

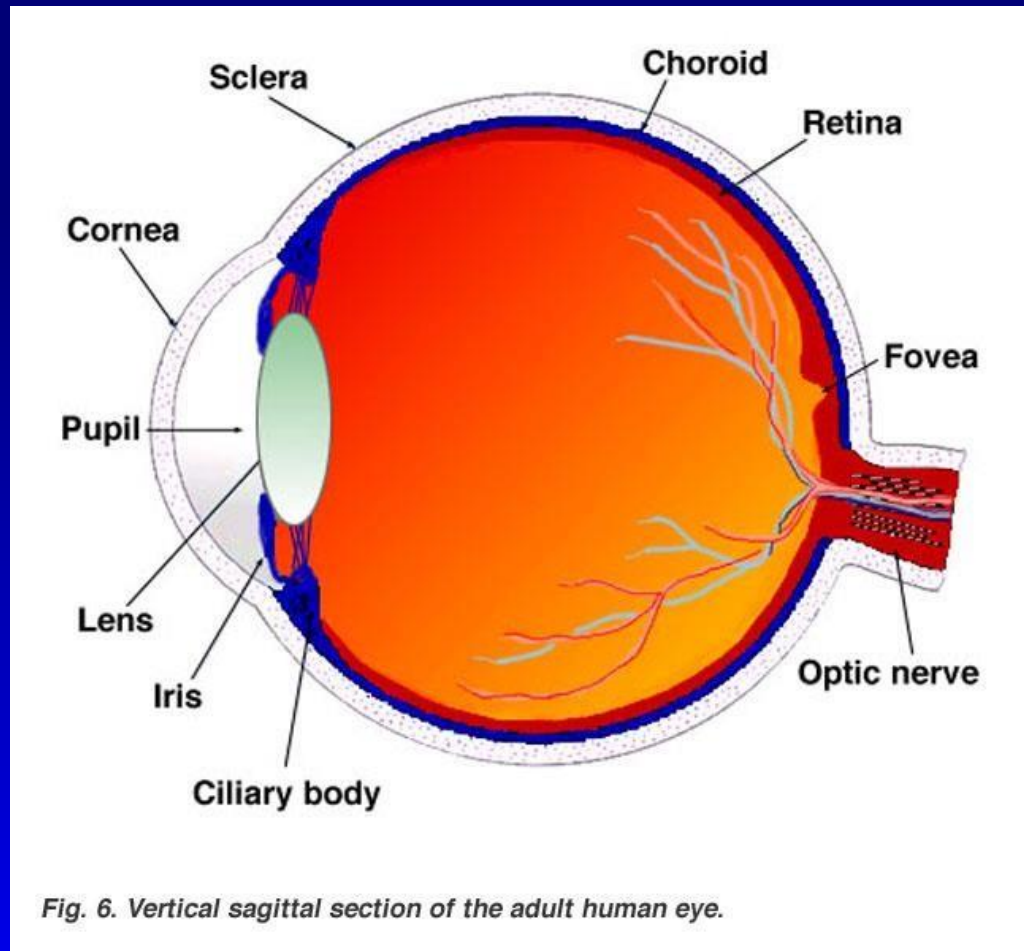
Pediatric ophthalmology

Lecture1

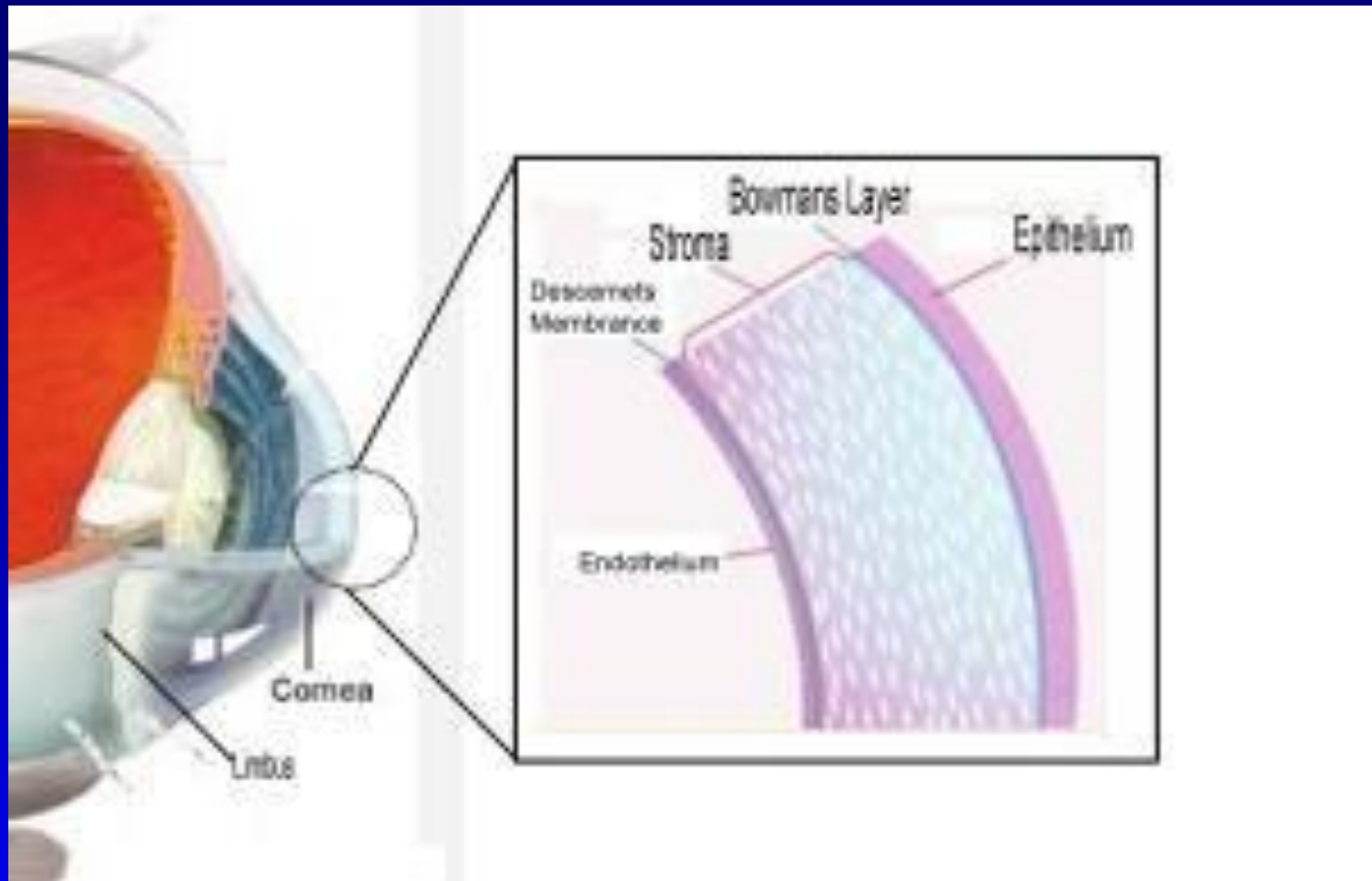
Dr. Azzam A. Ahmed

Anatomy, Physiology and the Pediatric Eye Exam

Anatomy of the eye

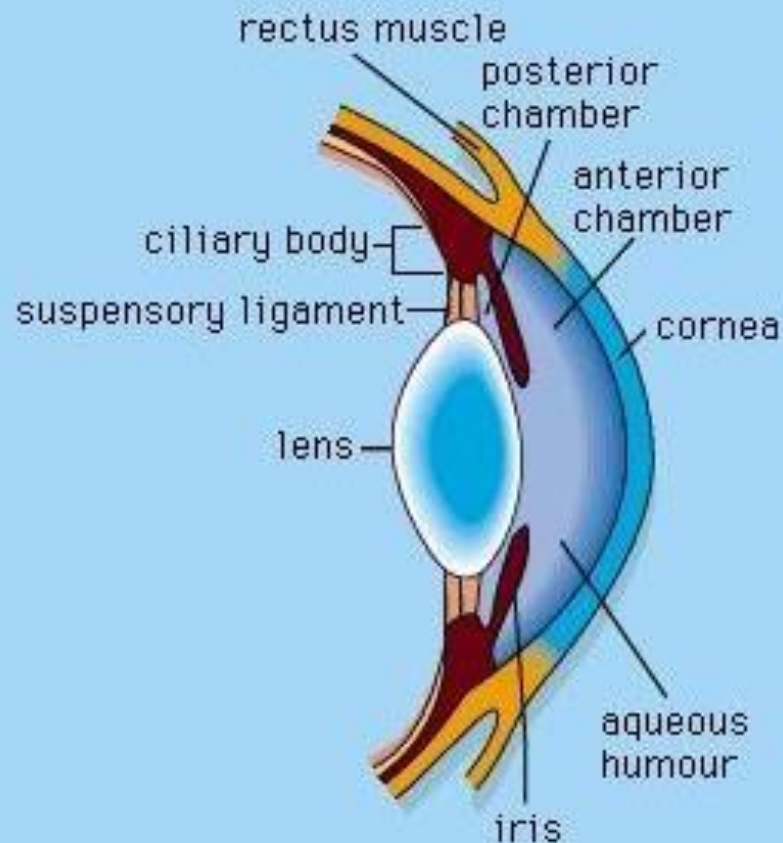


Cornea

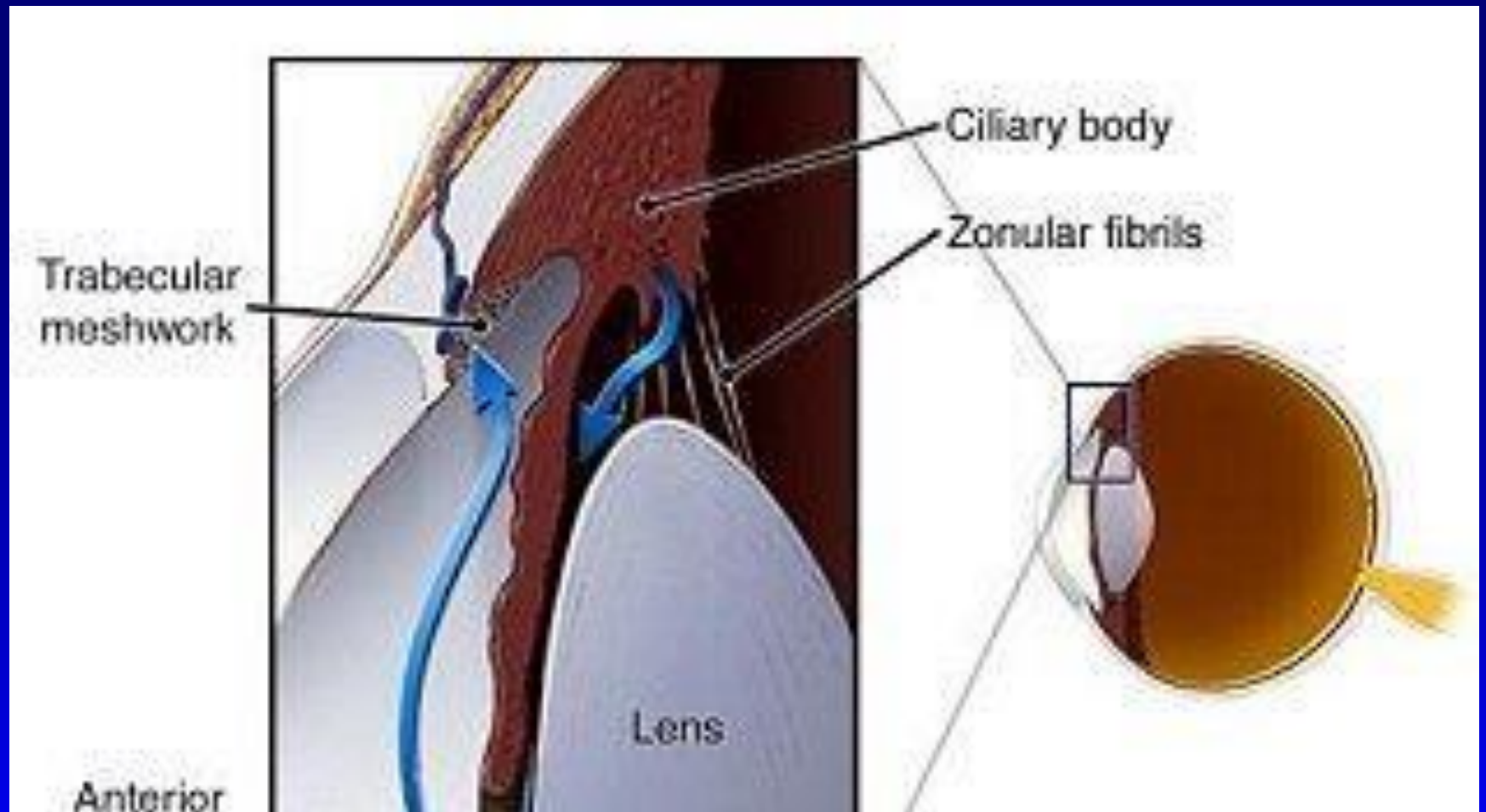


Anterior Chamber

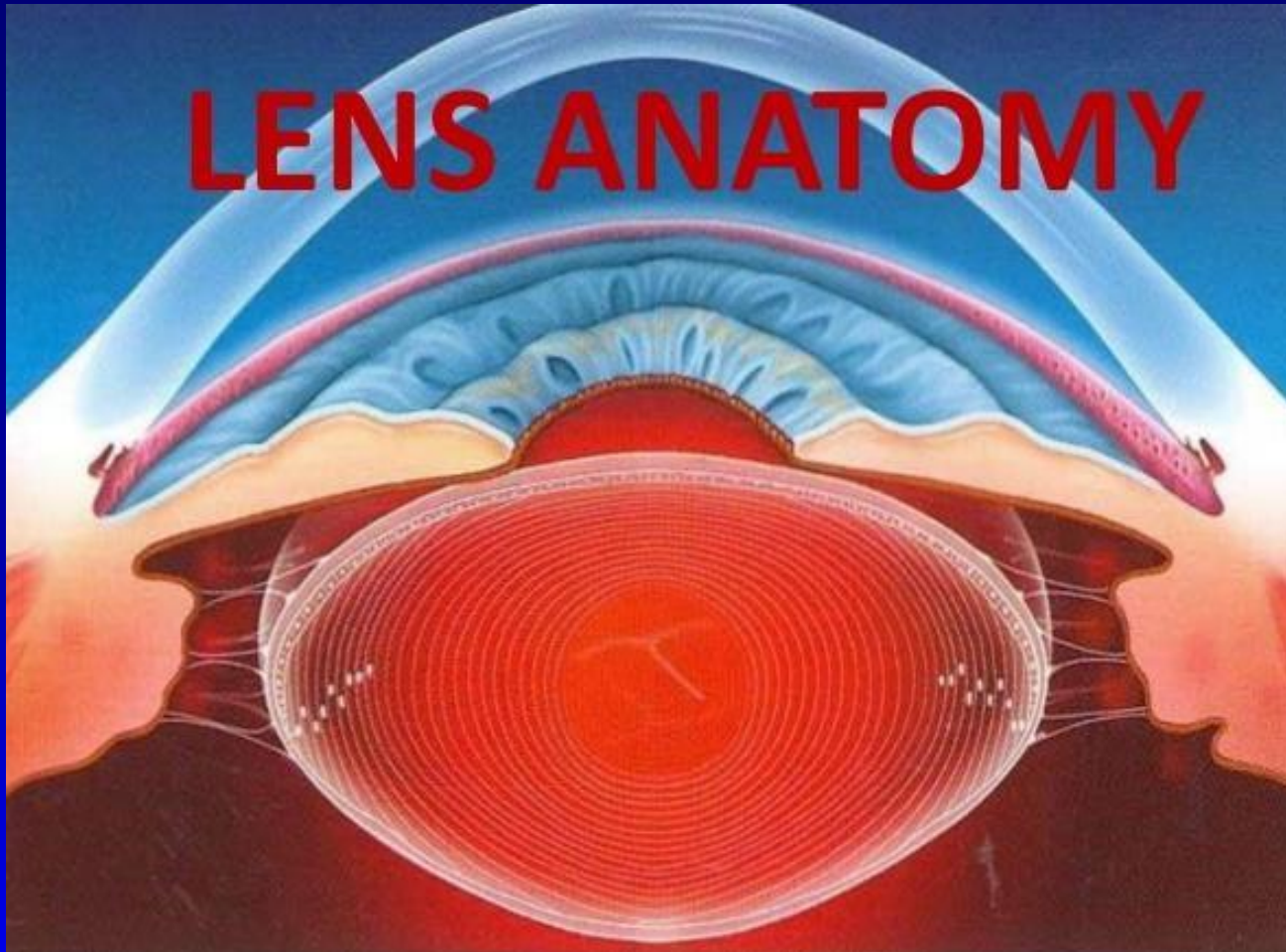
The Anterior Segment



Anterior Chamber

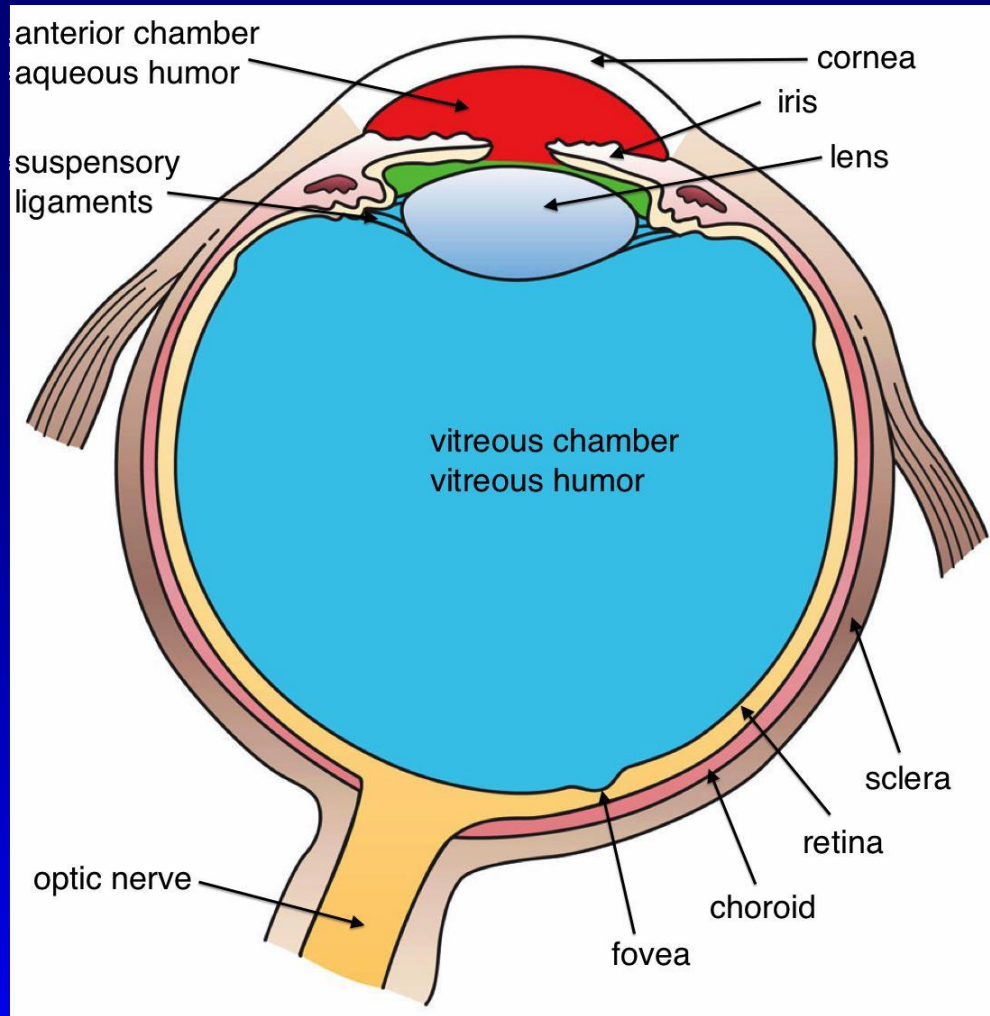


Lens

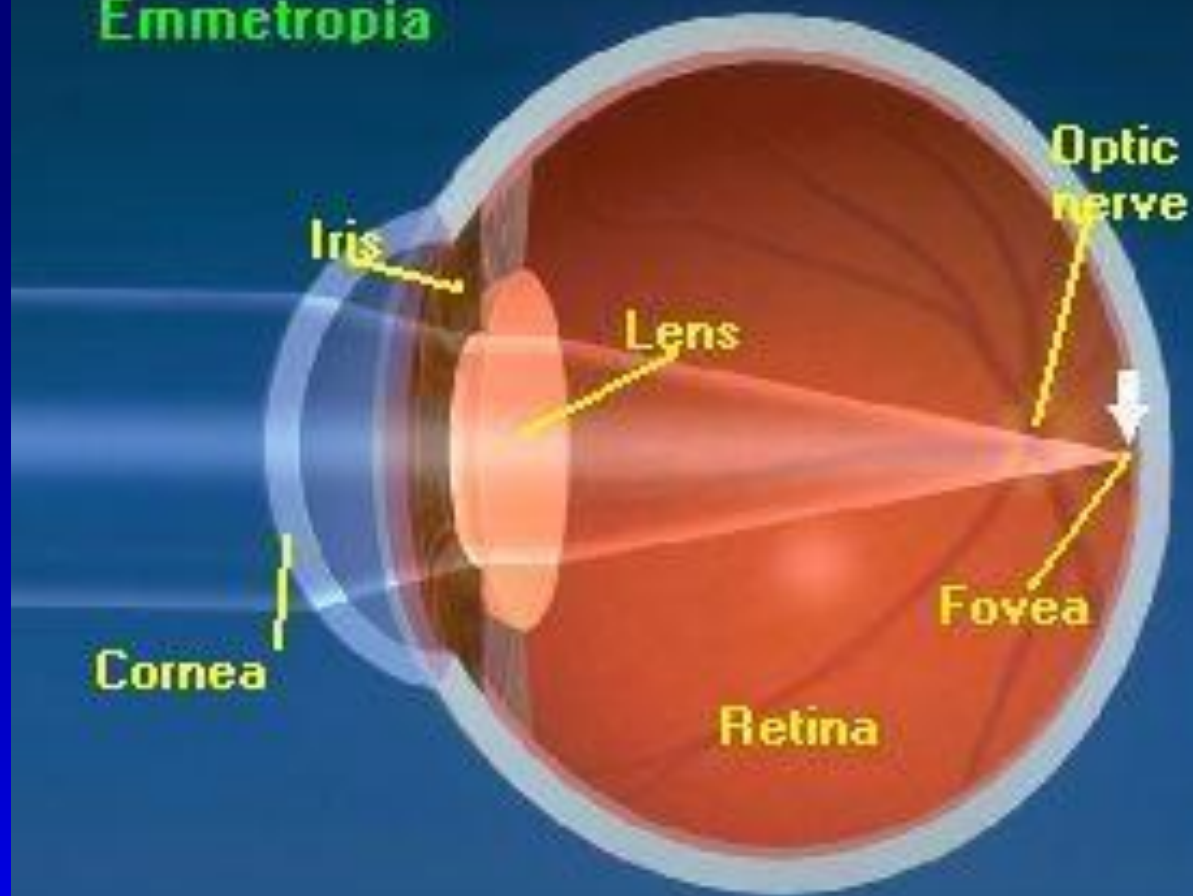


Lens anatomy sivateja

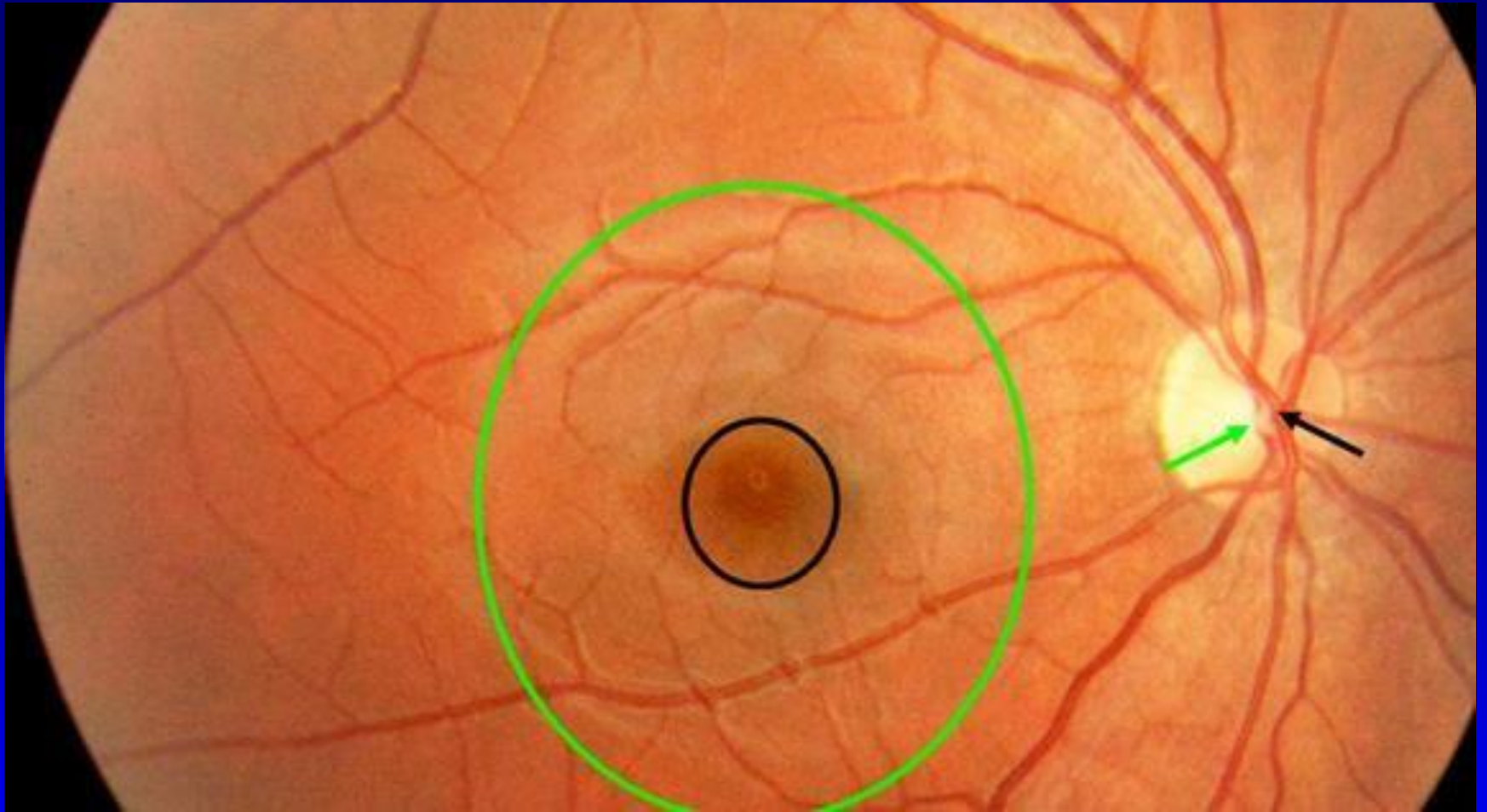
Lens



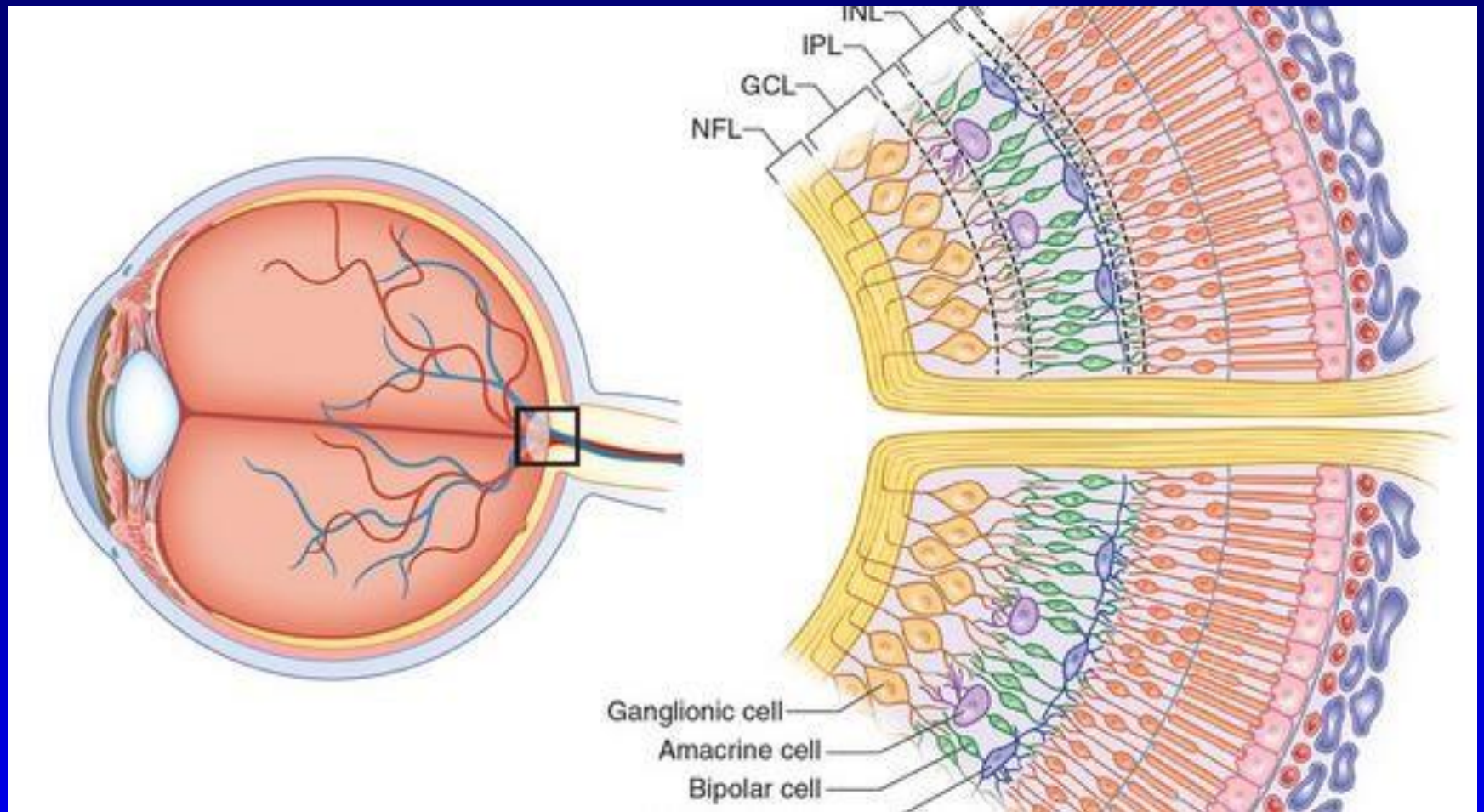
Emmetropia



Retina

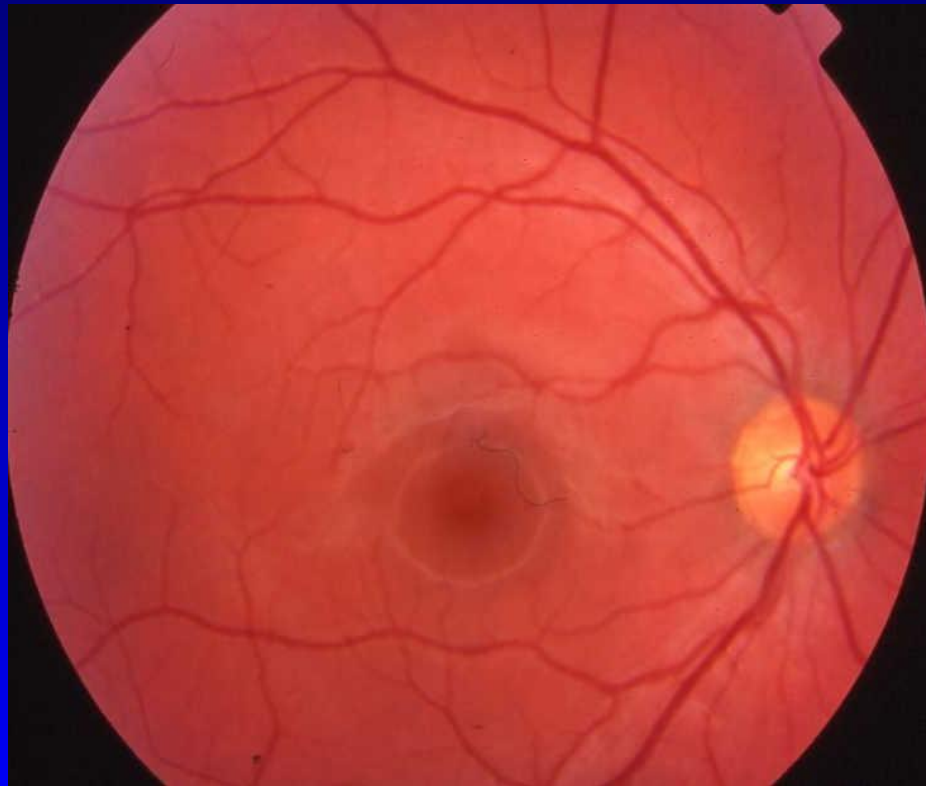


Retina

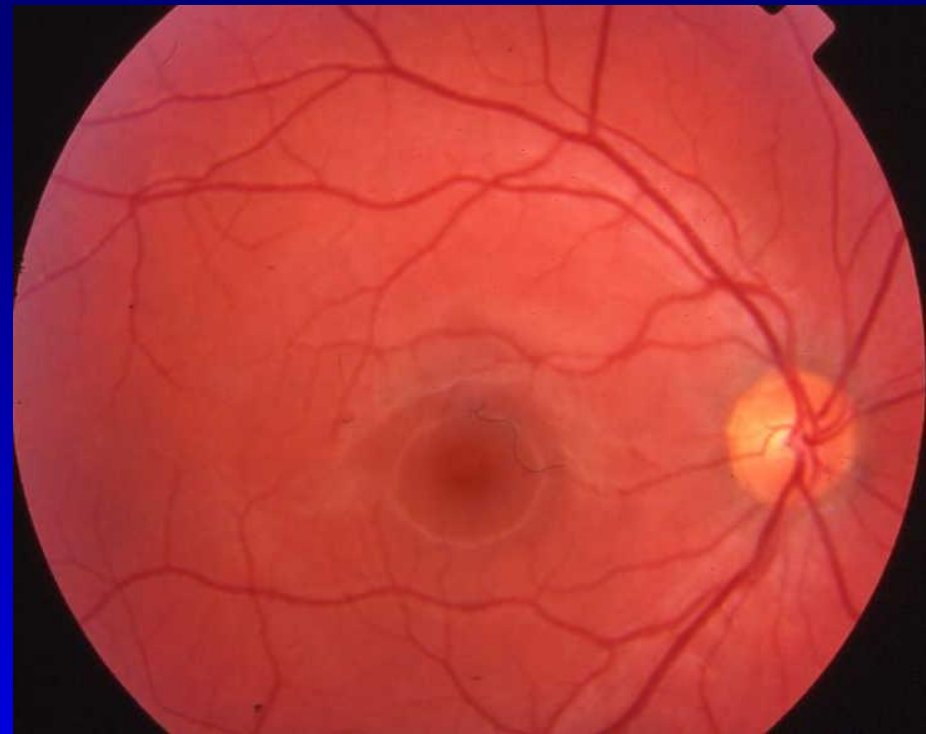
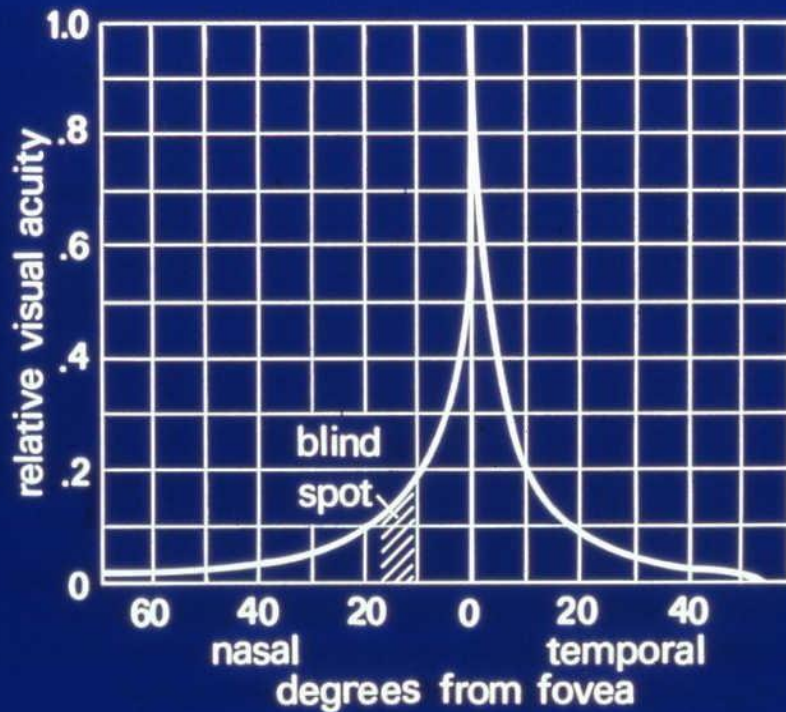


Fovea

- Most sensitive area of retina for high spatial frequencies
