective vision
- Floaters - seeing black dots
- If central area is involved
    - Metamorphopsia (distortion)
    - Micropsia (objects appear smaller)
    - Macropsia (objects appear larger)
- Photopsia (flashes of light)

Signs

Requires indirect ophthalmoscopy to detect the various abnormalities in the retina and choroid.

Treatment

It depends upon the cause. It is better to refer the case for investigation and treatment in a specialized eye center

Ocular Trauma

Normal Protective ocular mechanisms:

- Eyelids and eyelashes
- Tear fluid (washes debris and bactericidal)
- Corneal sensation
- Bony orbit
- Retrobulbar fat: cushion-like effect
- Bell's phenomenon
- Miosis: pupillary consrtriction secondary to light exposure
- Neck withdrawal reflex

Types of ocular injuries:

1- Blunt trauma
2- Sharp trauma:
   - Penetrating
   - Perforating
3- Physical injuries
4- Chemical injuries

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