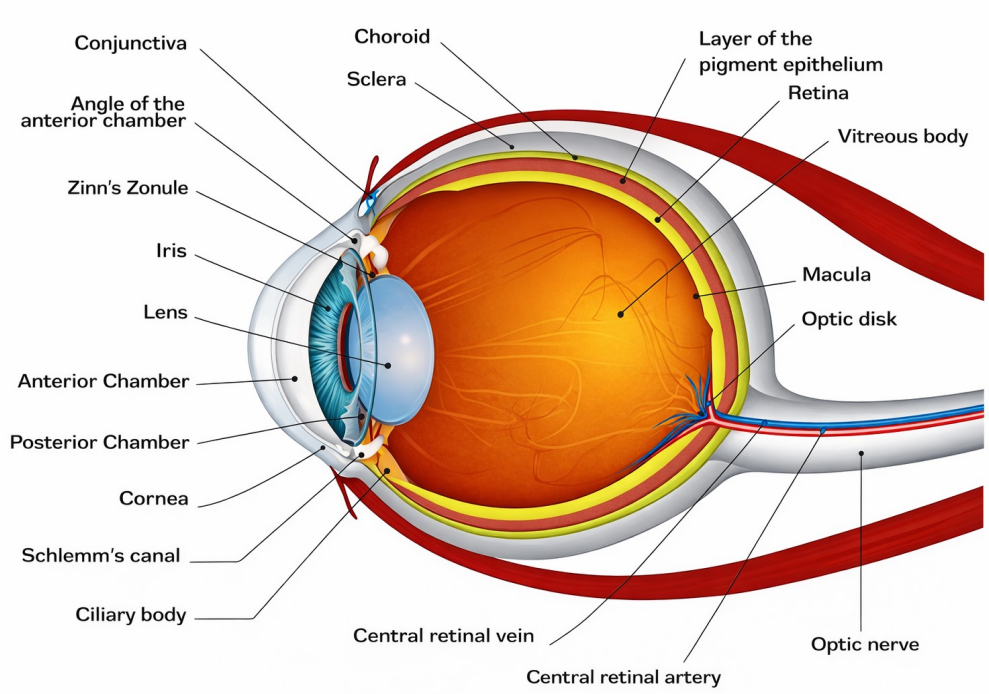
OPHTHALMOLOGY

Basic anatomy and embryology

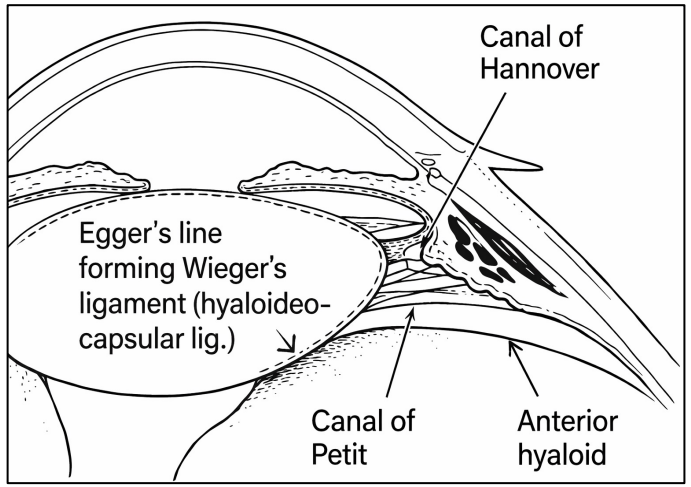


Lens
Epithelium-Cornea, conjunctiva
Lacrimal gland

ON
Retina
Iris and CB epithelium
Sphincter, dilator pupillae

Corneal stroma, endothelium
Sclera (Except superotemporal)
Trabecular meshwork
Iris, choroid stroma
Melanocytes
Ciliaris