 - Va 20/20 or better
- Represents the center of our visual world
 - Retinal images off fovea viewed as left, right, above or below



Visual Acuity Rapidly Declines Away from Center of Fovea



Anatomy, Physiology and the Pediatric Eye Exam

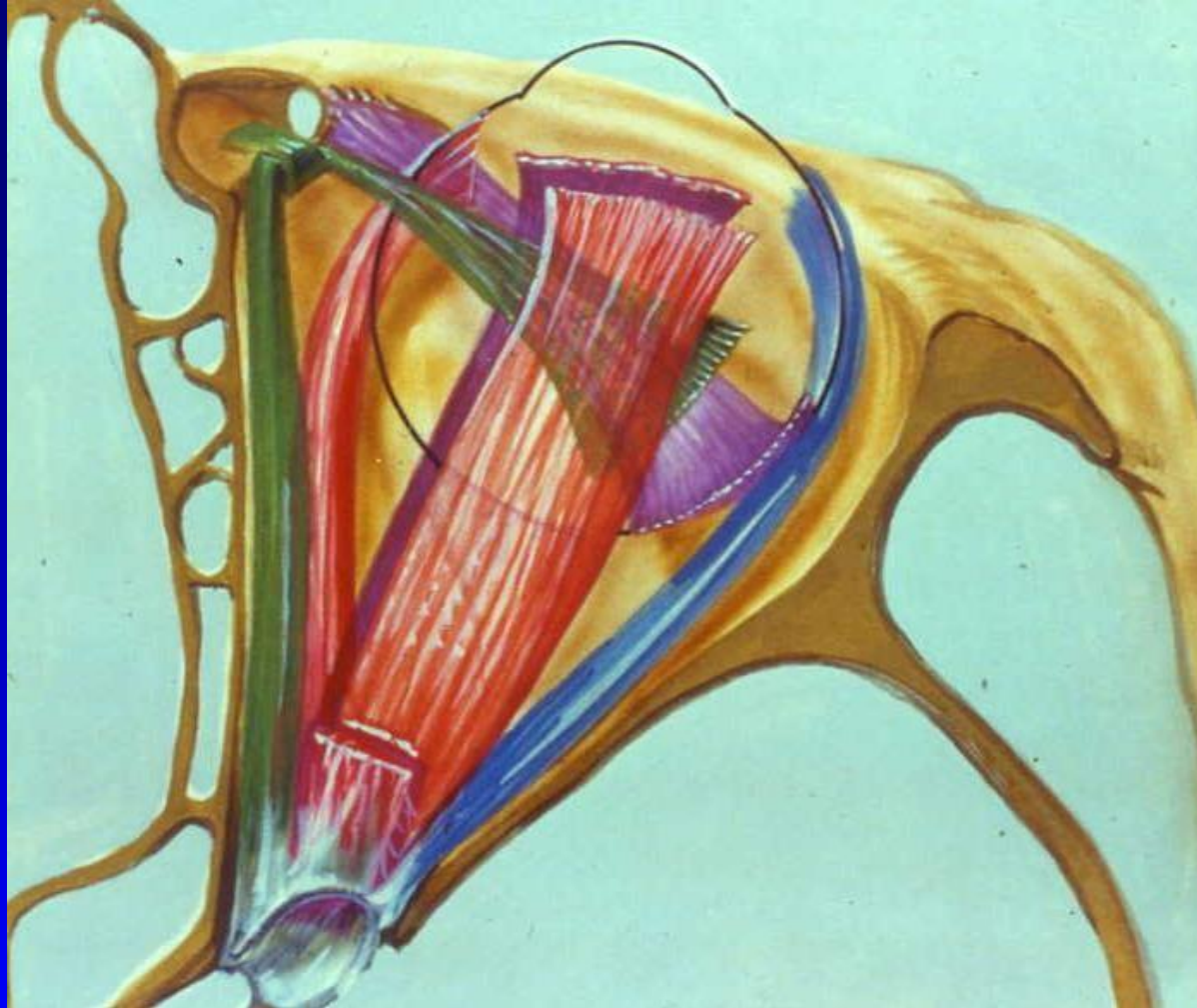
Eye Movements

- Allow the fovea of each eye to be directed at objects of regard in the visual world
- Binocular vision is made possible by efferent motor signals that simultaneously and precisely direct both foveas at the object of regard (visual target)
 - Represents motor component of “fusion”

ANATOMY IMPORTANT TO STRABISMUS

Six Extraocular Muscles

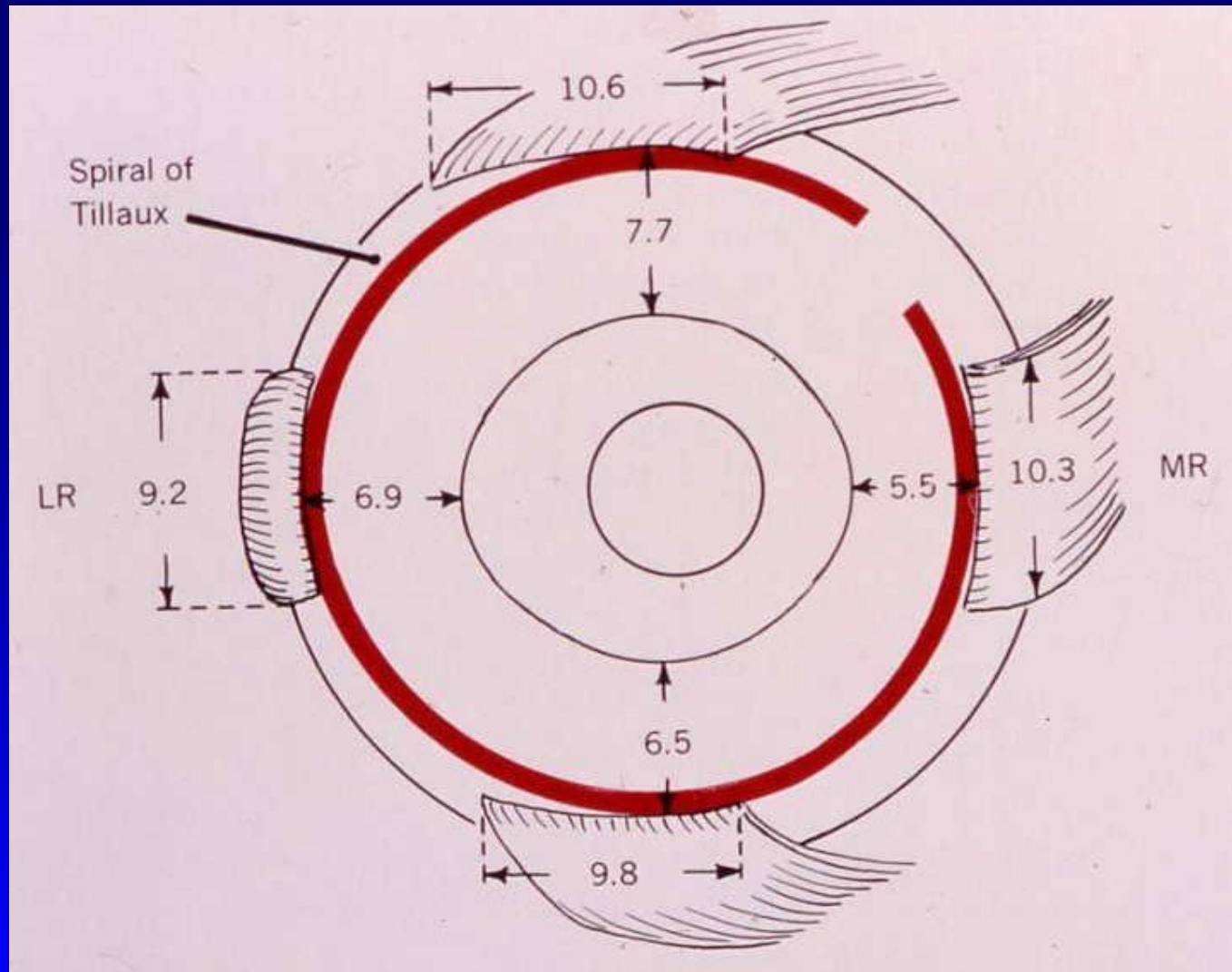
- Extraocular muscle fibers are striated, skeletal-type fibers



*Surgical Anatomy of
the Orbit. Zide BM,
Jelks GW. Illus
Luce C. NY: Raven
Press, 1985*