Vitreous

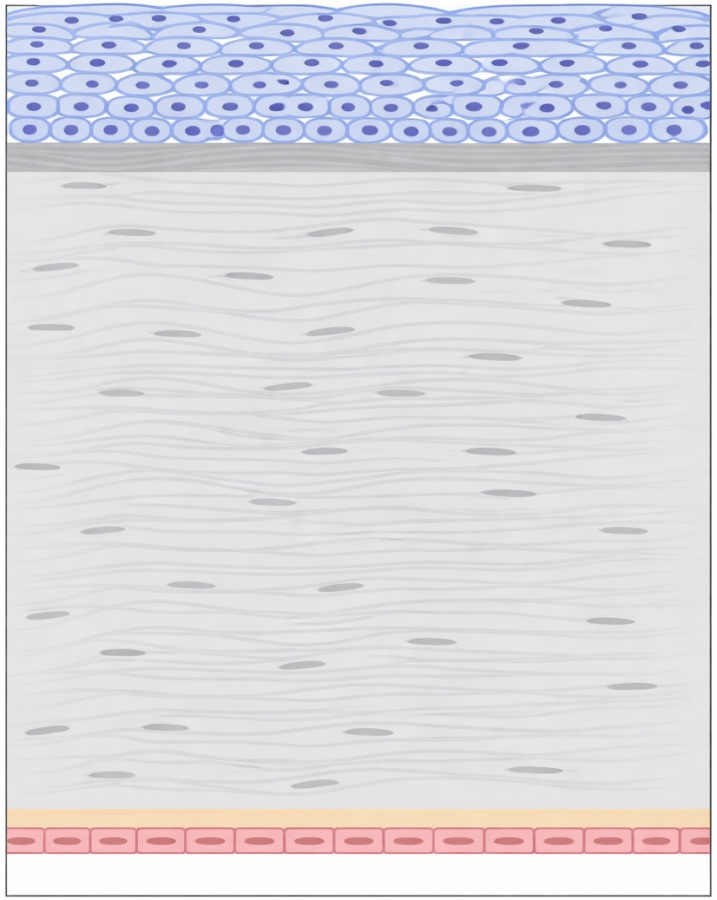


Lamina Fusca
Sclera proper
Episclera
Tenon capsule
Conjunctiva

Retrobulbar:
Peribulbar:

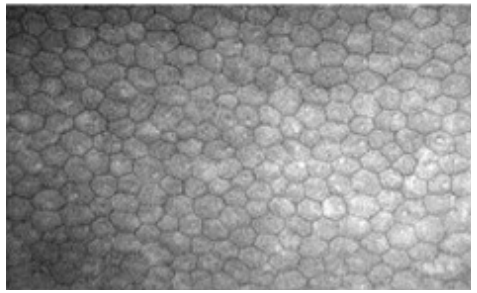
Axial length:
AC depth:
Anisometropia:
At birth:
Total Refractive power:
Cornea
Purkinje images

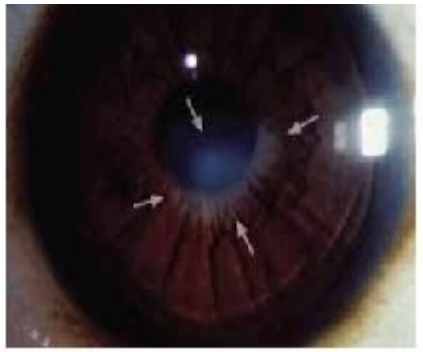
Cornea



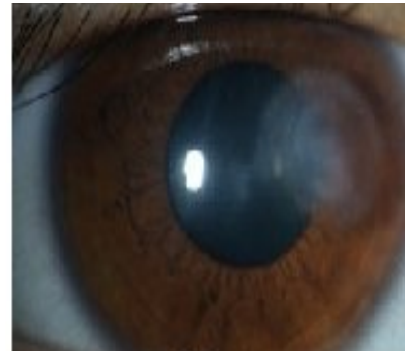
Avascular
Corneal blink reflex:
Corneal Anesthesia:

Interstitial keratitis:

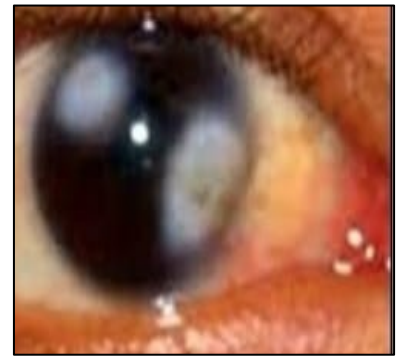




Nebula

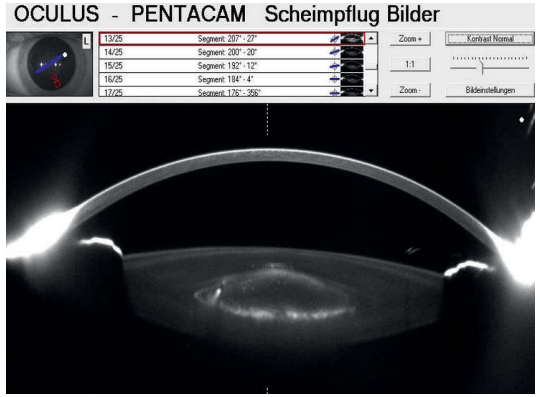


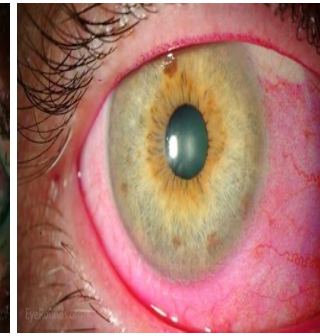
Macula



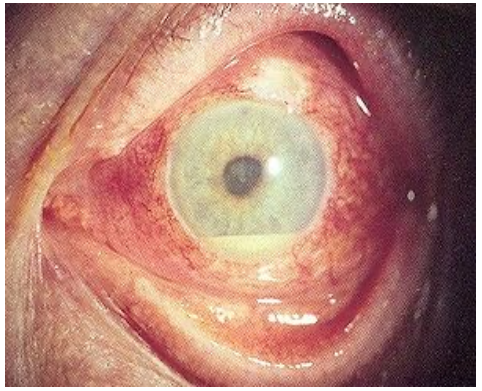
Leucoma

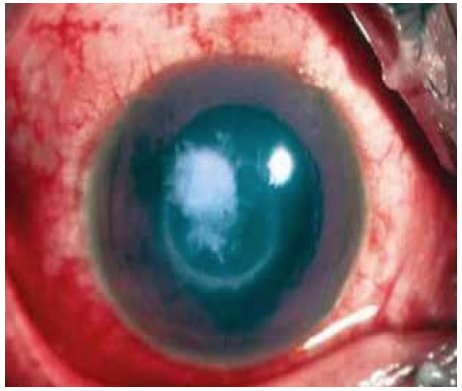
Cornea Investigations

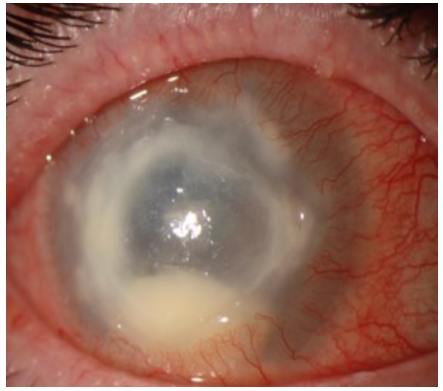


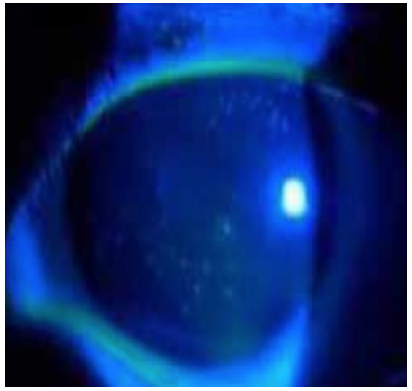


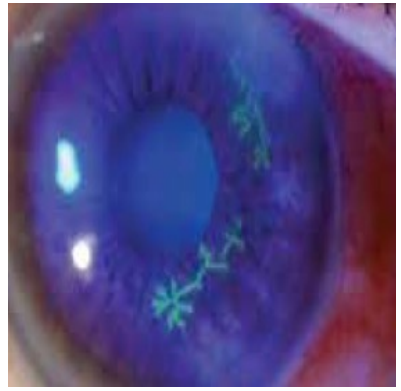
Cornea Infections









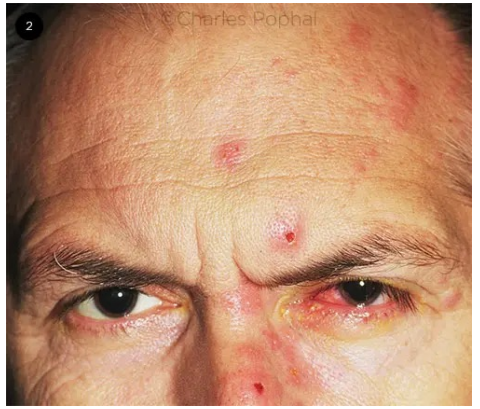


Hypopyon:
Sterile, mobile-
Asterile, immobile-
Ulcus serpens:

- Wesley's immune ring
- Satellite lesions
- h/o trauma with vegetative matter

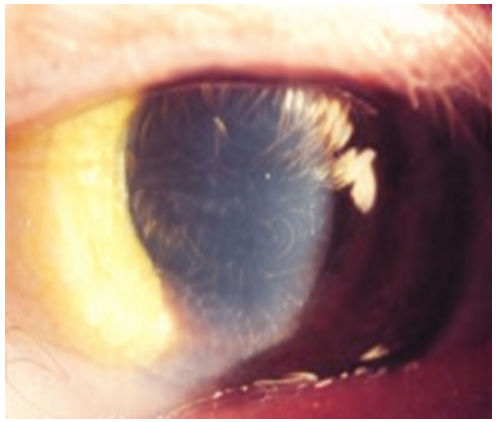
- Ring abscess
- -Pseudo-dendrites
- H/o contact lens misuse
- PAIN!!
- Stain:

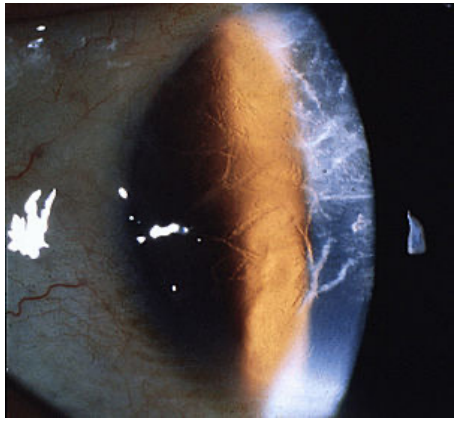
Stromal / disciform keratitis

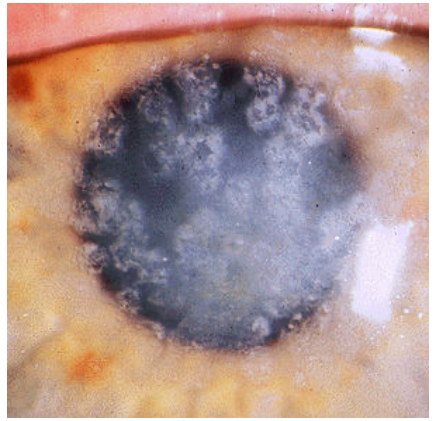


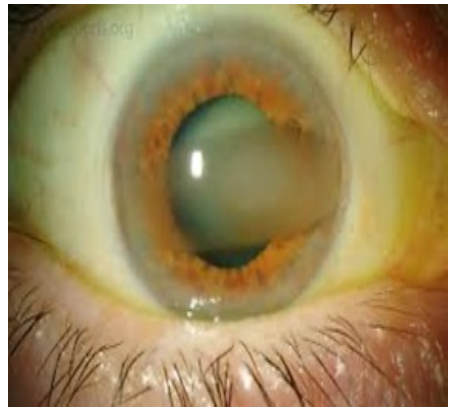
Corneal Dystrophies

Inflammatory?
Progressive?
B/L?
Inherited?