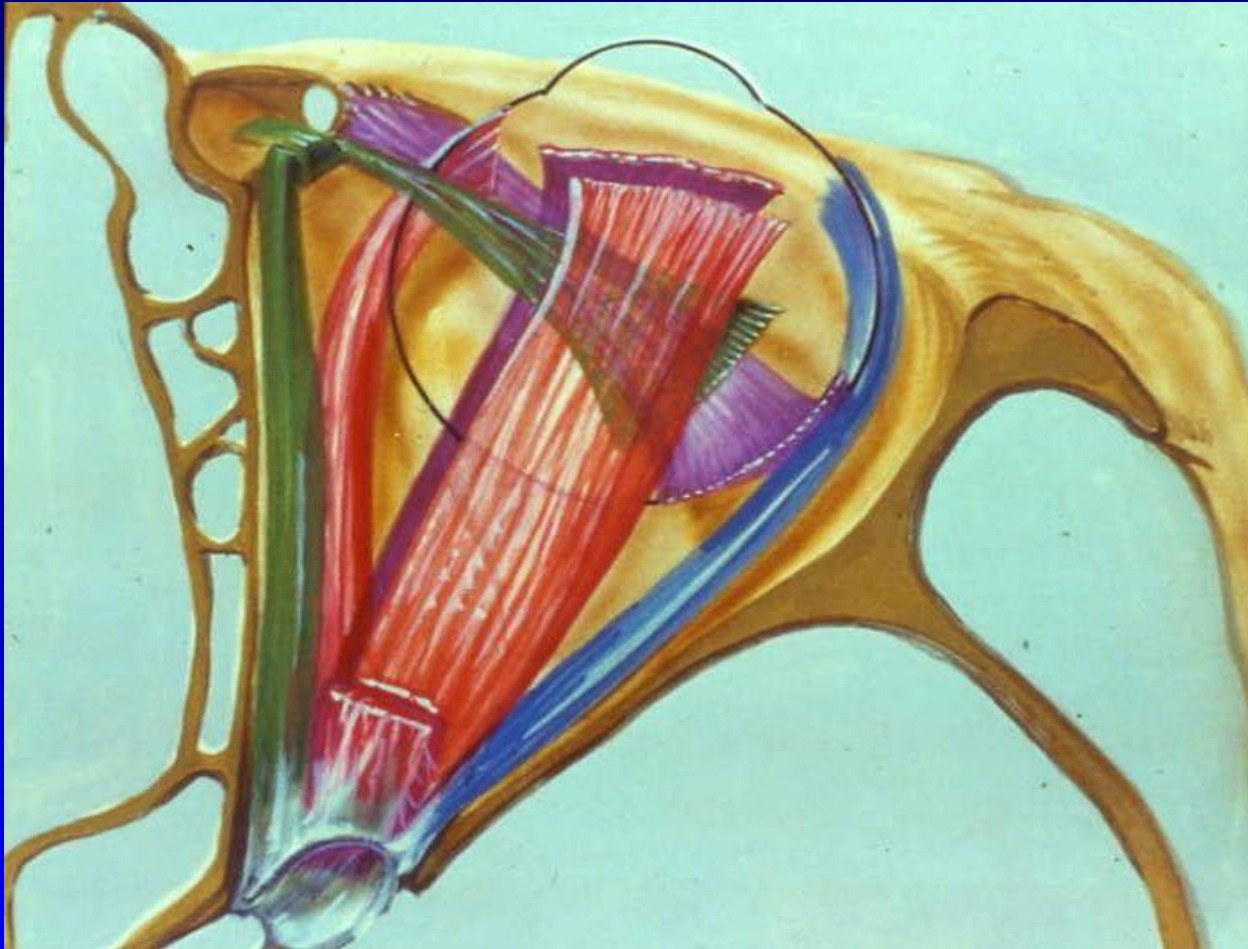
Spiral of Tillaux

Each rectus insertion varies relative to limbus



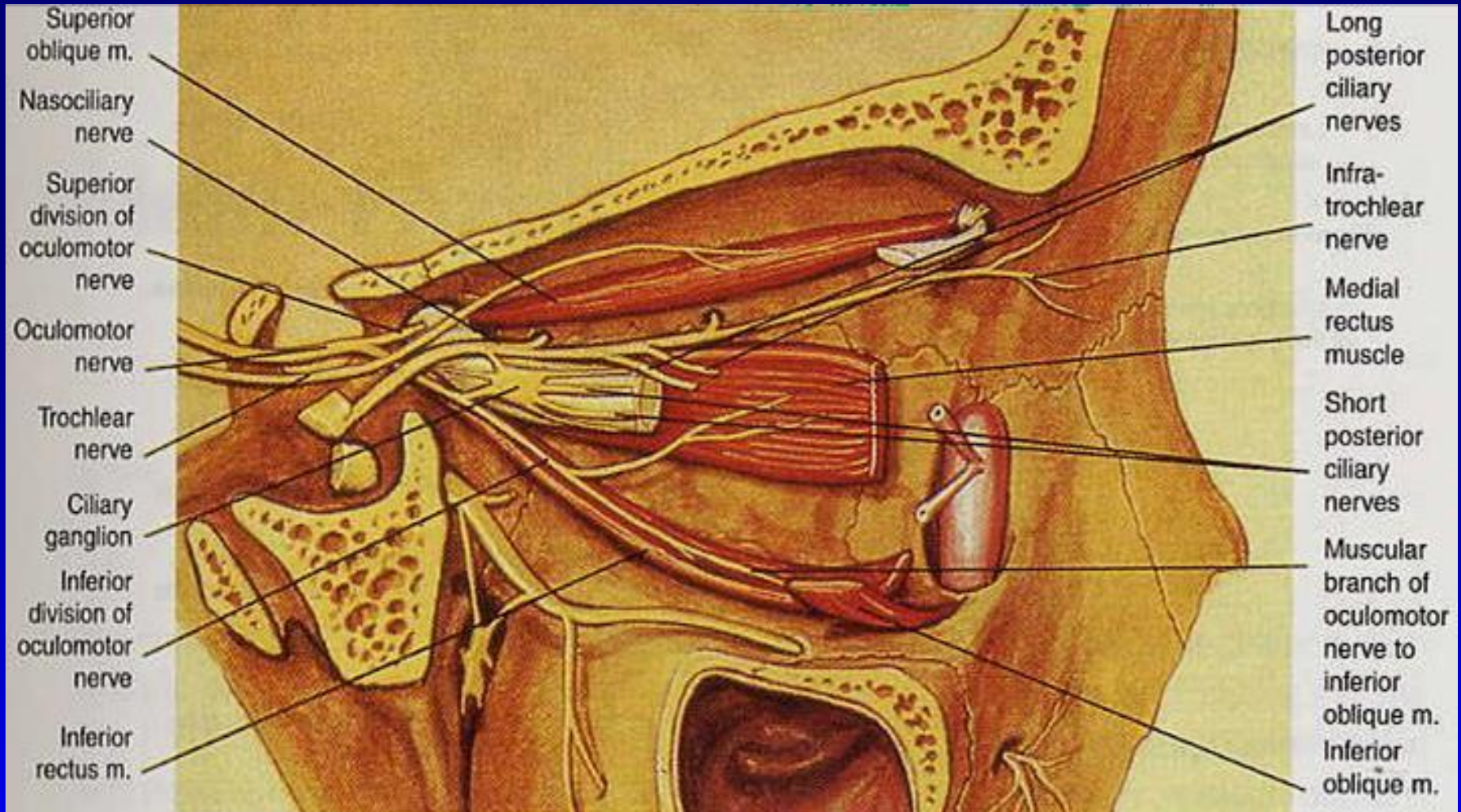
Six Extraocular Muscles

- *Origin of four rectus muscles is at Annulus of Zinn*
- *Two oblique muscles*

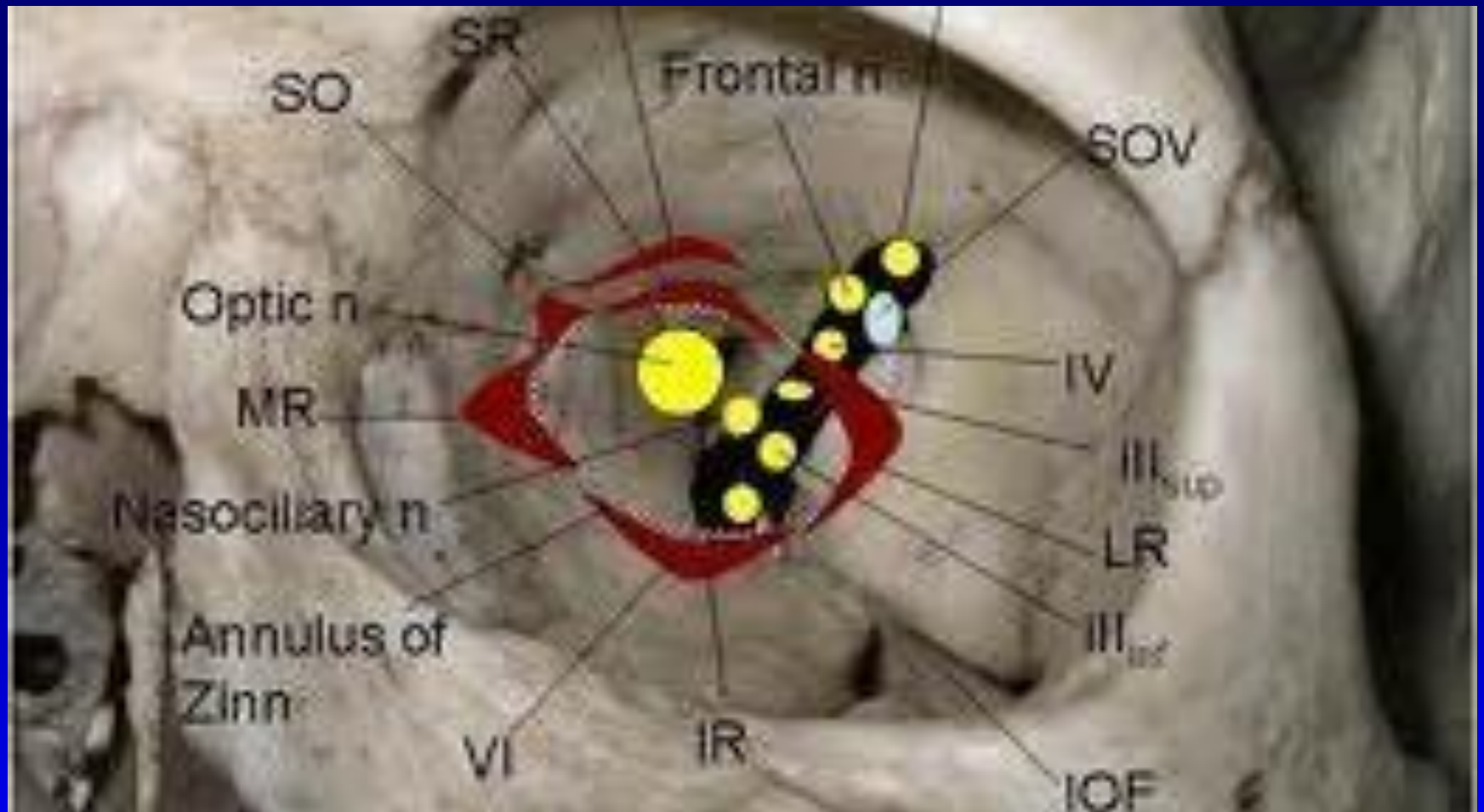


Surgical Anatomy of the Orbit. Zide BM, Jelks GW. Illus Luce C. NY: Raven Press, 1985

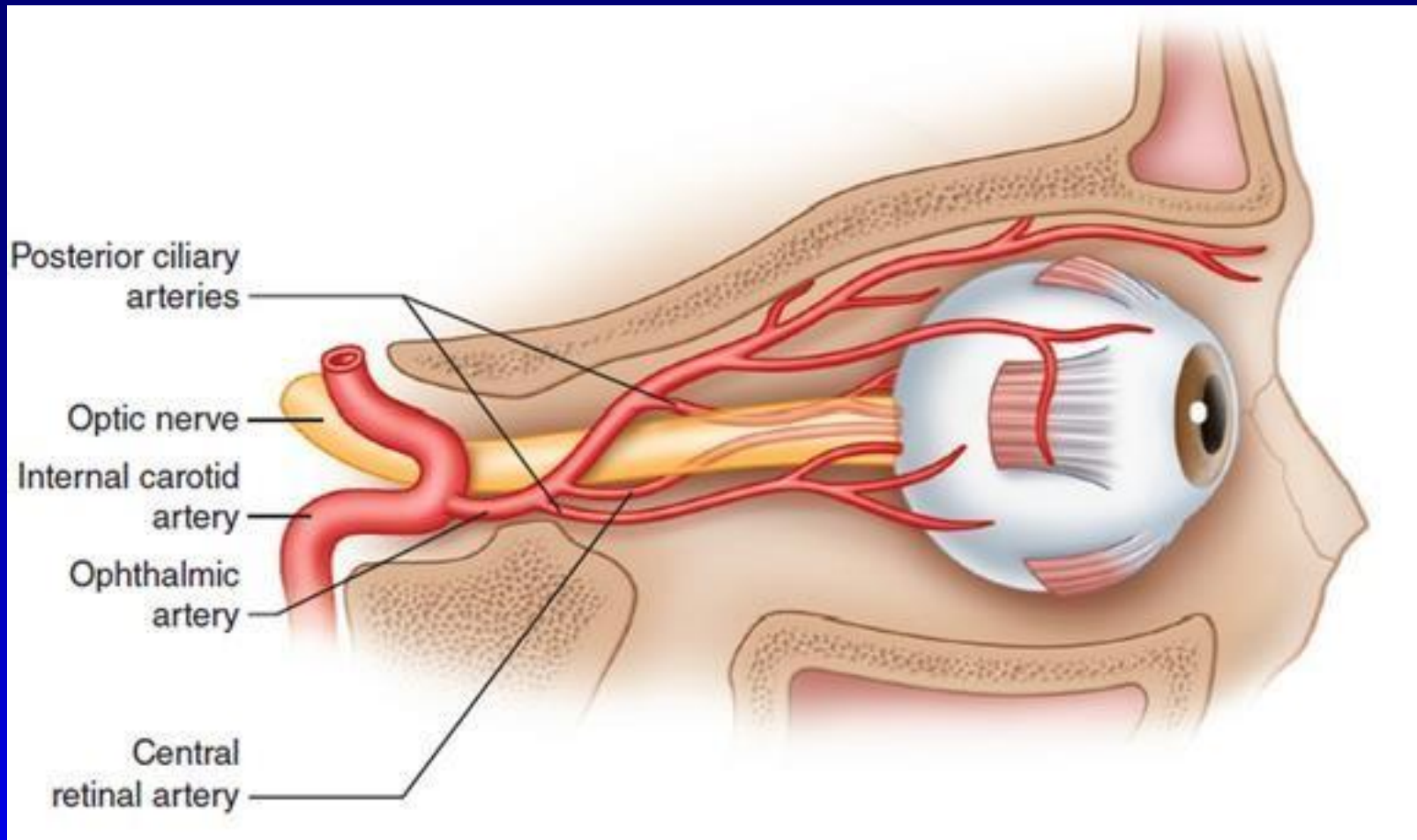
Nerves to the Orbit – Nasal View



Orbital Apex



Arterial Supply

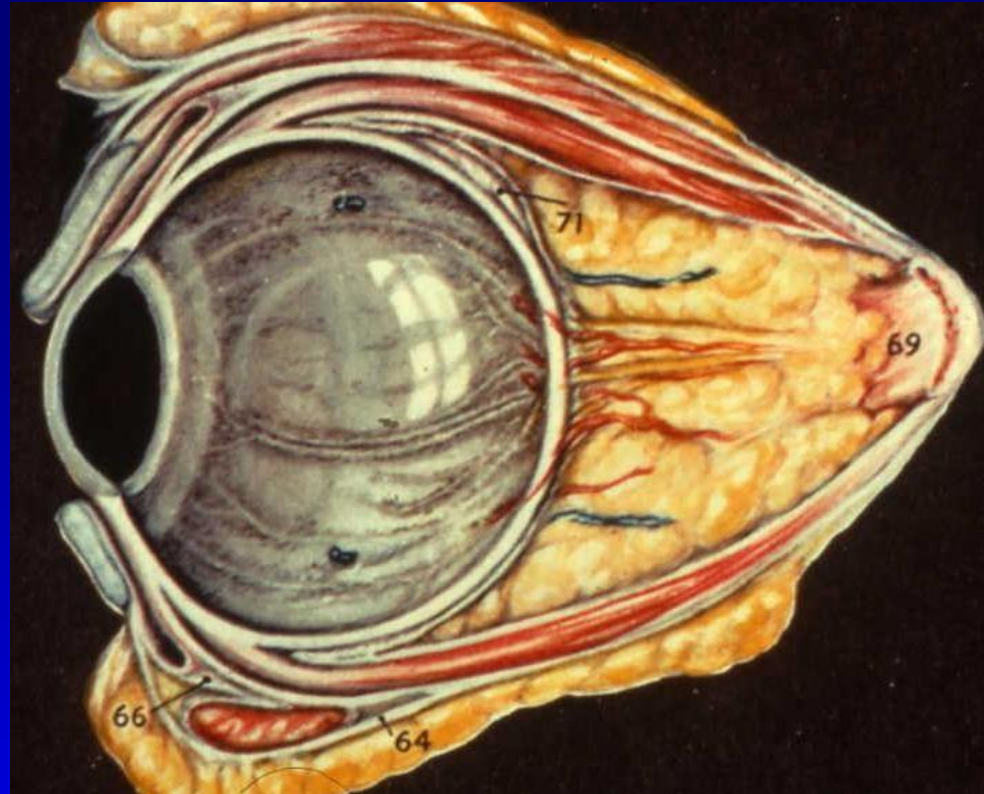


ORBITAL

CONNECTIVE TISSUE

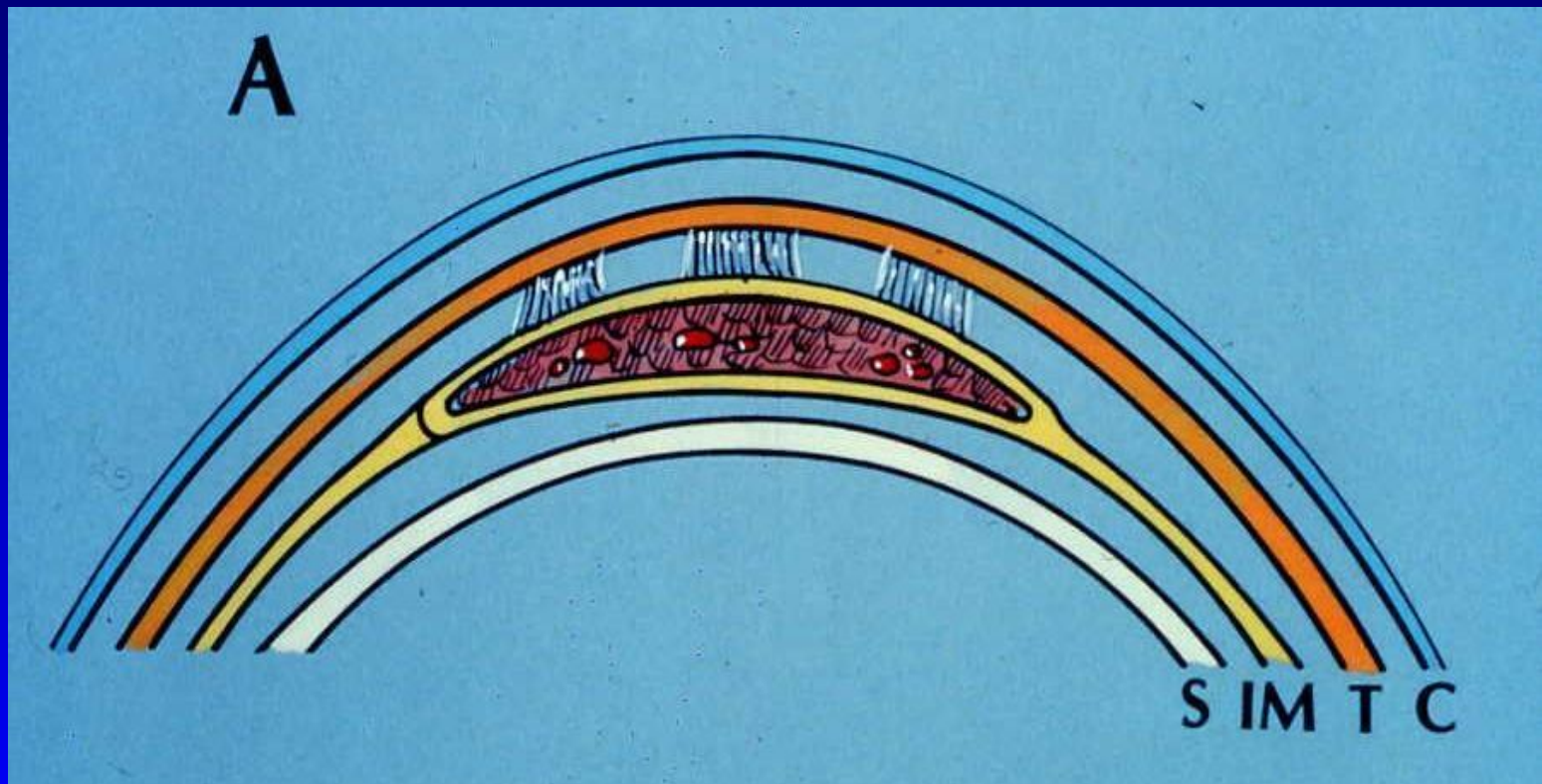
Orbital Tissues

- Globe is suspended in the orbit
- Cushioned by orbital fat
- Optic nerve has considerable slack
- EOM actively contract & passively stretch
- Orbital tissues passively stretch



Muscle Capsule

- Glistening, smooth surface permits muscle and tendon to glide over other tissues



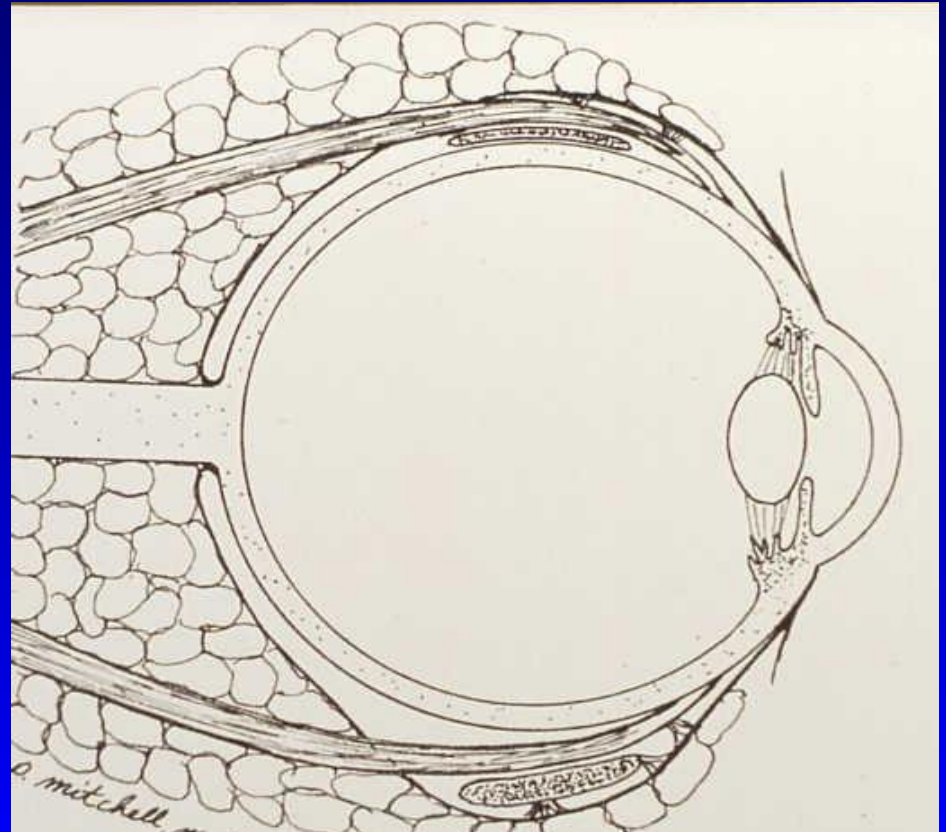
Intermuscular Septum

- Fascial sheet consisting of transparent, thin, avascular connective tissue
- Extends from the border of the capsule of one EOM to the nearest adjacent muscle



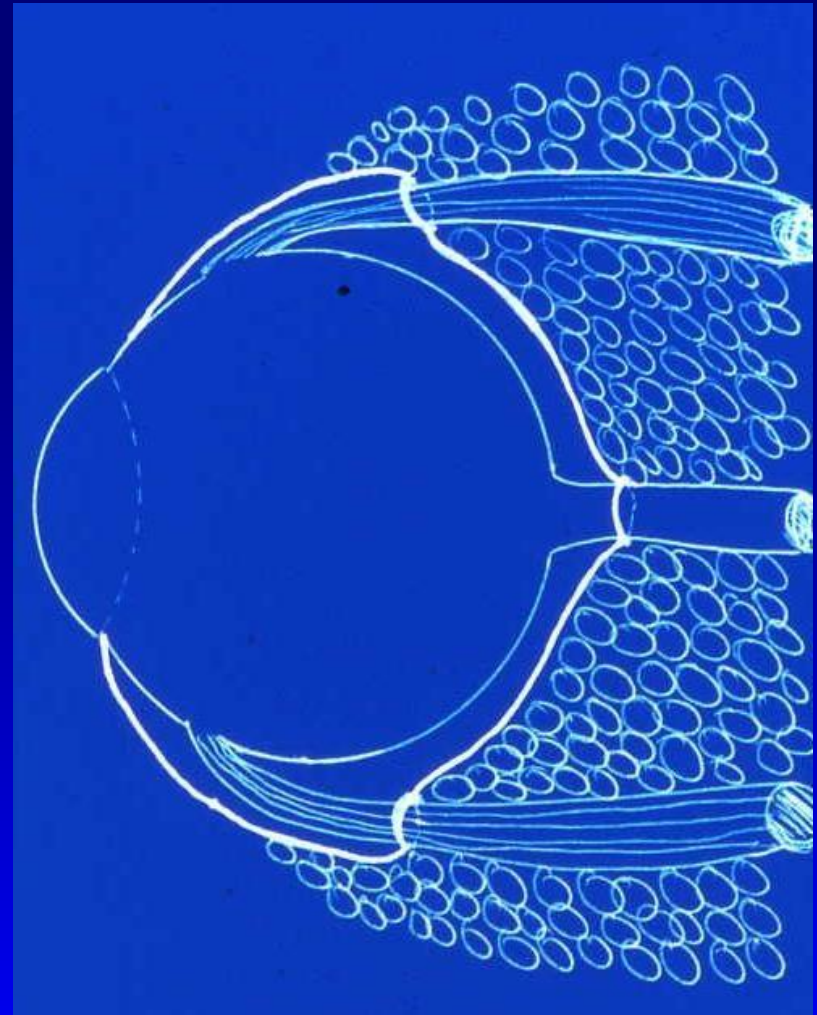
IM Septum Separates Orbital Fat

- Posterior to the globe, it separates the orbital fat into two zones:
 - Extraconal fat
 - Intraconal fat



Tenon's Capsule

- Relatively dense, translucent, connective tissue
 - Minimally vascular
 - Elastic
- Extends from limbus to optic nerve
- Firm attachments at:
 - Limbus
 - Penetration site of EOM
 - Optic nerve



Disorders of Ocular Motility

*Anatomy and action of
extraocular muscles*

Anatomy of the Extraocular Muscles

- There are 6 extraocular muscles: 4 of them are recti muscles and 2 of them are oblique muscles.
- The primary action of recti muscles is to rotate the eyeball in 4 directions: up, down, out, in.
- The primary action of oblique muscles is to rotate the globe (intorsion and extorsion).