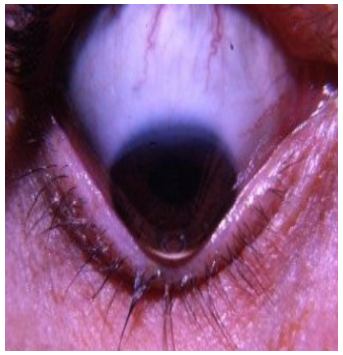


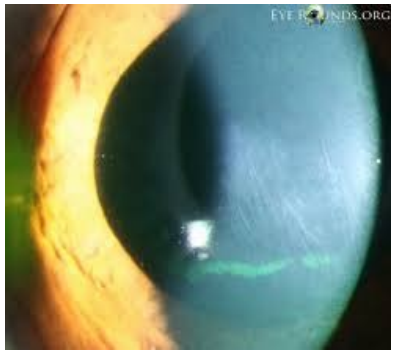


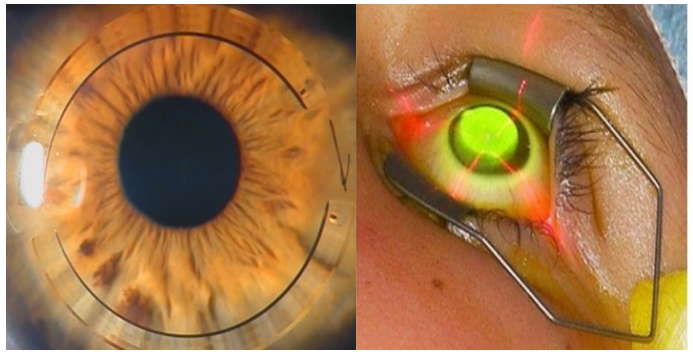




Other corneal-scleral pathologies



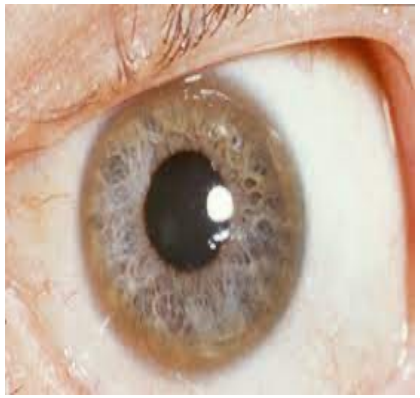


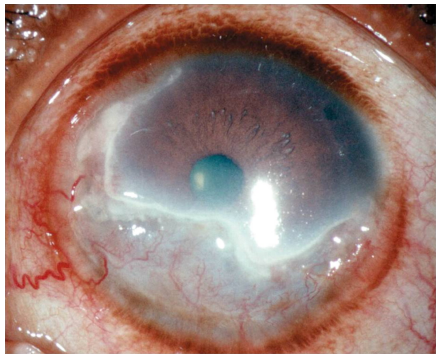


Pain:
2.5% phenylephrine:
Association:

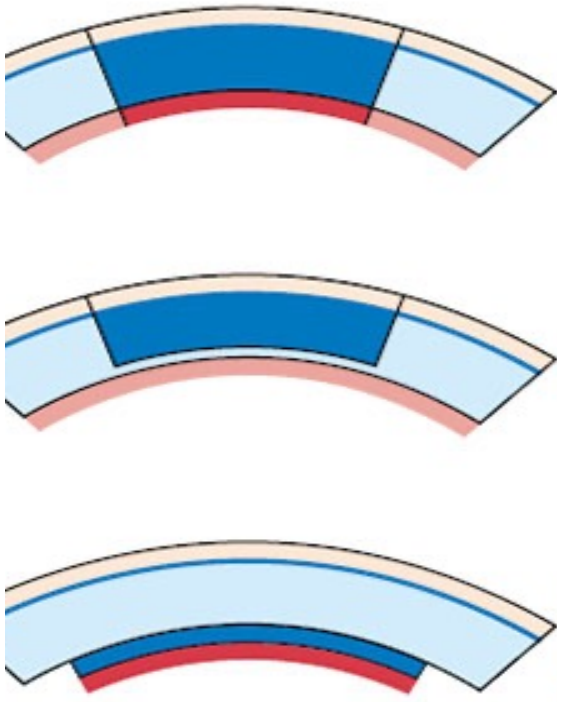
Irregular myopic astigmatism
Munson sign
Vogt's striae
Fleischer ring
Pseudo-Fleischer ring:
Rizutti sign
Oil droplet ("Charleaux" sign):

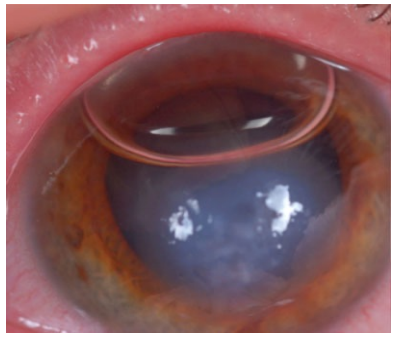
Scissoring:

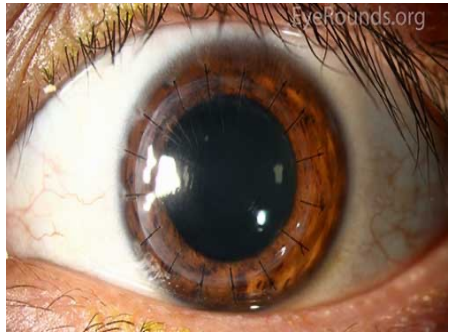




Keratoplasty

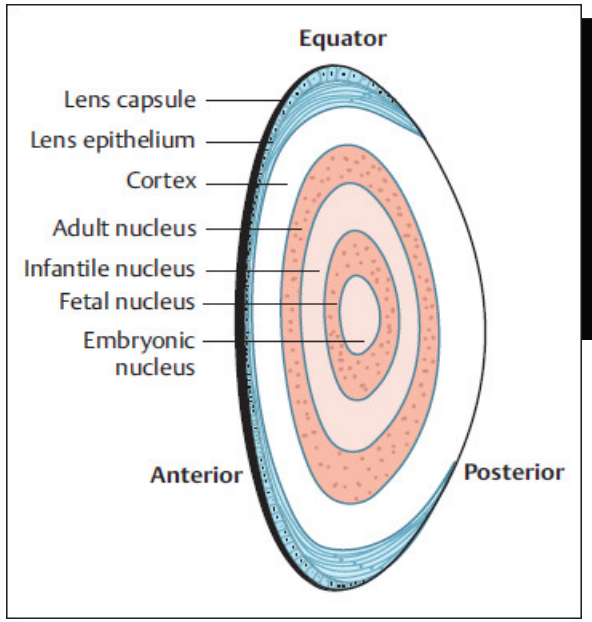


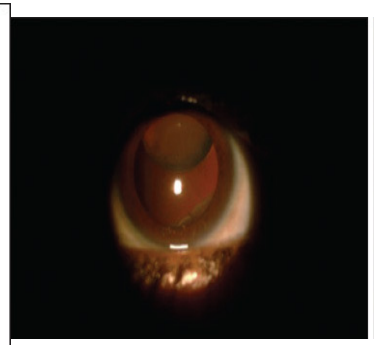


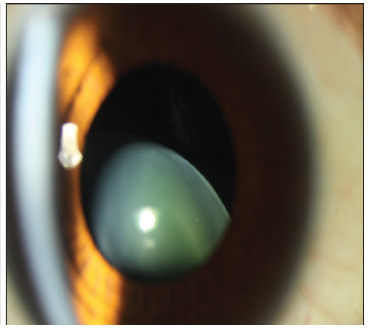


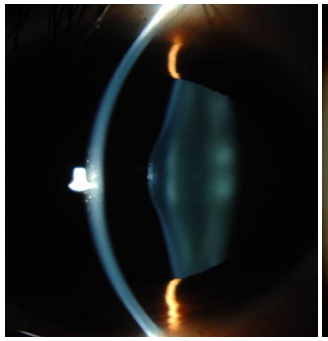
McCarey Kauffman medium
Nylon sutures
Kayes dots: Subepithelial
Khoda-daust line