Lateral and Anterior View

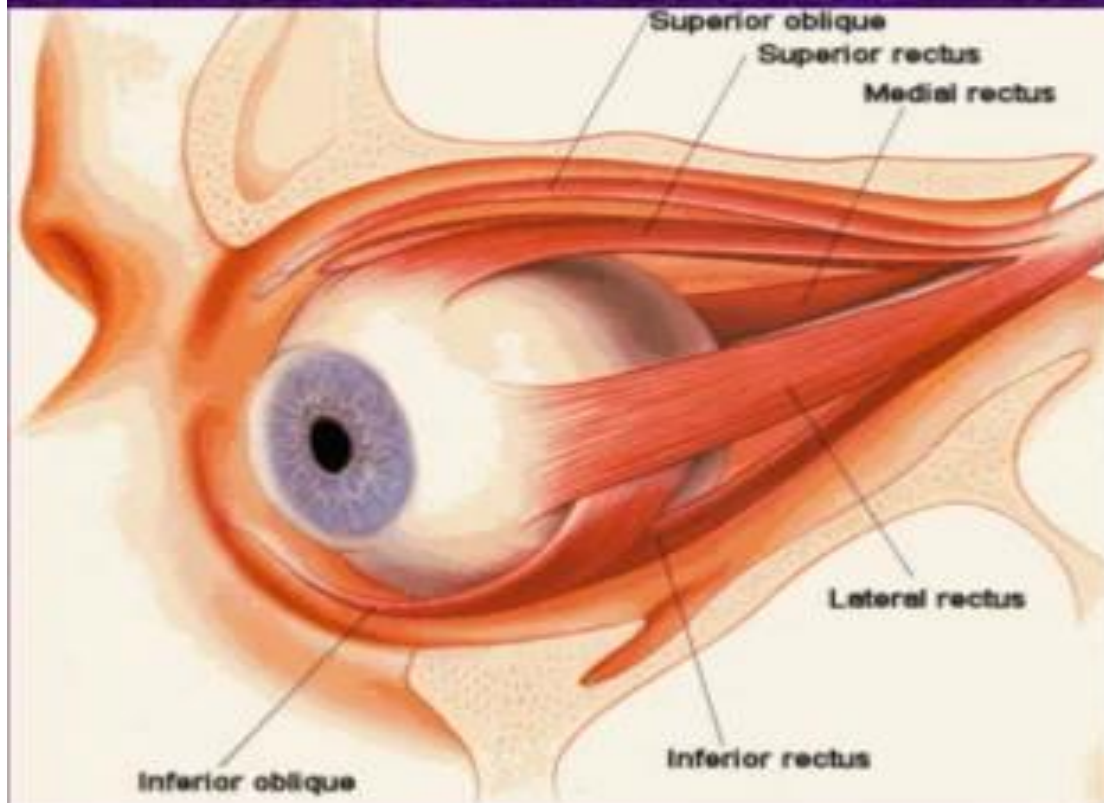
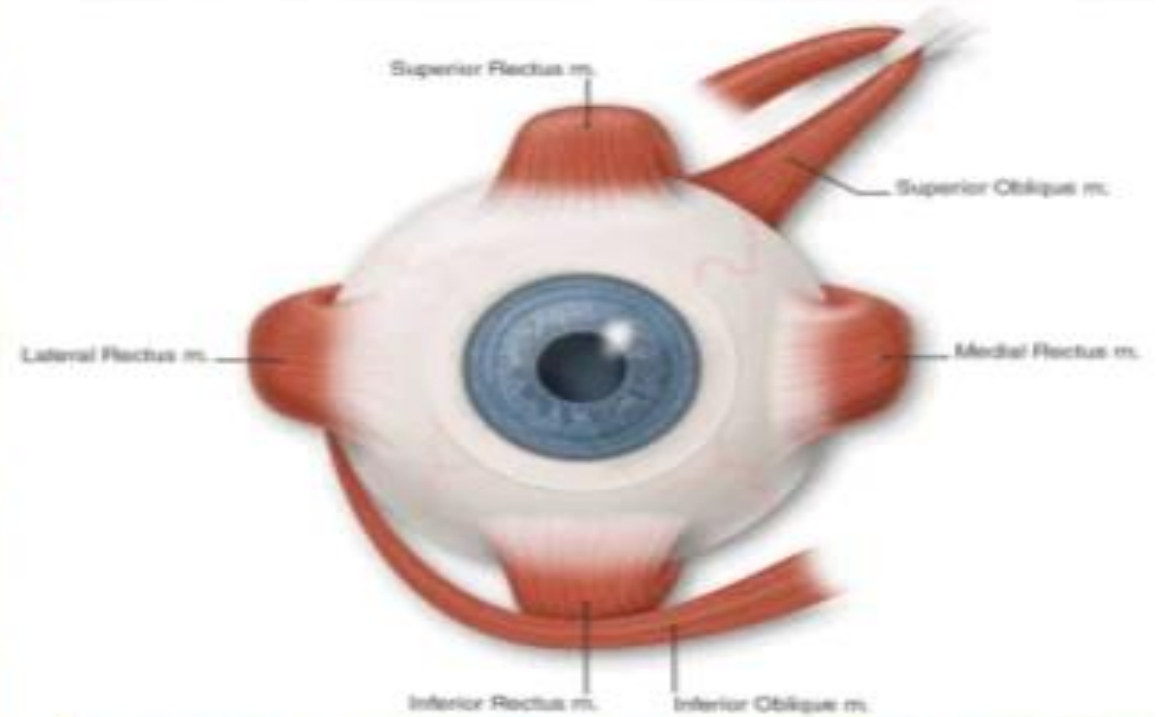


Fig. 1 Extraocular Muscle Anatomy



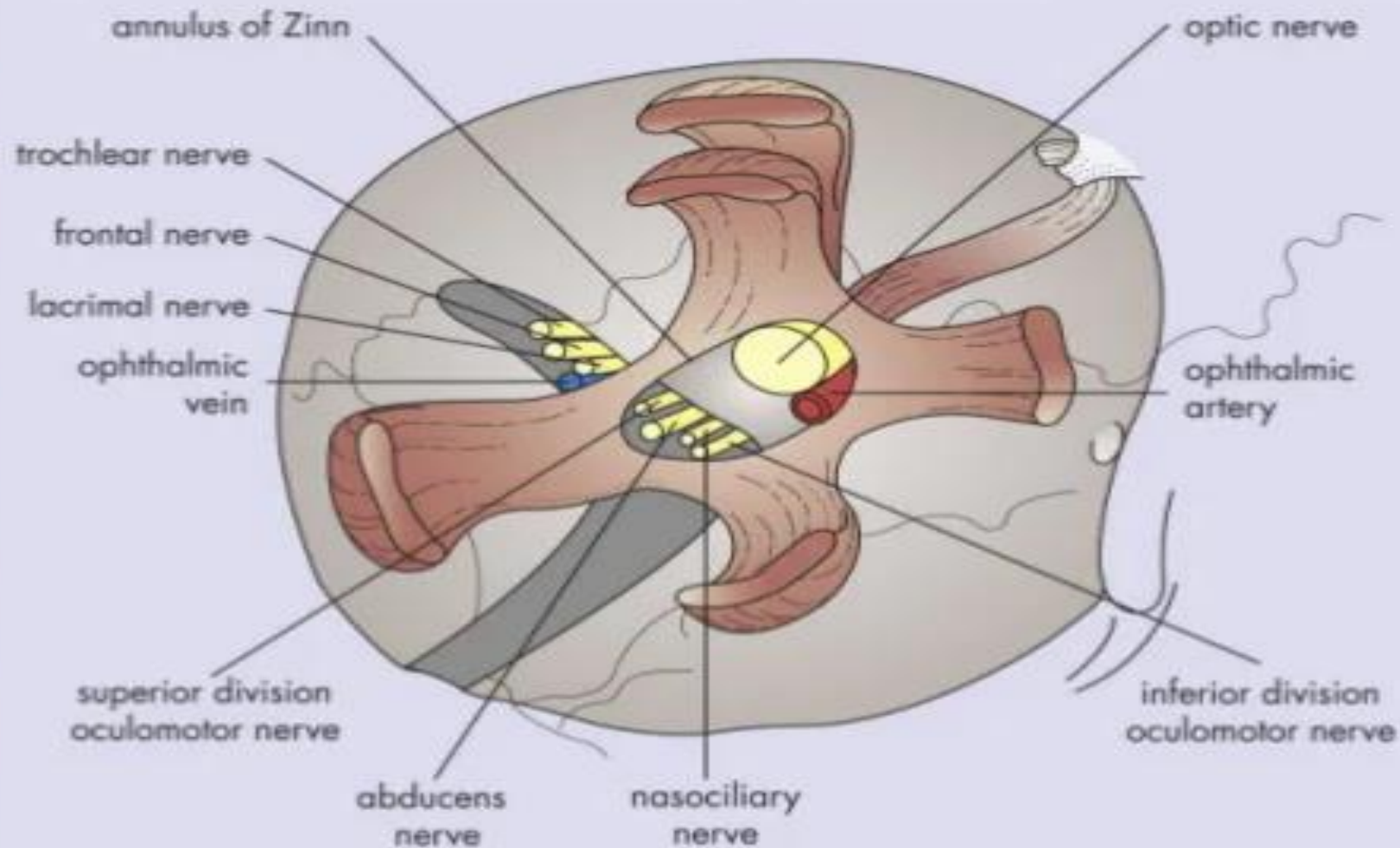
Origin of Extraocular Muscles

- All the 6 extraocular muscles (except Inferior Oblique) originate at the orbital apex.
- The superior, inferior, medial and lateral rectus muscles arise from the **ANNULUS OF ZINN**, an oval, fibrous ring at the orbital apex.
- The 6th extraocular muscle, the **Inferior oblique**, originates from the **Maxillary bone**, adjacent to the lacrimal fossa, posterior to the orbital rim.

Annulus of Zinn

- Structures passing through the annulus:
 1. Oculomotor nerve (superior and inferior divisions).
 2. Abducens nerve.
 3. Optic nerve.
 4. Nasociliary nerve.
 5. Ophthalmic artery.

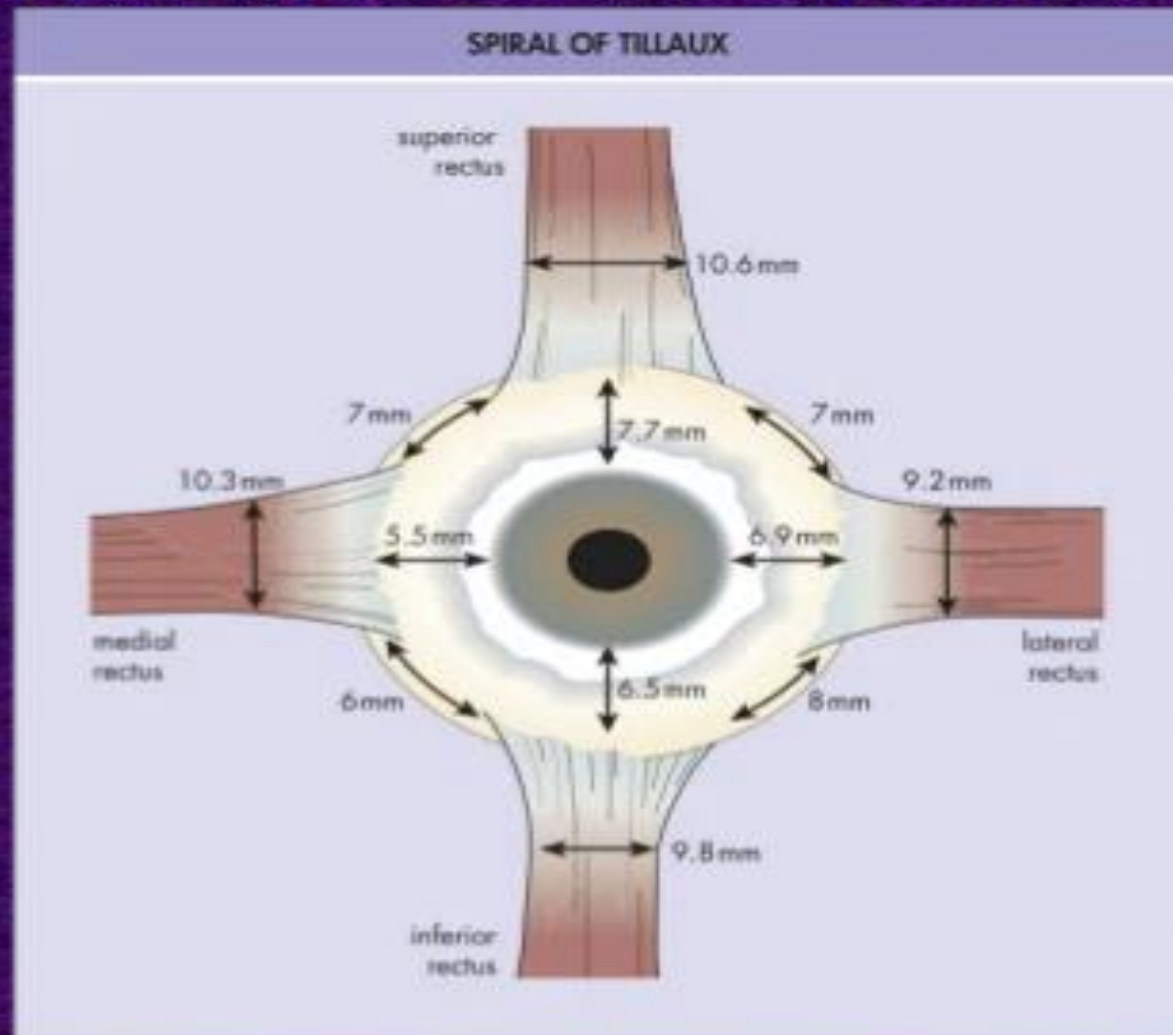
THE ANNULUS OF ZINN AND SURROUNDING STRUCTURES



Insertion of Recti Muscles

- The rectus muscles insert into the sclera just anterior to the equator of the globe.
- The spatial formation created by connecting their insertion is called the spiral of Tillaux.
- Note that the *medial rectus* inserts closest to the limbus, followed by the inferior, lateral, and superior recti in that order. **[MILS]**

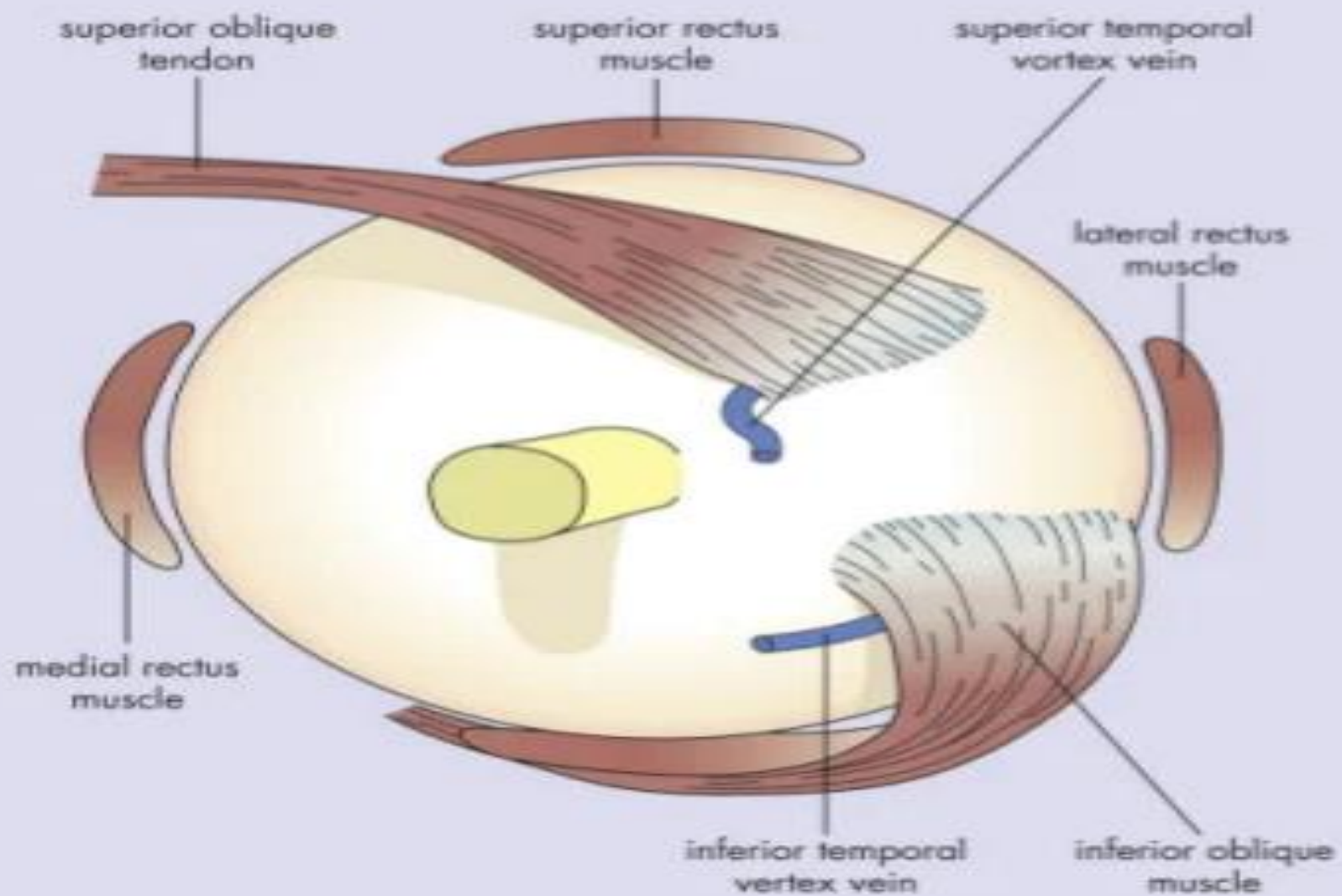
Spiral of Tillaux: The structure of the rectus muscle insertions.....



Insertion of Oblique Muscles

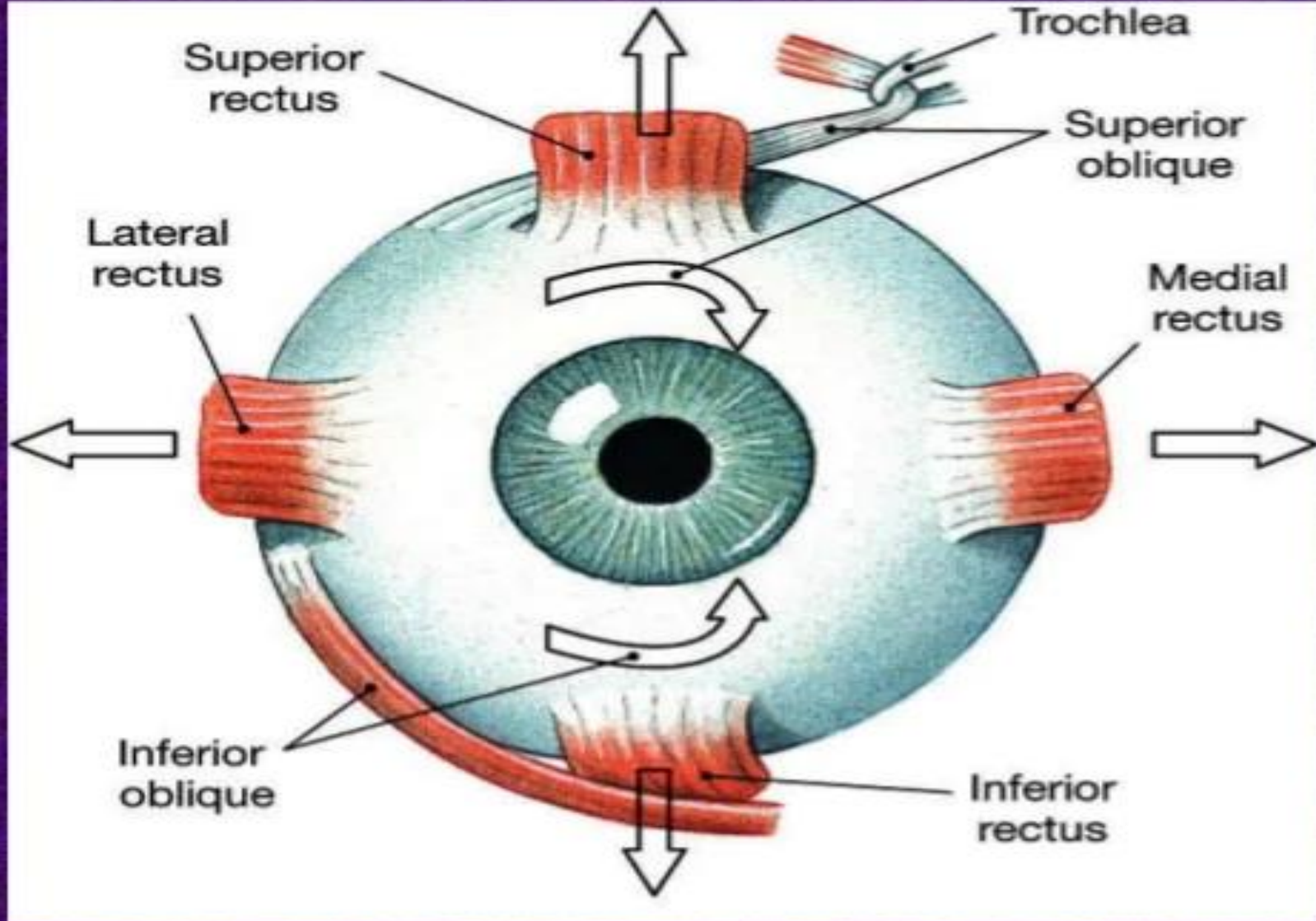
- The oblique muscles insert into the sclera posterior to the equator of the globe.
- The *superior oblique tendon* inserts into the posterior, ***superolateral sclera*** in a broad, fan-shaped fashion under the superior rectus muscle.
- The insertion extends near the ***superotemporal vortex vein***.
- The *inferior oblique muscle* inserts into the posterior, ***inferolateral sclera***. The insertion lies in close proximity to both the macula and the ***inferotemporal vortex vein***.

POSTERIOR VIEW OF RIGHT EYE WITH TENON'S CAPSULE REMOVED



Action of Extraocular Muscles

Muscle	Action
Medial rectus	Adduction
Lateral rectus	Abduction
Superior rectus	Elevation
Inferior rectus	Depression
Superior oblique	Intorsion
Inferior oblique	Extorsion



Innervation of Extraocular Muscles

<i>Nerves</i>	<i>Innervated muscles</i>
Superior division of Oculomotor (3 rd) nerve	Levator palpebrae and Superior rectus muscles.
Inferior division of Oculomotor nerve	Medial rectus, Inferior rectus and Inferior oblique muscles.
4 th nerve (Trochlear nerve)	Superior oblique.
6 th nerve (Abducens nerve)	Lateral rectus.

Pediatric ophthalmology

Lecture 4

Subjective Visual Acuity Not Possible to About Age 2-3 yrs



Assessment of Strabismus

- Visual acuity: Age 0-2
 - Fix and follow method (F&F)
 - Central steady and maintained method (CSM)
 - Teller Acuity (preferential looking)





Child looks up at stripes



Teller Acuity Card (TAC)

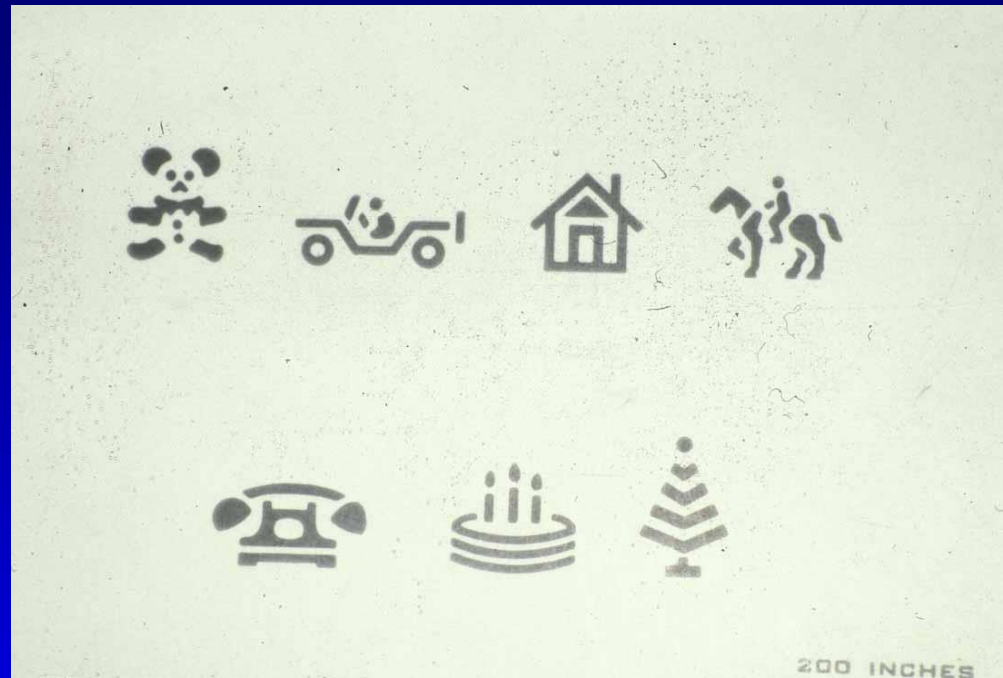
Child looks down at stripes



Teller Acuity Card (TAC)

The Pediatric Eye Examination

- Visual acuity
 - Allen pictures:
Verbal preschoolers
Age 2-5
Normal: 20/40 to 20/20



The Pediatric Eye Examination

- Visual acuity: Age 2-5
 - **Tumbling E game**
 - **HOTV**

Normal 20/40-20/20



The Pediatric Eye Examination

- Visual acuity
 - **Snellen:**
Age 4+
20/30-20/20
 - Crowding bars to
prevent overestimating
VA in amblyopia

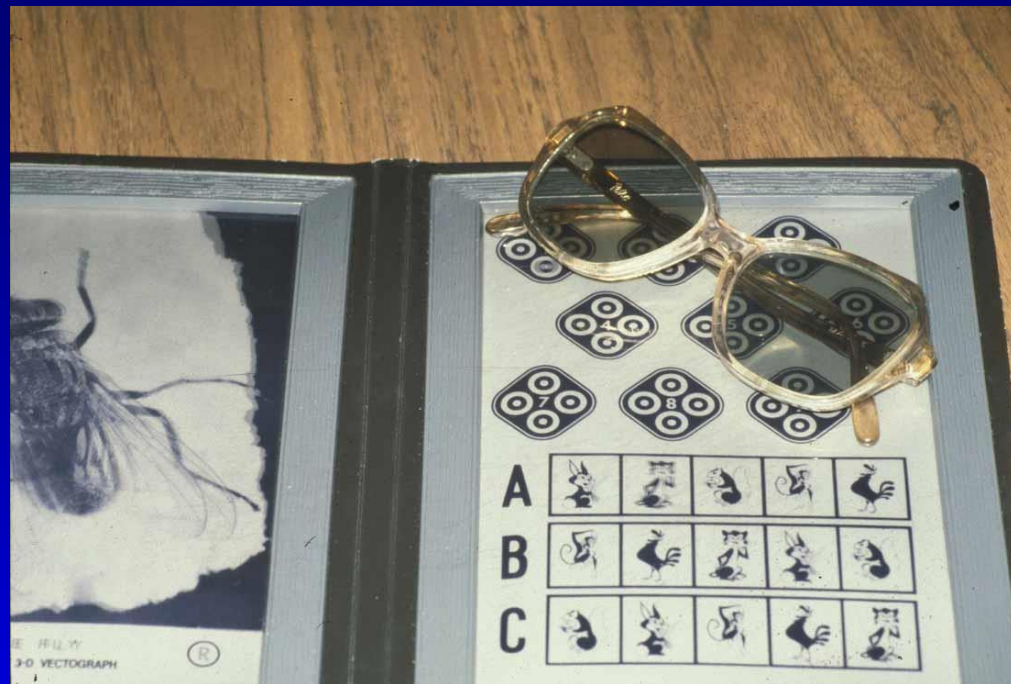




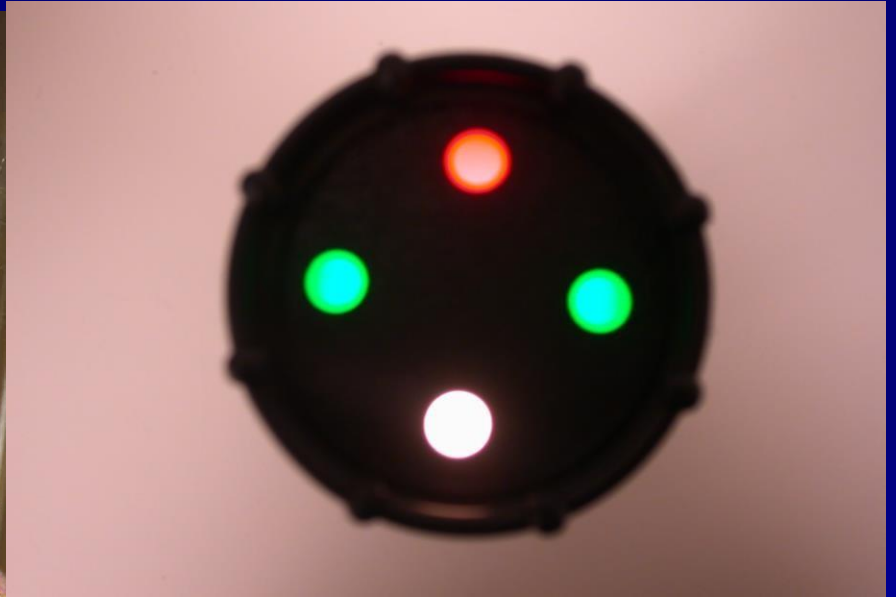


The Pediatric Eye Examination

- Stereopsis and Fusion
 - Stereopsis:
 - Fusion
 - simultaneous perception
 - good visual acuity OU
 - Titmus and Randot

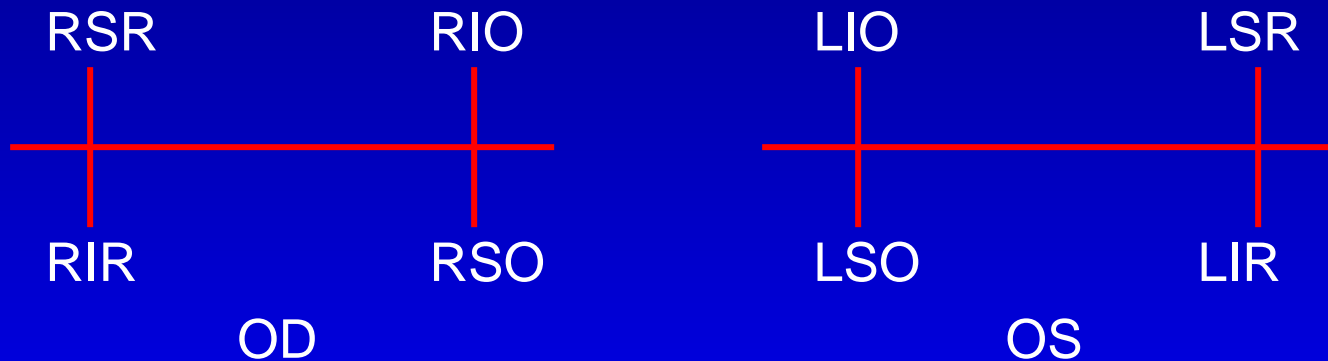


Worth 4 dot test-Test of fusion



The Pediatric Eye Examination

- Assessment of motor function
 - Ductions and versions
 - Evaluate in the 6 cardinal positions
 - Follow H configuration for versions



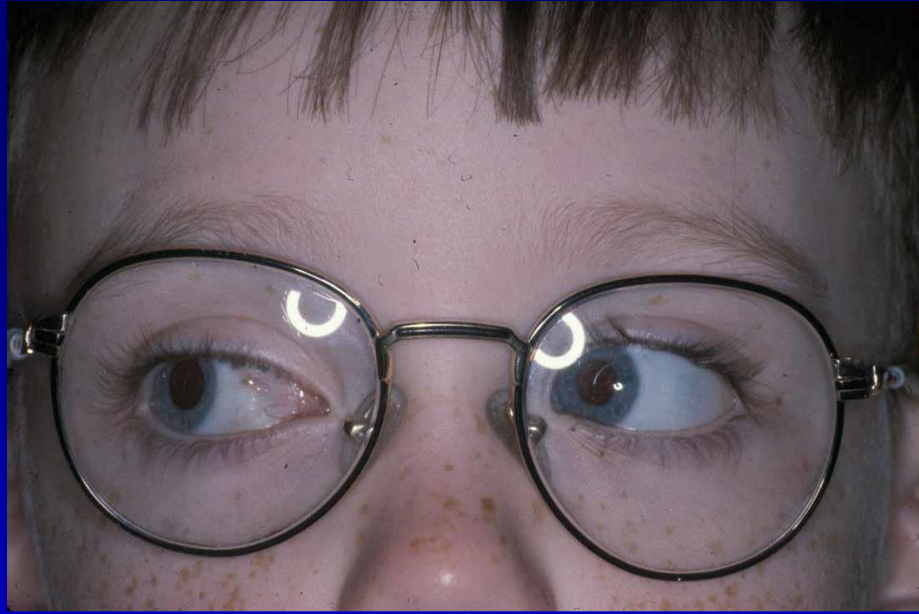
The Pediatric Eye Examination

Ductions



Versions









Near point of convergence

The Pediatric Eye Examination

- Assessment of binocular motor function
 - Corneal light reflex tests:
 - **Hirschberg method:**
1mm—7deg or 15 PD
 - Modified Krimsky method
 - Bruckner test



The Pediatric Eye Examination

- Assessment of binocular motor function
 - Corneal light reflex tests:
 - Hirschberg method: 1mm—7deg or 15 PD
 - **Modified Krimsky method**
 - Brückner test



The Pediatric Eye Examination

- Assessment of binocular motor function
 - Corneal light reflex tests:
 - Hirschberg method: 1mm—7deg or 15 PD
 - Modified Krimsky method
 - **Brückner test**



The Pediatric Eye Examination



- Assessment of binocular motor function
 - Cover tests:
 - More accurate
 - Require patient cooperation
 - cover–uncover test
 - alternate cover test
 - simultaneous prism cover test
 - prism alternate cover test

The Pediatric Eye Examination

- Positions of gaze for strabismus measurement
 - Distance and near fixation
 - 9 diagnostic positions

Up & right	Upgaze	Up & left
Right gaze	Primary gaze	Left Gaze
Down & right	Down	Down & Left

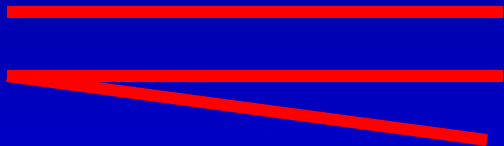


SNELLEN FEET 30



Pediatric Eye Examination and the Assessment of Strabismus

- Assessment of torsion
 - Double maddox rods



The Pediatric Eye Examination



Incomitant Deviation

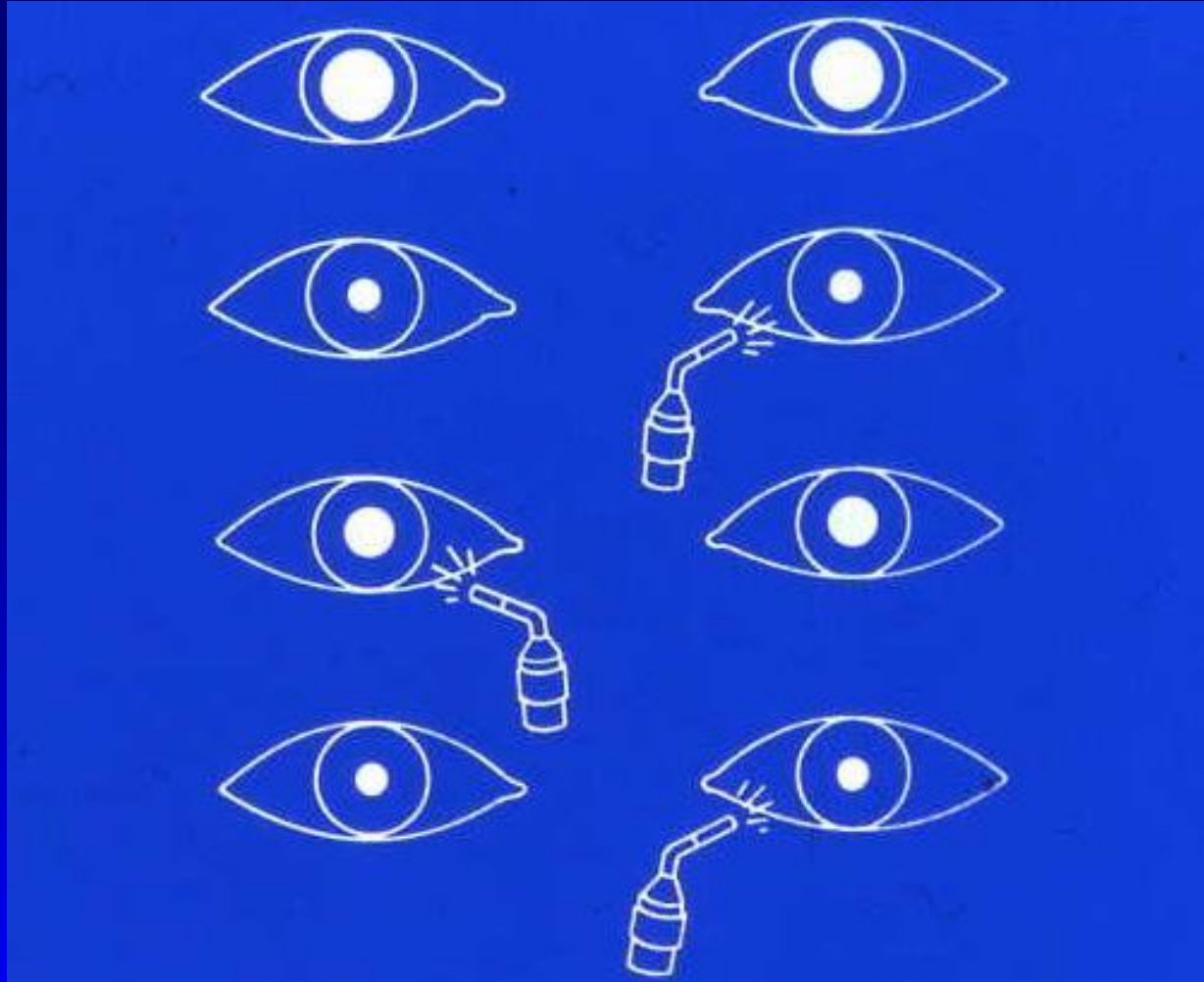
Pediatric Eye Examination and the Assessment of Strabismus



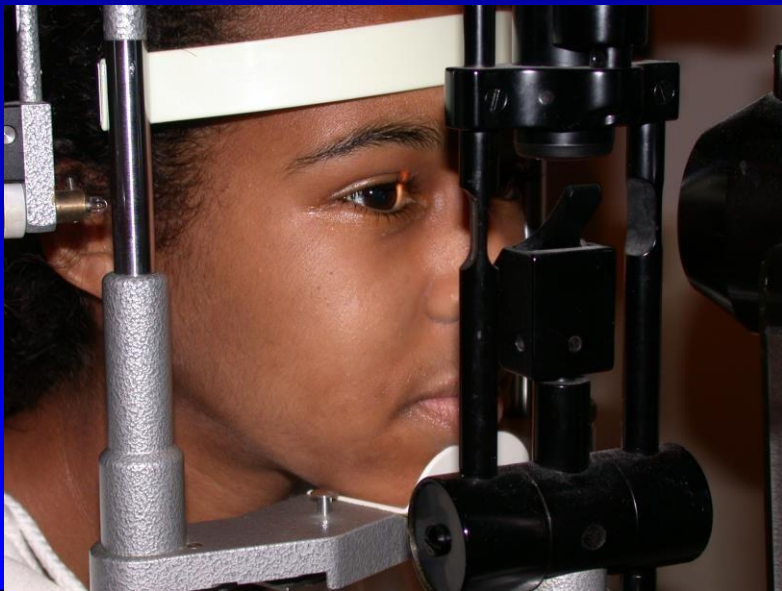
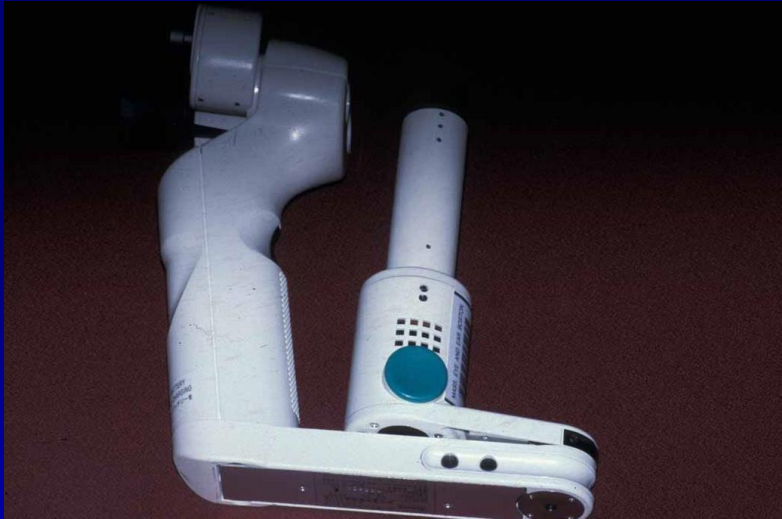
- Examination
 - Pupils:
 - Use mechanical toys at distance
 - Swinging light test

Pupil Responses

+ Afferent
Pupillary
defect
(+APD)



The Pediatric Eye Examination



- Examination
 - SLE:
 - Feasible in 3yr olds and older
 - Portable slit lamp for infants and young children

The Pediatric Eye Examination



- Intraocular pressure:
 - Palpation
 - Perkins tonometer, Tonopen
 - Applanation

The Pediatric Eye Examination

- Examination
 - Refraction
 - Cycloplegic refraction essential in children
 - cannot rely on a dry refraction
 - Cycloplegic agents:
 - Cyclopentolate 0.5%, 1%
 - Atropine 0.5%, 1%
 - Phenylephrine 2.5% to enhance dilation
 - Tropicamide not adequate for cycloplegia



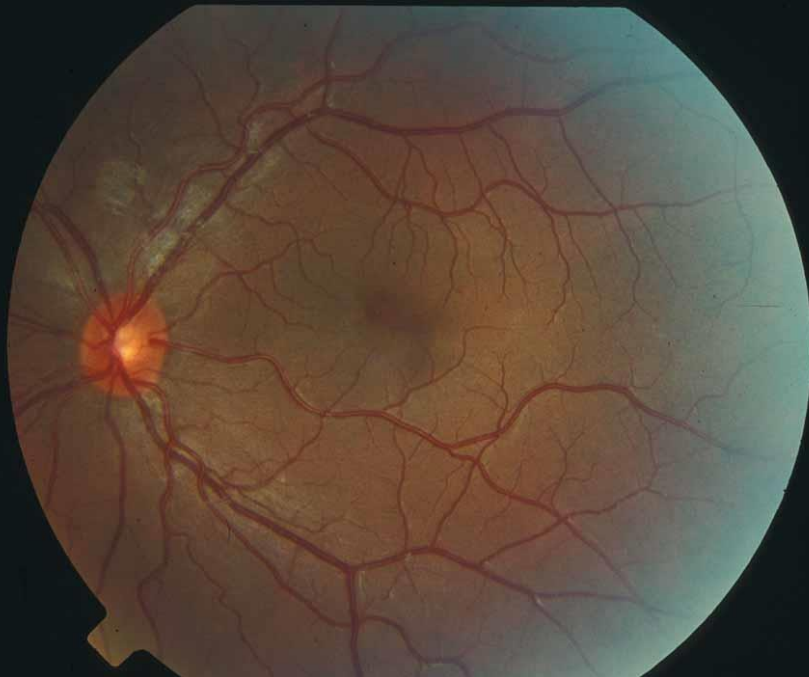
The Pediatric Eye Examination

- Examination
 - Refraction
 - Loose lenses in trial frame for the young
 - Phoropter for the older kids
 - Occlude fellow eye during retinoscopy



Examination

- Dilated fundus examination
 - 28D and 20D lenses
 - Lid speculum may be necessary for infants
- Fundus Torsion



The Pediatric Eye Examination

In Summary:


-History

-Examination:

- External
- Visual acuity
- Binocular motor and sensory function
- Pupils
- Slit lamp examination
- Intraocular pressure
- Refraction
- Dilated fundus examination
- Fundus torsion

Ophthalmic History Taking

Session Structure

- **Introduction and Describing Aim & Objectives**
 - Chief complaint
 - History of present illness
 - Past medical history
 - Systemic enquiry
 - Family history
 - Drug history
 - Social history
- 



Taking the history & Recording:

•

- Always record personal details: NASEOMADR.
 - Name,
 - Age,
 - Address,
 - Sex,
 - Ethnicity
 - Occupation,
 - Religion,
 - Marital status.
 - Date of examination

Complete History Taking

- **Chief complaint**
- **History of present illness**
- **Past medical /surgical history**
- **Systemic review**
- **Family history**
- **Drug Allergy history**
- **Social history**

CHIEF COMPLAINT

Chief Complaint

Chief Complaint (CC):

- Short/specific in one clear sentence communicating present/major problem/issue.
- Timing
- Recurrent
- Any major disease important e.g. DM, asthma, HT, pregnancy.
- Note: CC should be put in patient language.

History of Present Illness

Details & progression, regression of the CC:

Past Medical Illness

Past medical history includes

- Ischemic heart disease
- Diabetes
- Hypertension
- Thyroid problems

Past surgical history

- 1- Previous squint surgery
- 2- Glaucoma and cataract surgery
- 3- Past ocular trauma.
- 4- Lacrimal surgery
- 5- laser and injections

Drug History

- 1- Any medications- dose and duration.
- 2- Blood transfusion
- 3- Immunization history

Family History

- 1- History of refractive errors
- 2- History of ocular allergy
- 3- History of keratoconus
- 4- History of Glaucoma
- 5- History of ocular tumors e.g.-Retinoblastoma

Social History

- 1- Smoking
- 2- Drinking alcohol
- 3- Living standard
- 4- Socioeconomic status

Color coded eye drops

Recommendation:

The American Academy of Ophthalmology recommends to the FDA and the pharmaceutical industry that a uniform color-coding system for the caps and labels of all topical ocular medications be established. No other topical medications should carry the same color.

The recommended color codes are:

CLASS	COLOR	BRAND NAME (GENERIC NAME)
Mydriatics	Red	Phenylephrine
Cycloplegics	Red	Tropicamide Cyclopentolate Atropine
Anti-inflammatory		
Steroids	Pink	Lotemax, Alrex (loteprednol etabonate) Pred Forte/Pred Mild (prednisolone acetate) Fluor-Op, Fml, Flarex (fluomethalone) Durezol (difluprednate)
Nonsteroidal anti-inflammatory drugs (NSAIDS)	Grey	Voltaren (diclofenac) Acular (ketorolac)



Prostaglandin analogs (PGAs)	Teal	Xalatan (latanoprost) Travatan (travoprost) Lumigan (bimatoprost)
Beta-blockers (0.25%)	Light Blue	Timoptic (timolol) Betagan (levobunolol) Betoptic (betaxolol) Optipranolol (metipranolol)
Beta-blockers (0.50%)	Yellow	Timoptic (timolol) Betagan (levobunolol) Betoptic (betaxolol) Optipranolol (metipranolol)
Alpha agonists	Purple	Alphagan P (brimonidine) Iopidine ^{*white cap} (apraclonidine ^{*purple cap})



Carbonic anhydrase inhibitors (CAIs)	Orange	Trusopt (dorzolamide) Azopt (brinzolamide)
Miotics	Green	Pilocarpine
Beta-blocker combinations	Dark Blue	Combigan (brimonidine/timolol) Cosopt (dorzolamide/timolol)
Alpha agonist combinations	Mint Green	Simbrinza (brinzolamide/brimonidine)
Anti-bacterials	Tan	Besivance (besifloxacin) Ciloxan (ciprofloxacin) Iquix, Quixin (levofloxacin) Ocuflox (ofloxacin) Vigamox, Moxeza (moxifloxacin) Zymar (gatifloxacin)



When to refer child to eye
doctor

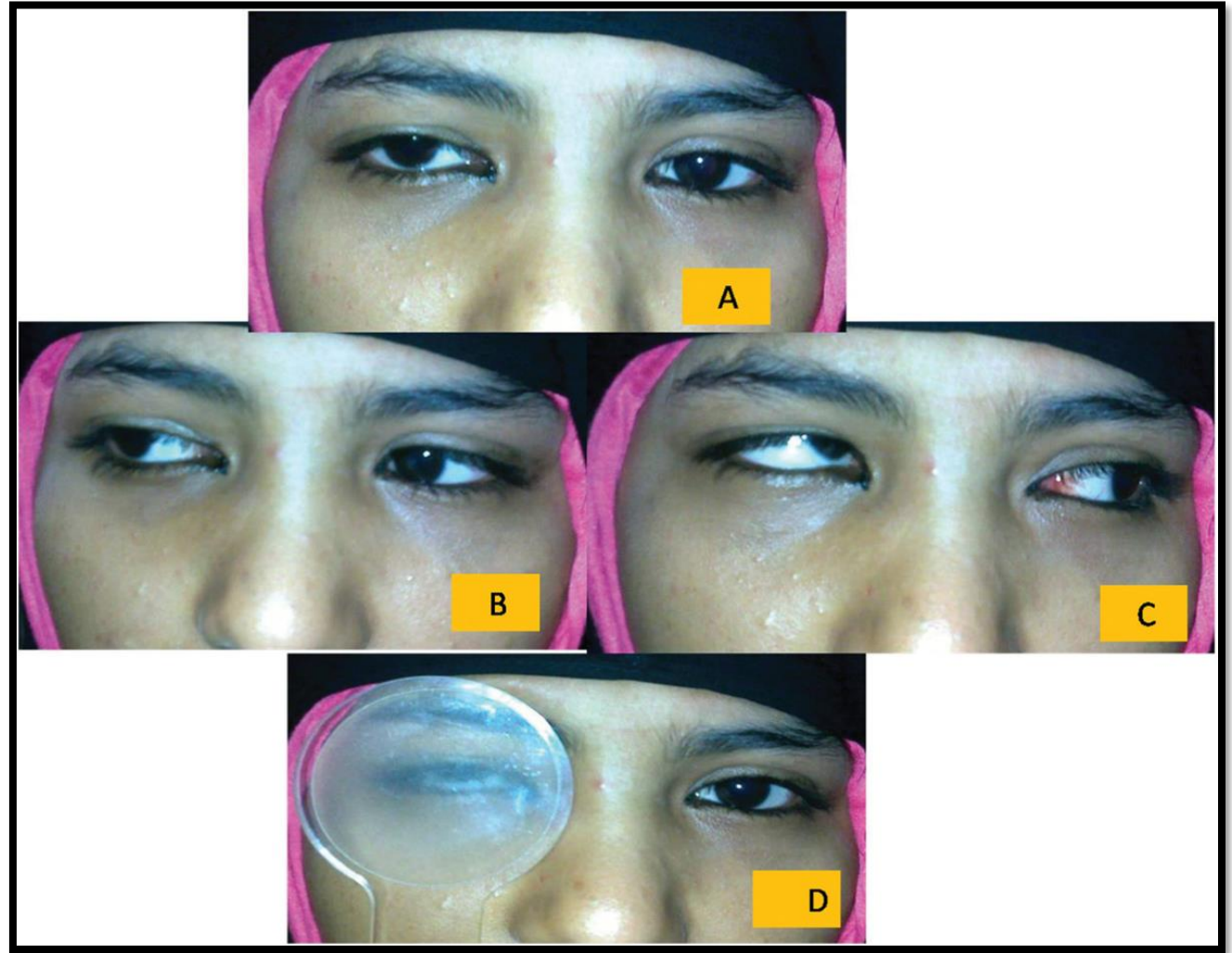
Orbital cellulitis





Squint

Dissociated vertical deviation



Brown Syndrome



Exotropia



Esotropia



Congenital Glaucoma



Leucokoria: retinoblastoma



Congenital cataract



Congenital nasolacrimal duct obstruction



Drugs and EYE

Mydriatics and Cycloplegics

Agent	How Available	Maximum Effect (Minutes)	Duration of Action	Comments
Phenylephrine (Neo-Synephrine) 2.5%, 10%	Solution	20	3 hours	Produces mydriasis, but no cycloplegia; avoid 10% solution. May cause angina, increased blood pressure, myocardial infraction, stroke (mainly with 10%).
Tropicamide (Mydracyl) 0.5%, 1%	Solution	25	4–6 hours	Inadequate for cycloplegic refraction of children.
Cyclopentolate (Cyclogyl) 0.5%, 1%, 2%	Solution	30	12–24 hours	Adequate for most cycloplegic refractions. Neurotoxicity can occur, particularly in children; incoherence, visual hallucination, ataxia, slurred speech, and seizures.
Homatropine 1%, 2%, 5%	Solution	40	2–3 days	Side effects are rare.
Scopolamine (Isopto Hyoscine) 0.25%	Solution	30	4–7 days	CNS side effects; dizziness, disorientation.
Atropine 0.25%, 0.5%, 1%	Ointment or solution	30	1–2 weeks	Systemic absorption can result in flushing, fever, tachycardia, restlessness, and excited behavior.









Homatropine Eye Drops



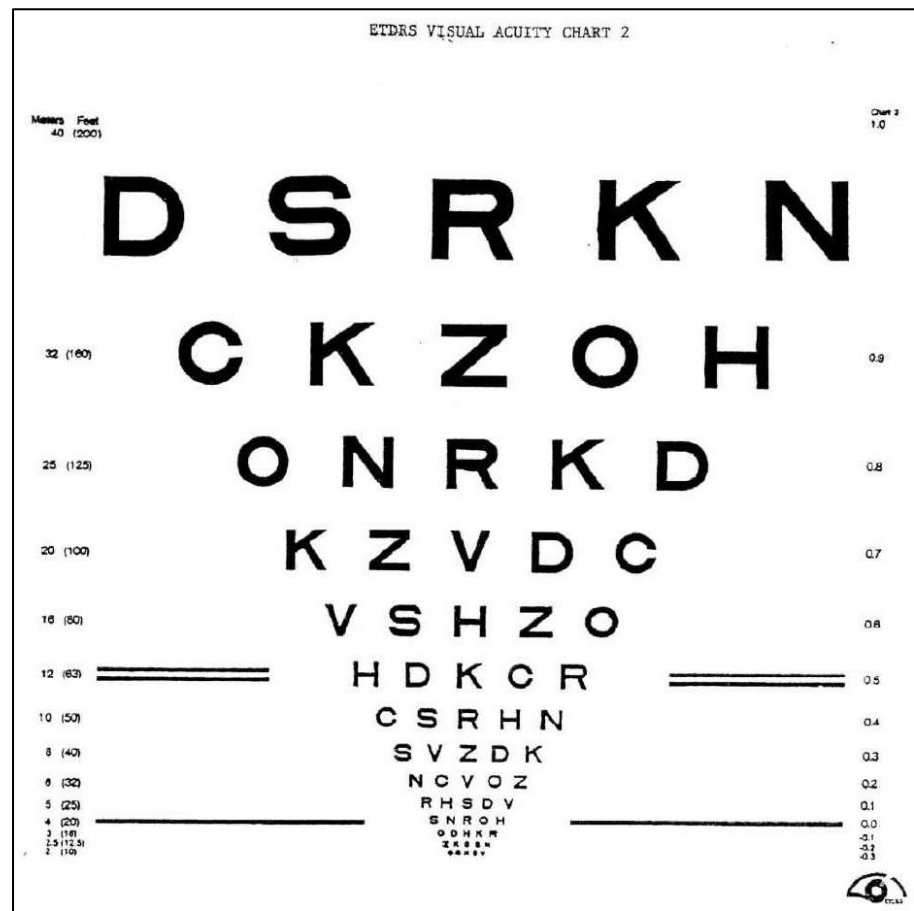
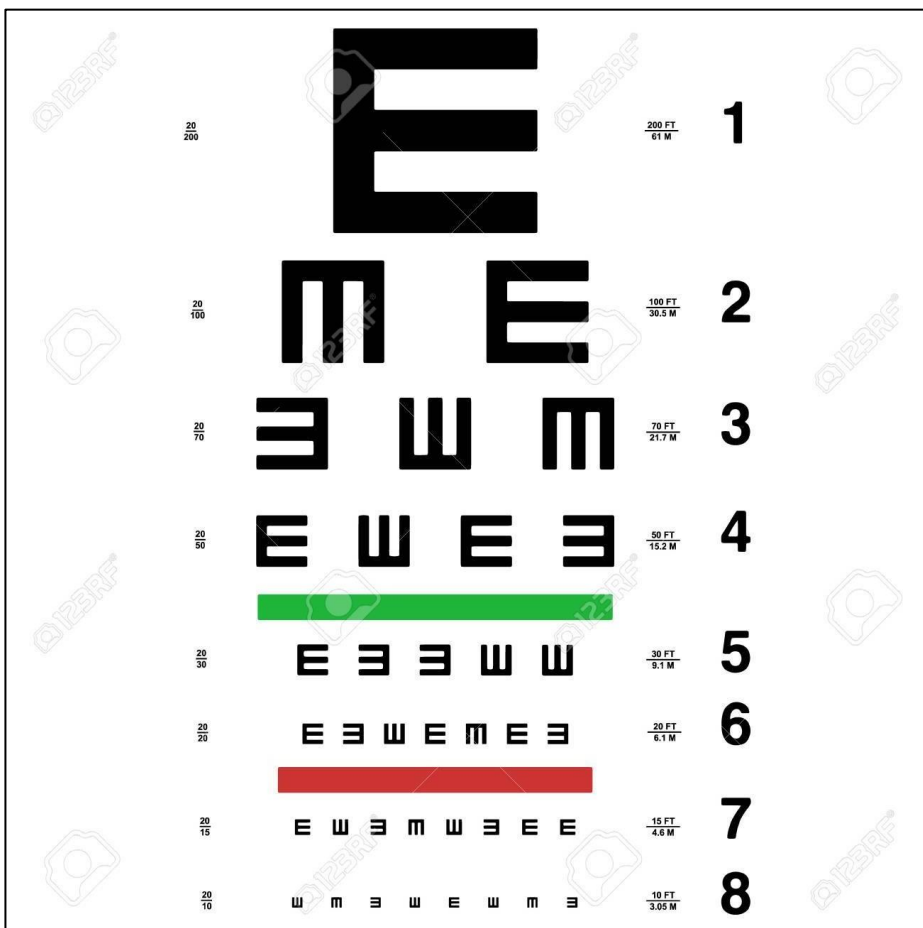
Testing visual system



Part one

- 1 Visual acuity
- 2 Visual field
- 3 Contrast sensitivity
- 4 Colour vision
- 5 Stereopsis

Visual acuity



Near visual acuity- Jaeger notation (J)

- Adult:

Rosenbaum pocket vision

Solan chart

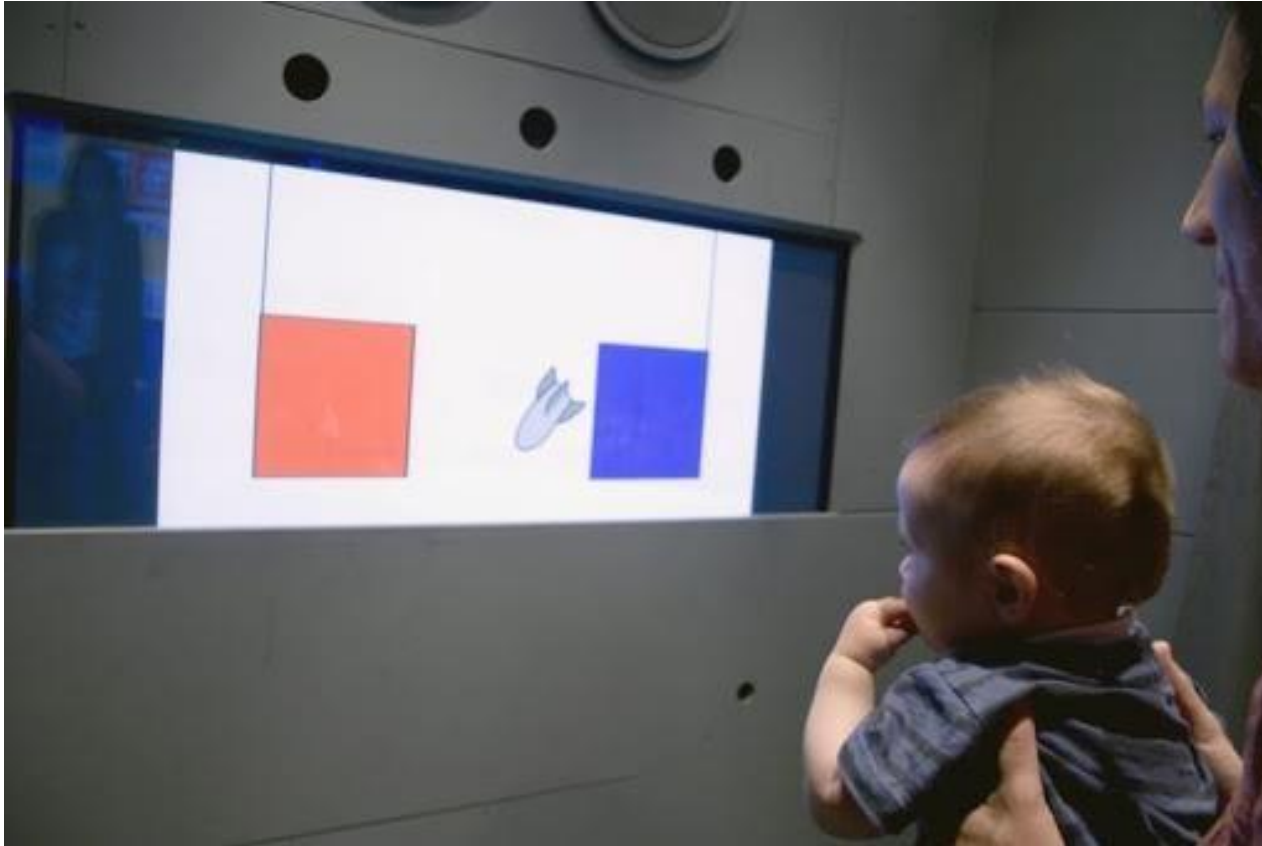
- Children

Allen reduced picture cards

HOTV

Lea figures

Preferential looking- preverbal

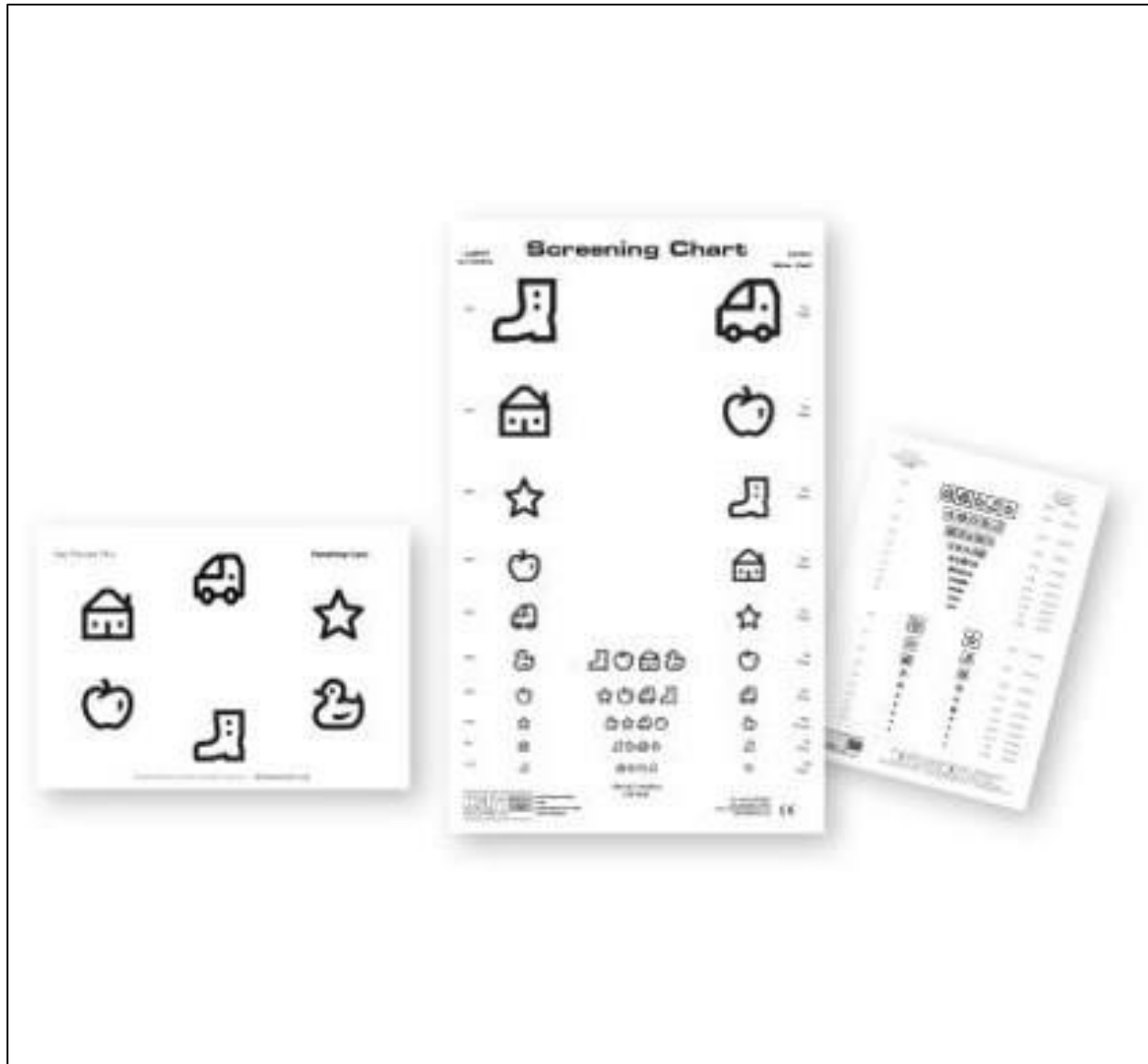


Back

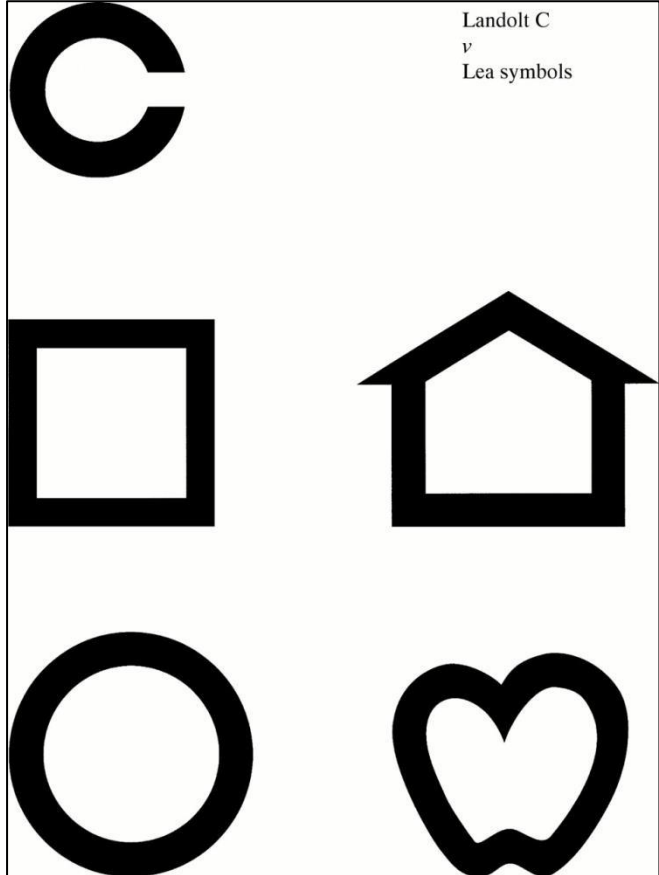
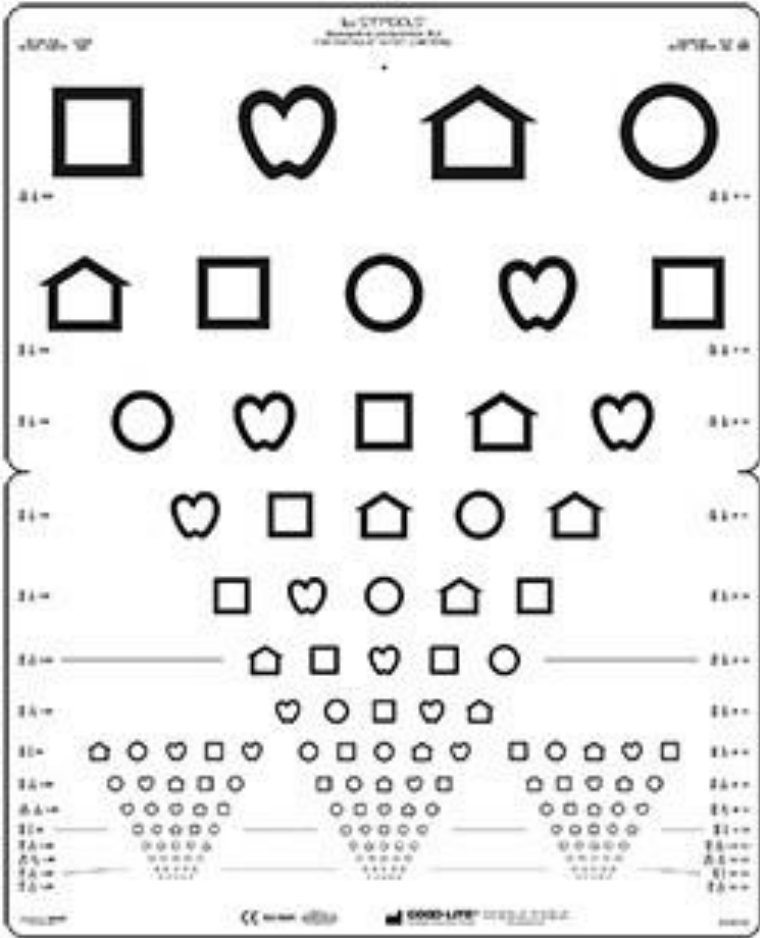


Front

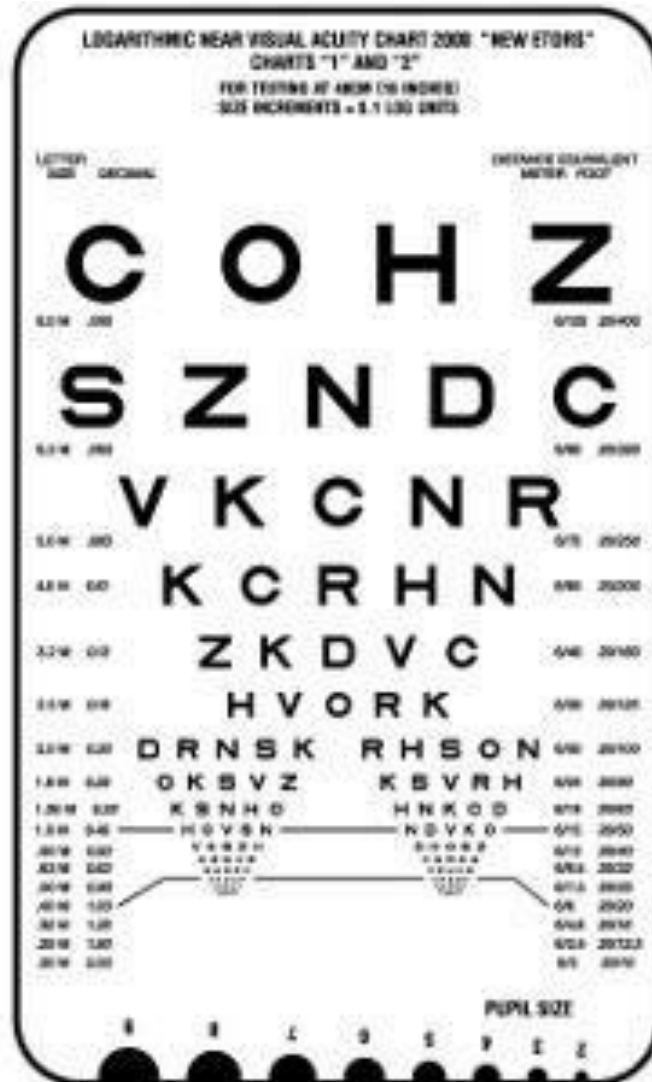
Kay pictures- 2 year



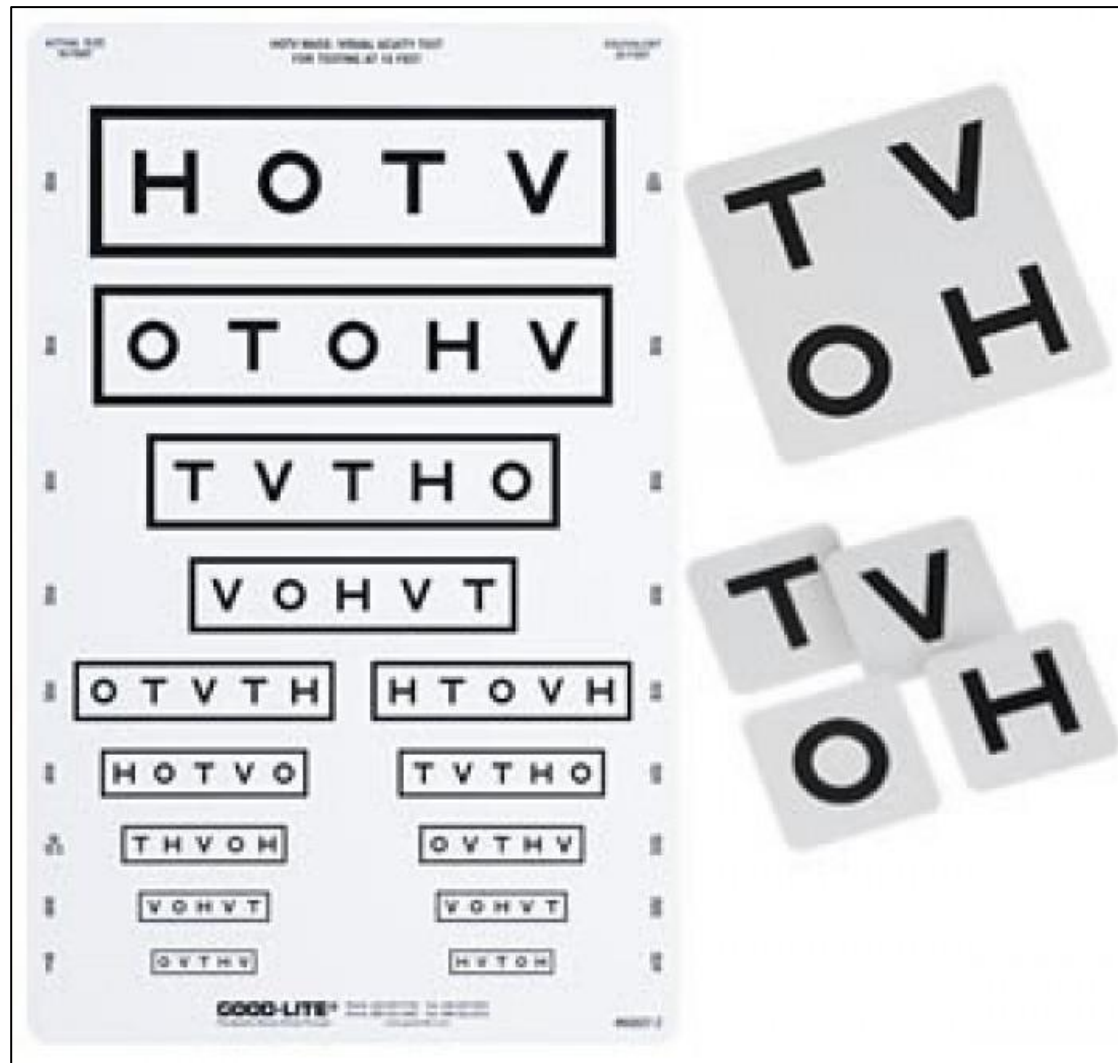
Matching test-3 year



Rosenbaum pocket vision



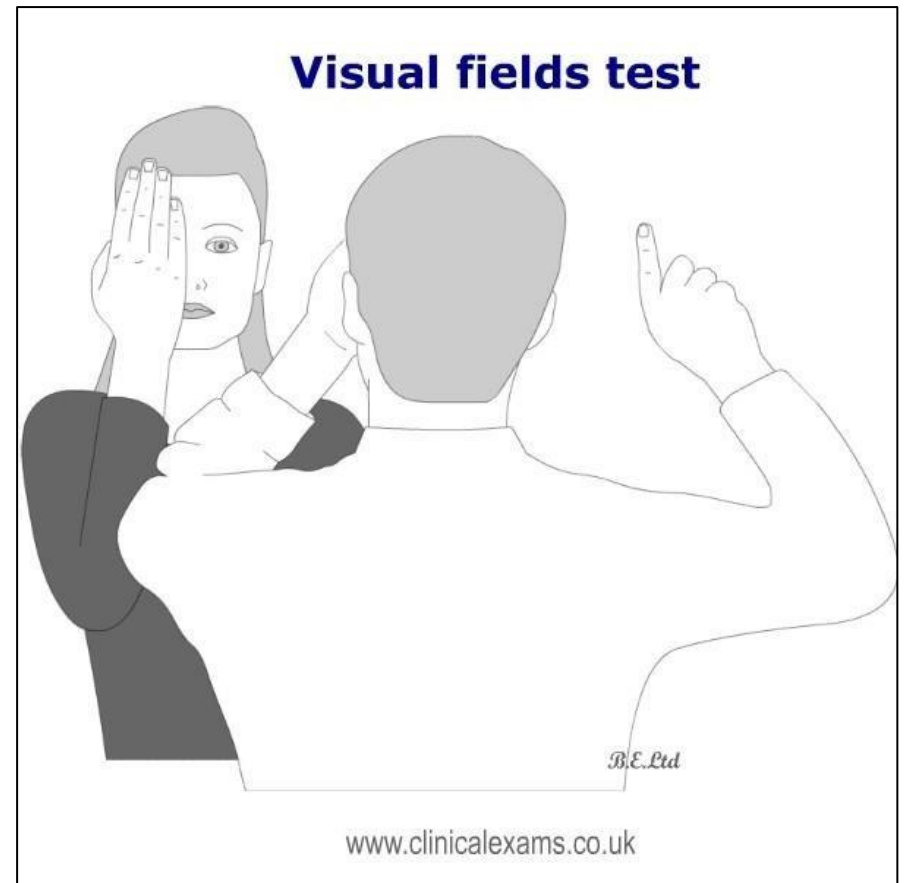
H O T V

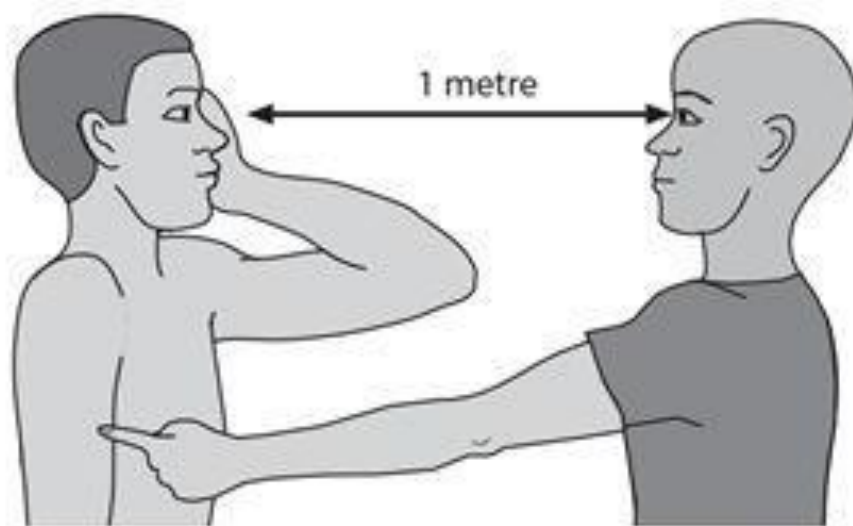
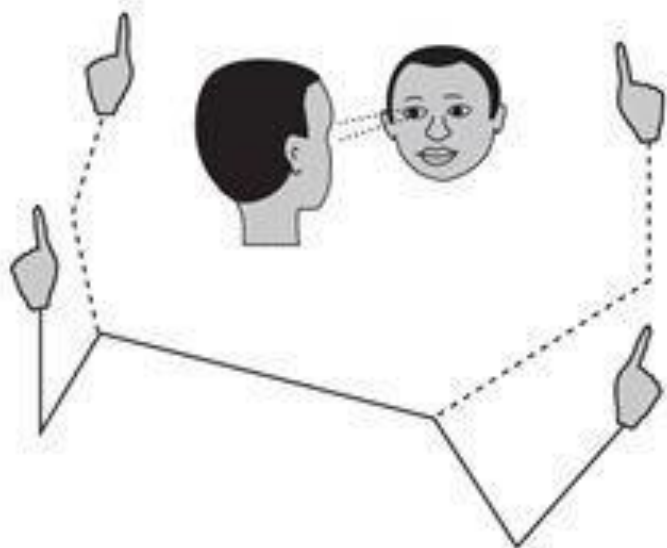


Part 2

2- Visual field

Field of vision
70 degree superior
90 degree inferior
110-120 degree horizontal

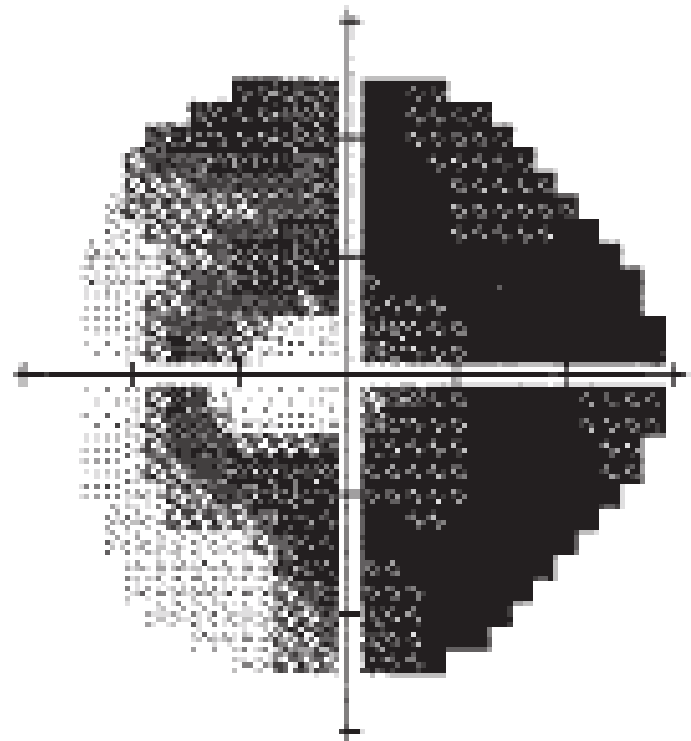


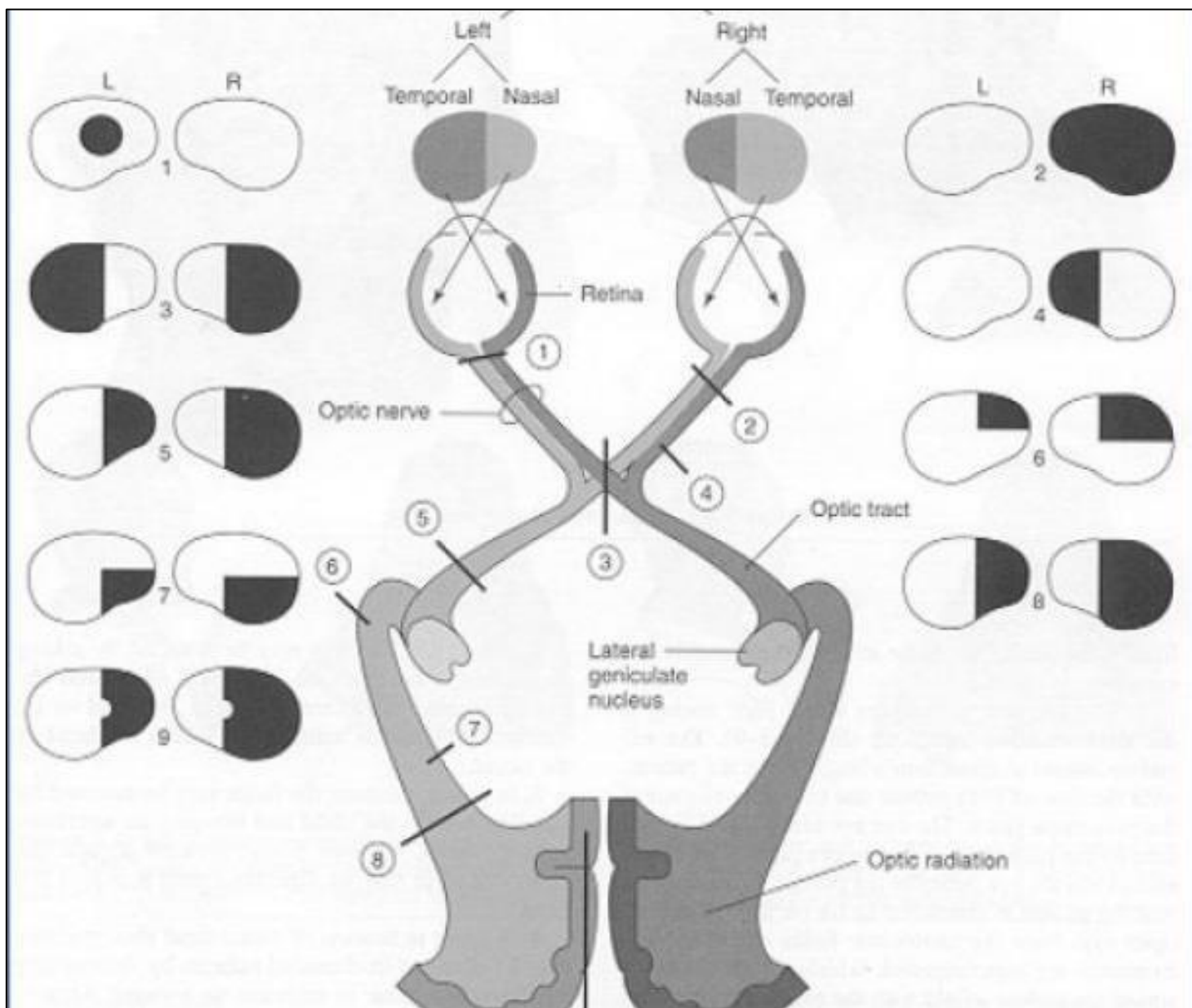


Normal visual field



Severe visual loss





3-Contrast sensitivity

Pelli-Robson

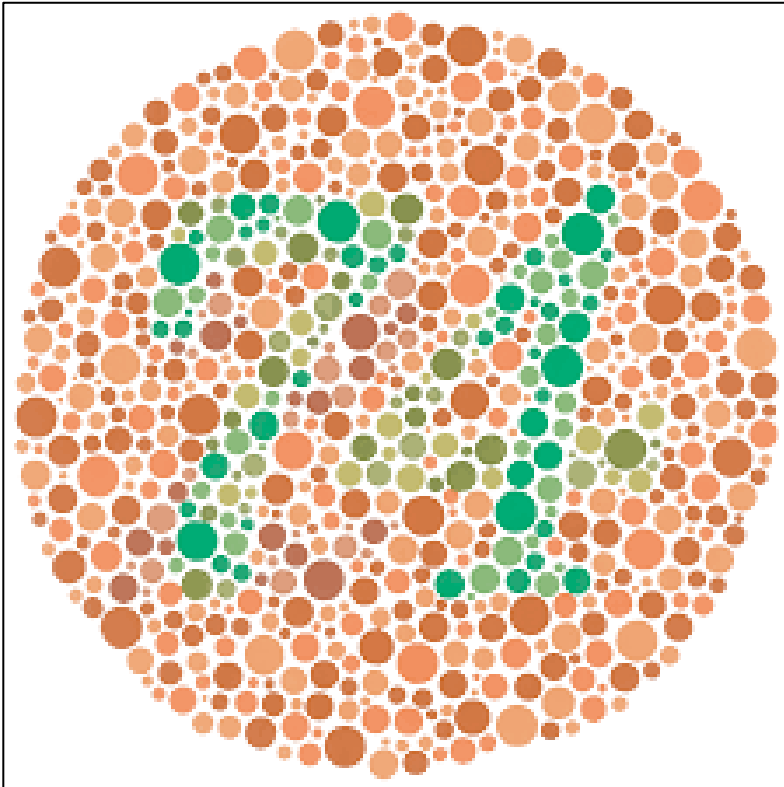


MARS chart



4-Colour vision

Ishihara



HRR





5- Stereopsis

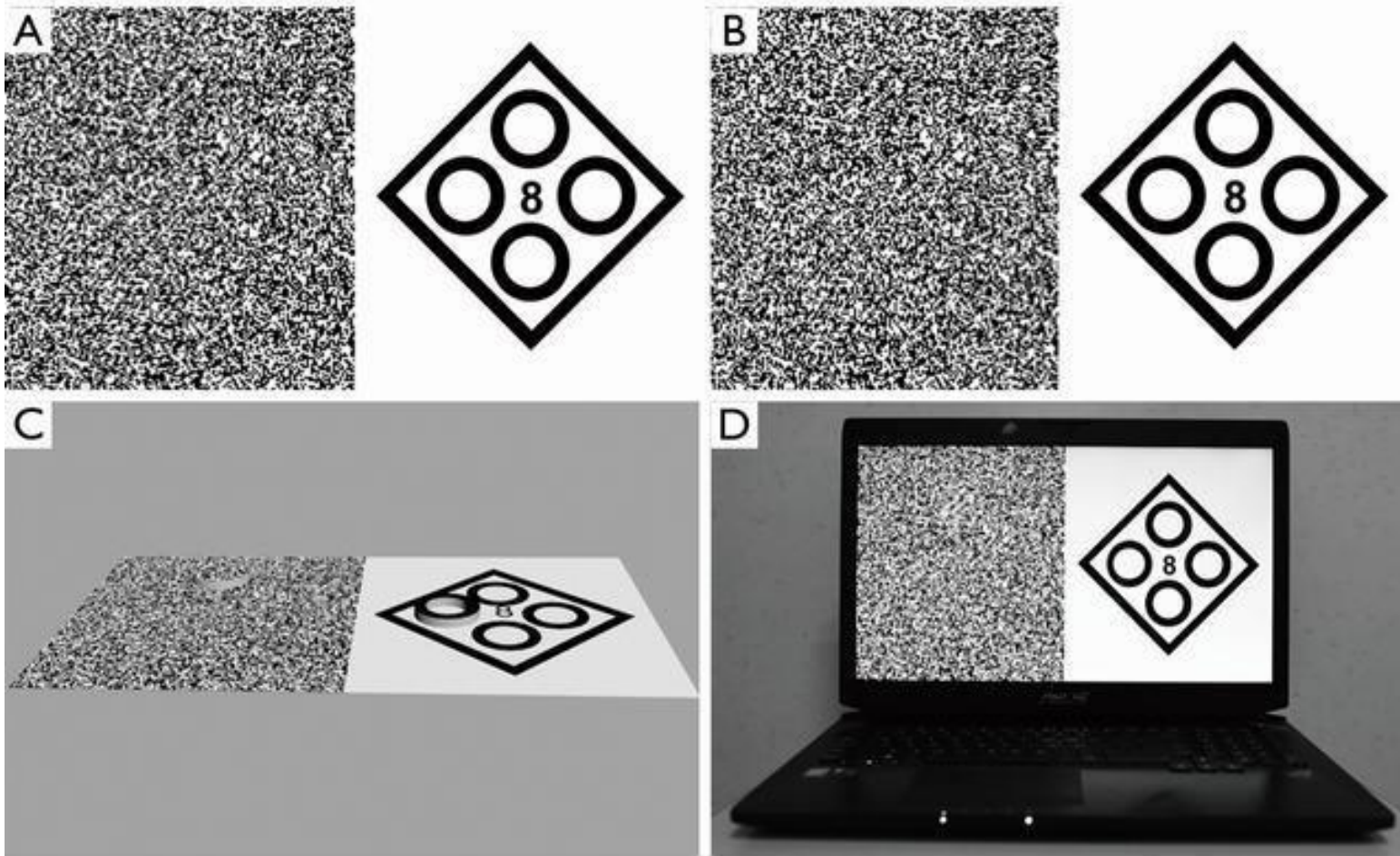
Fly test



TNO



Computerized test



Gradual loss of vision

- 1- Refractive errors
- 2- Cataract
- 3- Glaucoma
- 4- Age-related macular degeneration AMD
- 5- Diabetic retinopathy.

Sudden loss of vision

- 1- Optic neuritis
- 2- Ischemic optic neuropathy
- 3- Central retina artery occlusion
- 4- Central retinal vein occlusion
- 5- acute post-operative endophthalmitis

Part - III

5- Stereopsis

Stereopsis is measured in second of arc.

$1^{\circ} = 60$ minutes of arc

1 minutes = 60 seconds

the lower the value the better the acuity.

- 1- TNO test
- 2- Frisby test
- 3- Lang test
- 4- Titmus test

Random dot test (eg TNO test , Frisby test) provide the most definitive evidence of high grade binocular single vision

TNO test viewed with red-green spectacles.

Provides a true positive measurement.

Range from 480-15 seconds of arc tested at 40 cm.

Most children able to do this at age of 4 years.



50920

Titmus test

Need polarid spectacles.

Performed at distance of 40 cm.

Fly testing gross stereopsis 3000 second of arc

Circles: 9 squares with four circles per each.

Range 800-40 second of arc.

Animales similar to circles

Range 400-100 second of arc.



A



B



Frisby test

Square contains hidden circle.

Does not require special glasses.

Range 600-15 second of arc



Lang test

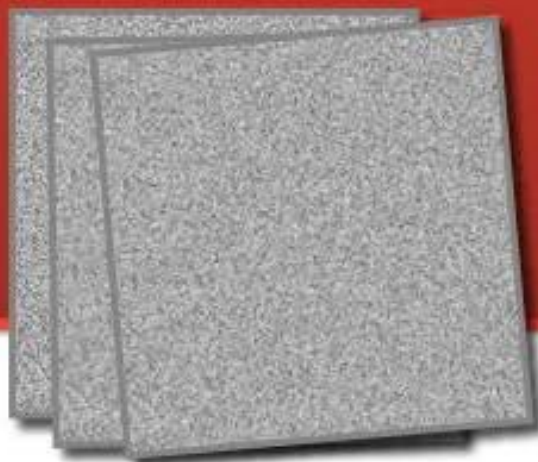
Do not require special glasses

Used to assess children and babies.

Range 200-1200 seconds of arc at 40 cm.

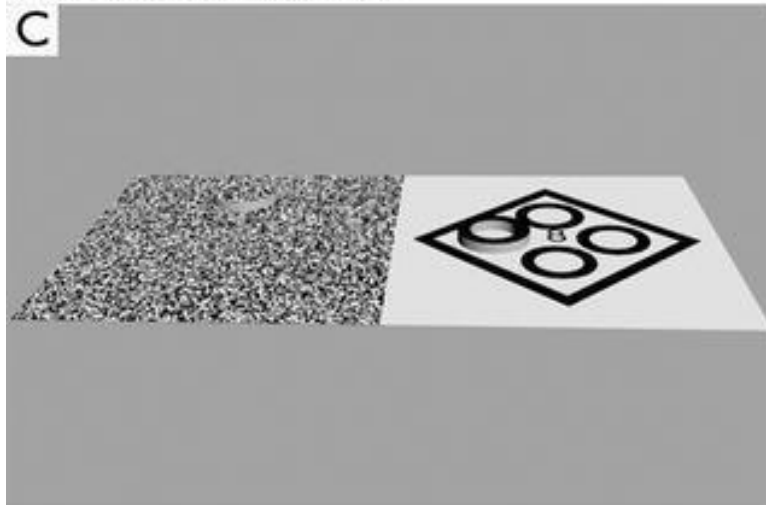
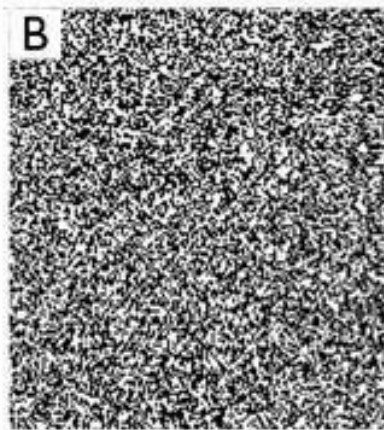
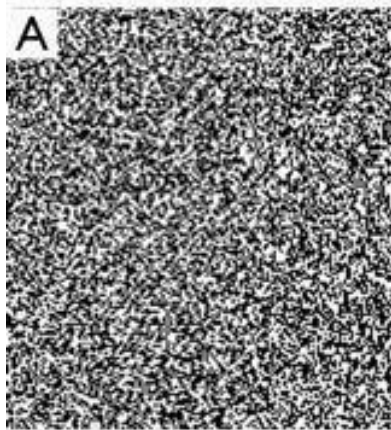


(test objects normally
are hidden)



LANG-STEREOPAD® C€

Computerized test



Frisby-Davis distance sterotest

A large cube with open front through which four small objects are visible.

Test is usually performed at 6 meters.

Patient has to decide which of 4 objects within the box is closest to them



Pediatric ophthalmology

Nystagmus

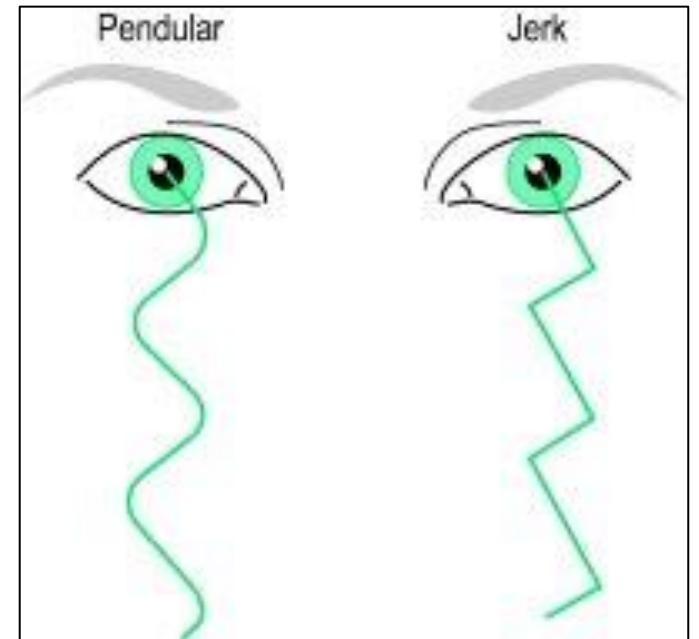
1- Congenital
2- Acquired

- Jerk nystagmus:

Slow face in one direction and fast face in other direction.

- Pendular nystagmus:

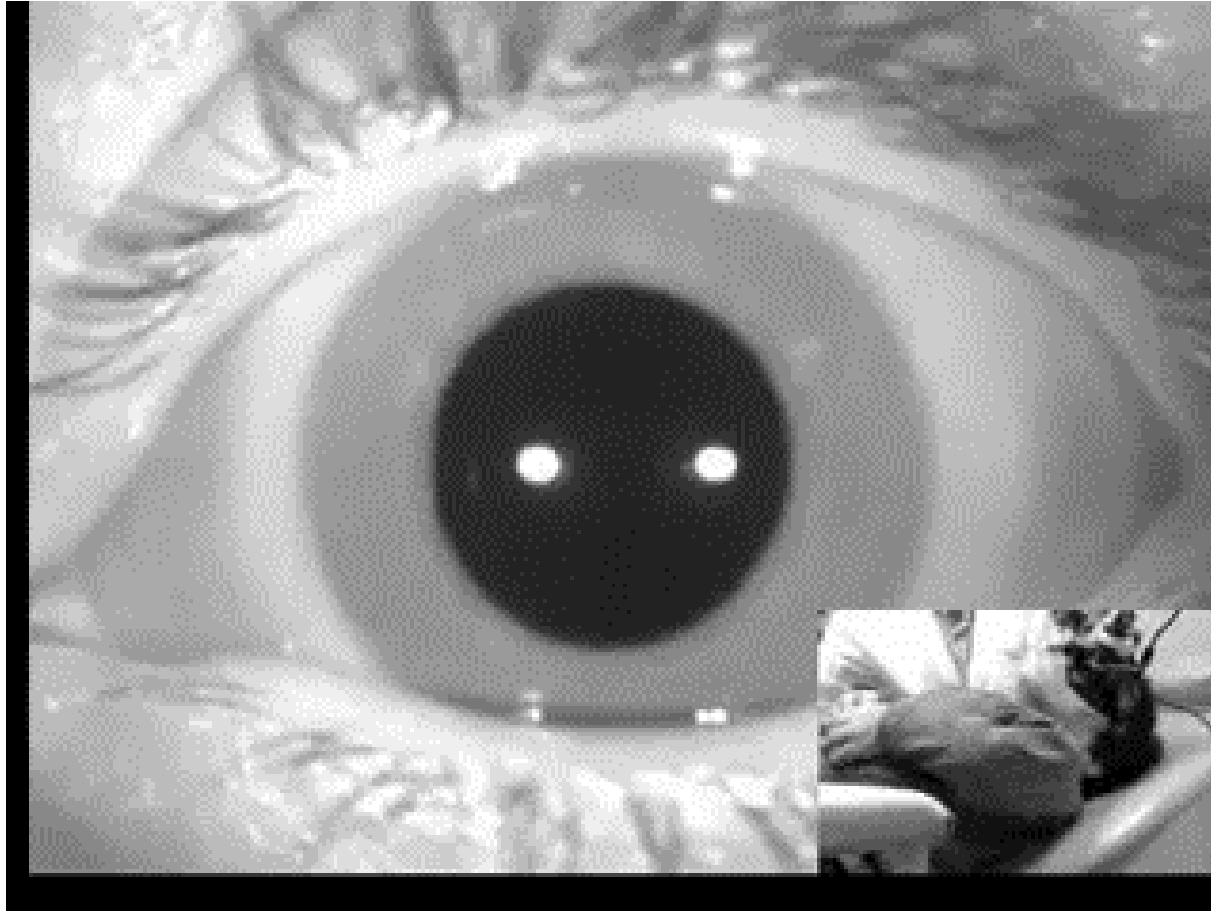
the two faces are in equal speed.



Congenital infantile nystagmus

- 2-3 months
- Null point
- Compensatory head position
- Usually horizontal
- Dampen with convergence

Video



Work-up

- History: age, head nodding, medication?
- Family history

Treatment

- Refraction
- Treat amblyopia
- Small face turn: prism
- Large face turn: surgery

Acquired nystagmus

CAUSES

- Visual loss: (dense cataract, trauma, cone dystrophy)
- Toxic : metabolic (alcohol), thiamine deficiency.
- CNS: thalamic hemorrhage, stroke, trauma.

Work-up

- History:
- Family history
- Albinism
- Motility exam, slit-lamp exam
- Visual field exam
- Drug intoxication
- CT/ MRI

PERIODIC ALTERNATING NYSTAGMUS

- Baclofen 15 mg every 3 days not exceeding 80 mg/day
- Not recommended in children.

PERIODIC ALTERNATING NYSTAGMUS

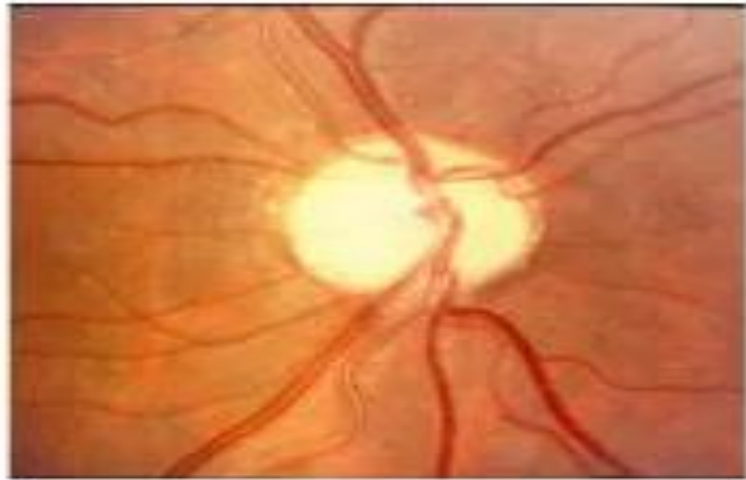


Pediatric ophthalmology

The bilateral blind child

Differential diagnosis

- Sever ocular disease/malformation
- Retinopathy of prematurity
- Dense bilateral cataract
- Aniridia
- Optic nerve hypoplasia
- Congenital optic atrophy

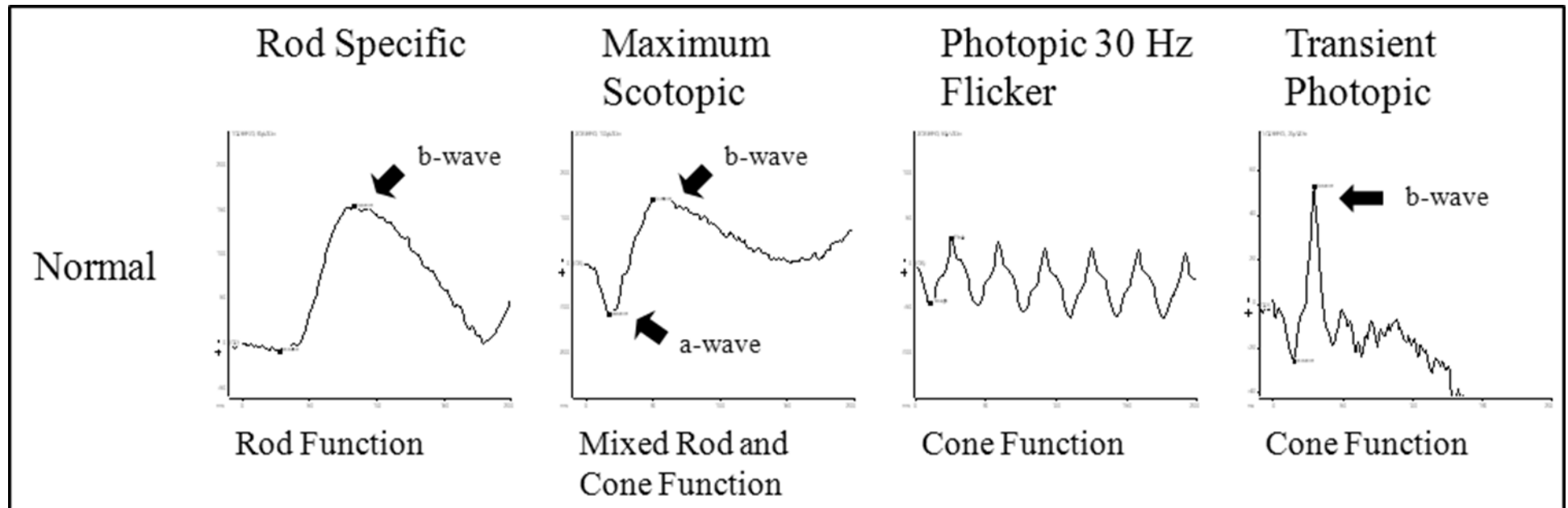




Work-up

- History: premature
- Ability to fix on object
- Nystagmus
- Dilated retina and optic nerve examination
- Cyclorefraction
- ERG
- CT scan/ MRI of brain
- VEP





Delayed Visual Maturation (DVM)

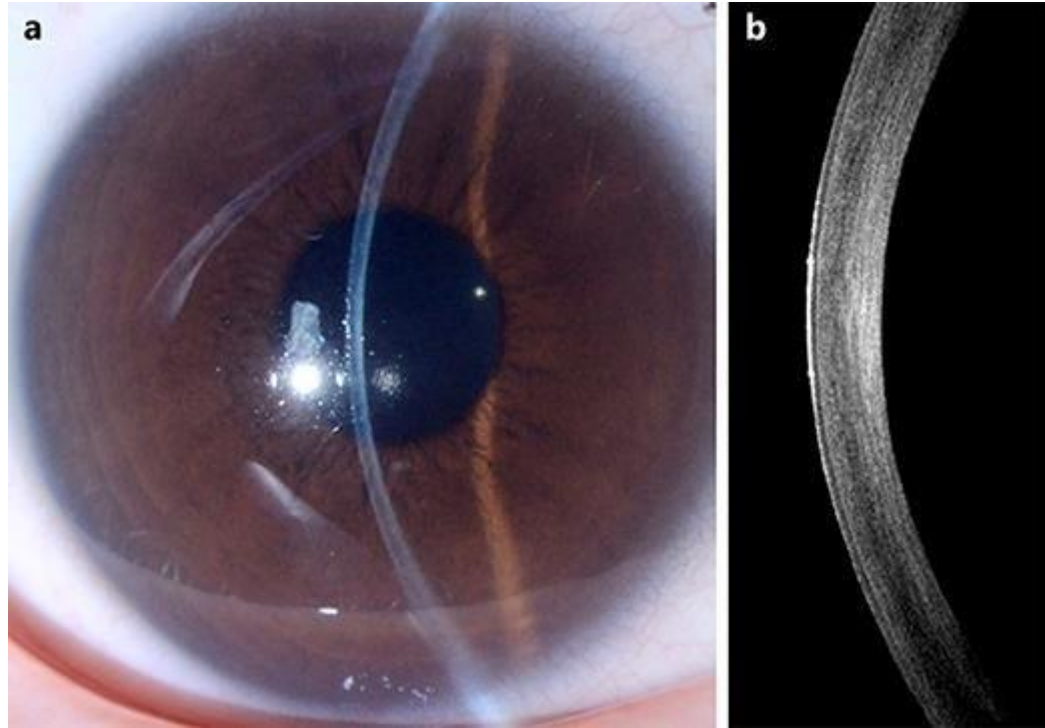
- Normal response to sound and touch.
- Normal neurologic examination
- ERG: normal
- Vision is usually develop between 4-12 months.
- More common in albinism.



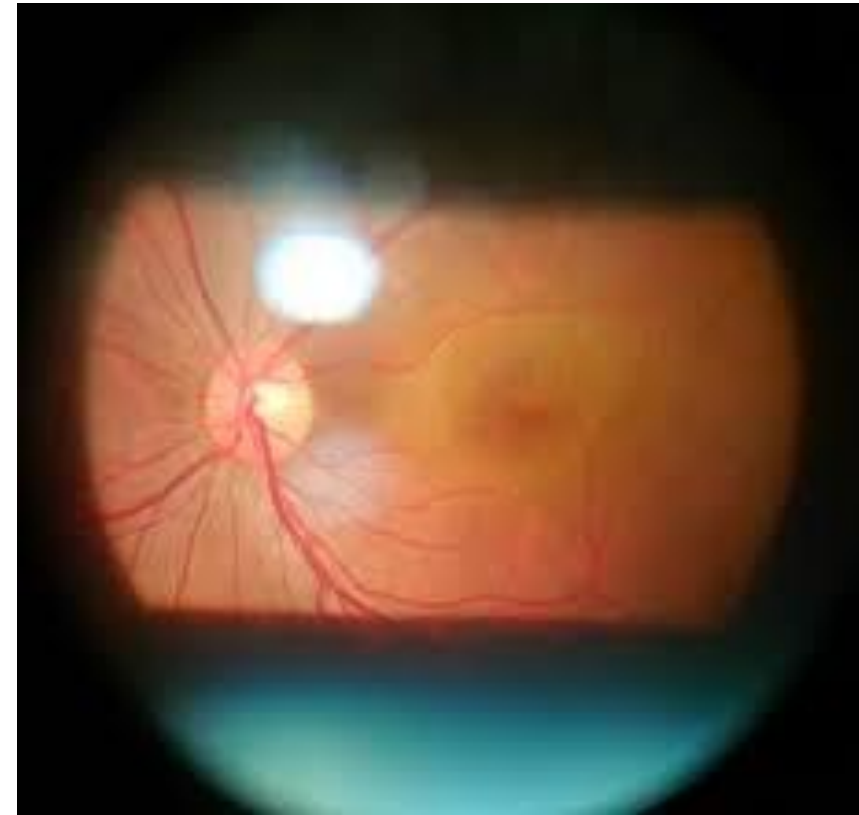
Slit lamp biomicroscope

It is an instrument that permits magnified examination of eye using various kinds of illumination.

Examination of the anterior segment



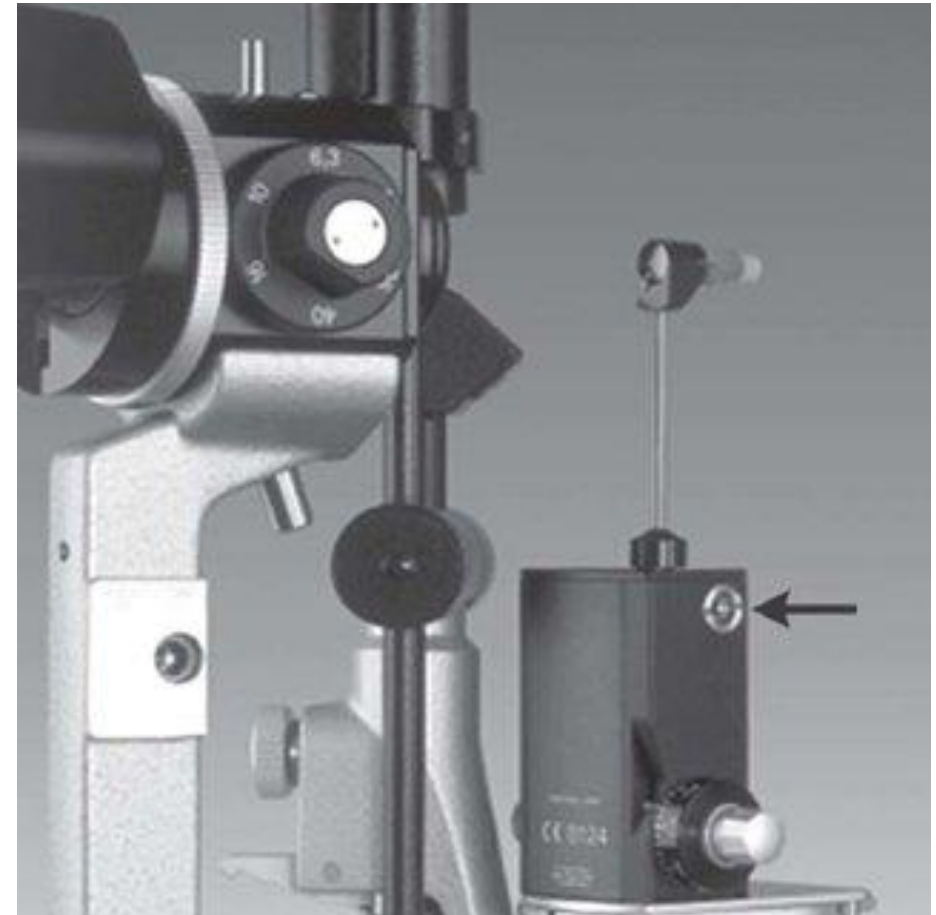
Examination of the posterior segment with auxiliary lenses



Gonioscopy examination



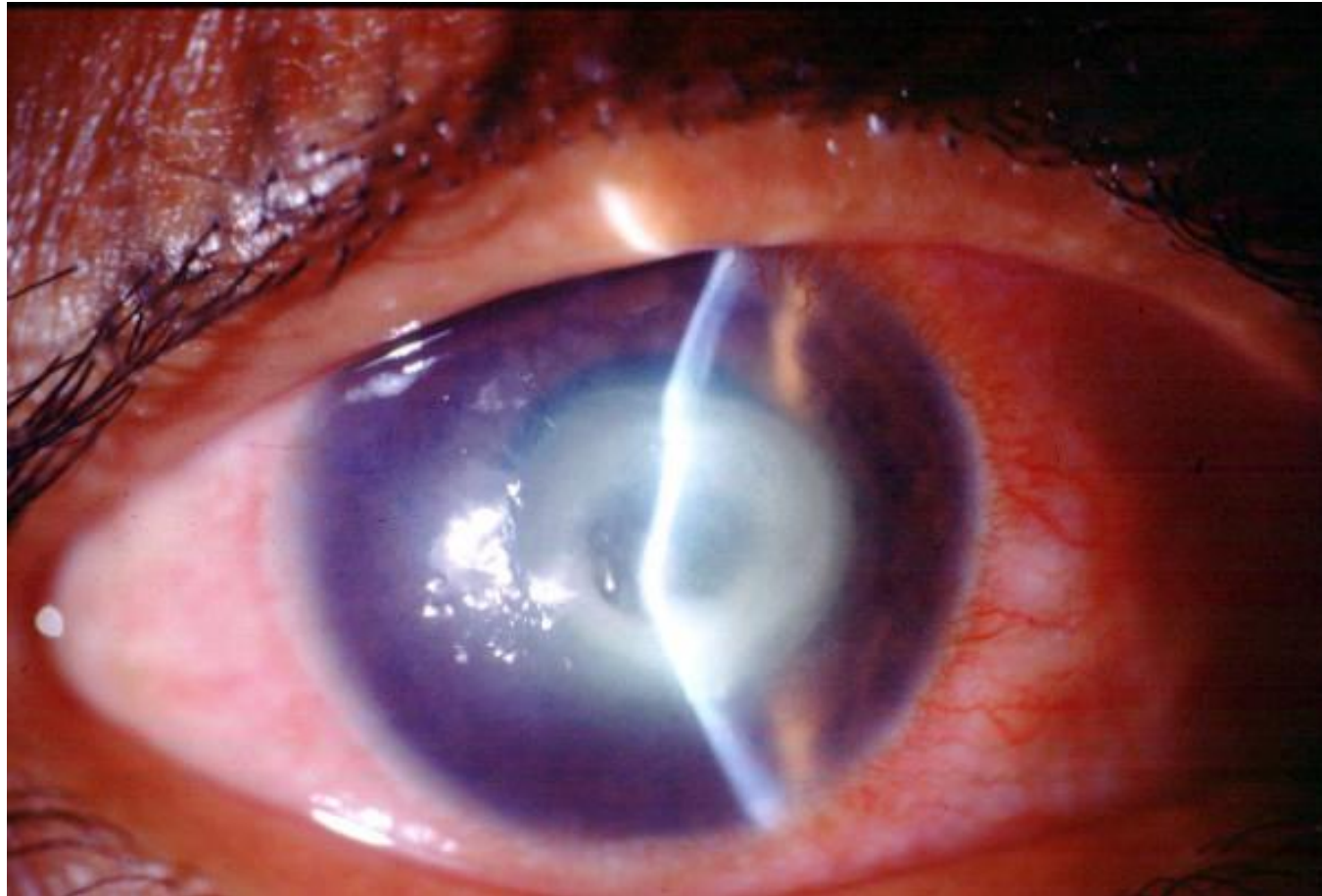
Tonometry (measurement of IOP)



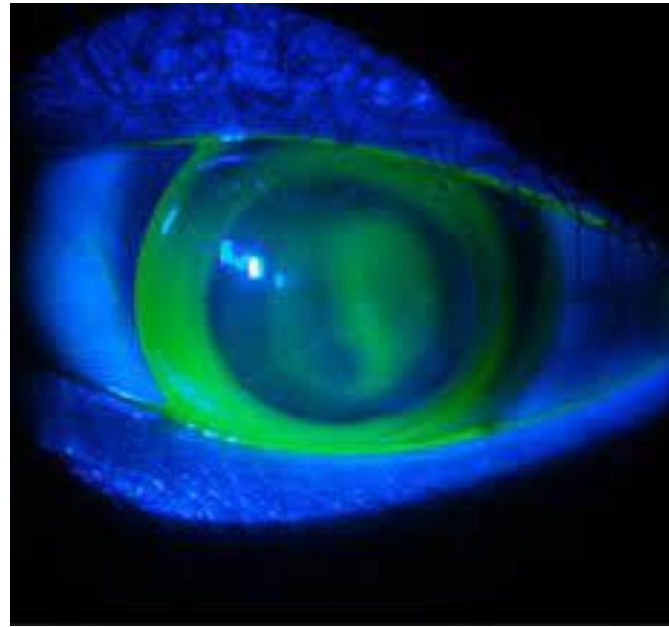
Digital photography



Linear measurement of a lesion



Contact lens fitting



Hand –held slit lamp for pediatric examination