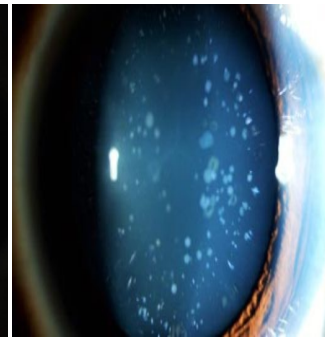
Lens

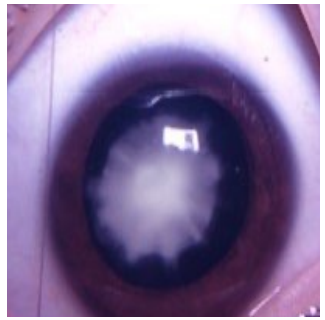






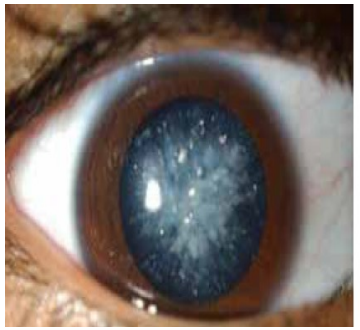


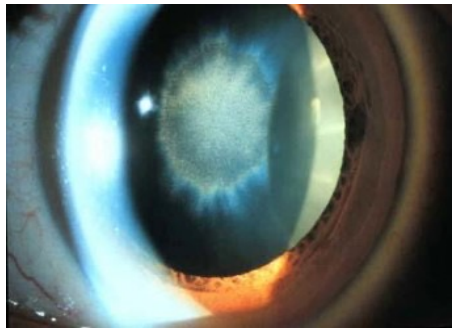


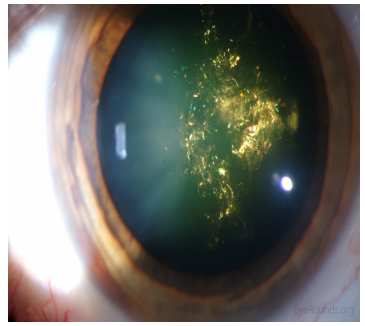


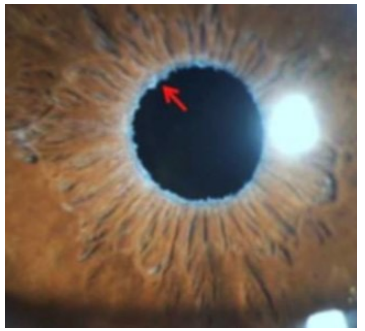
Superotemporal:
Inferonasal:
Microspherophakia:

Patellar fossa
Avascular
Refractive index-1.41 - 1.38-
Water soluble = crystallins
MC: Largest:
HM1,2 – Water soluble



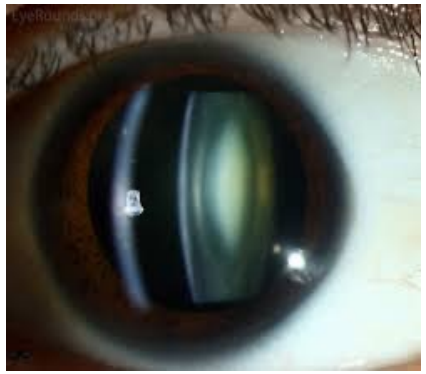
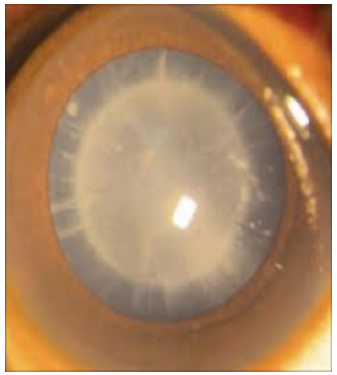
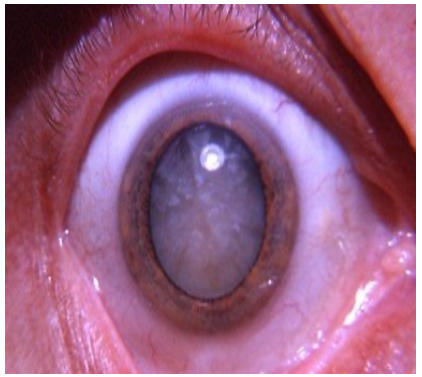
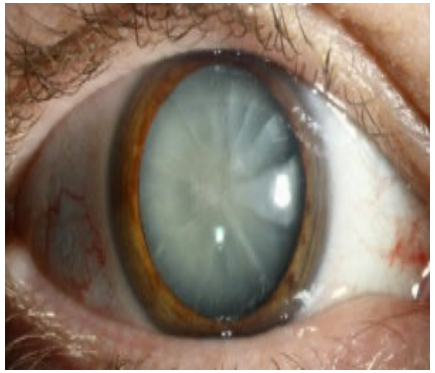
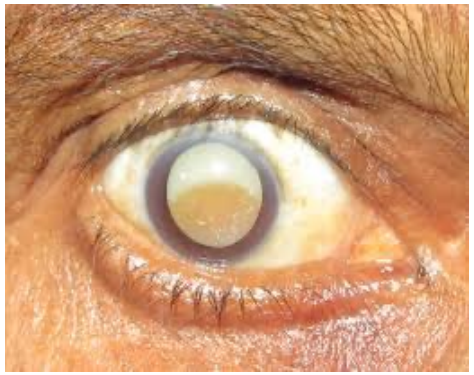




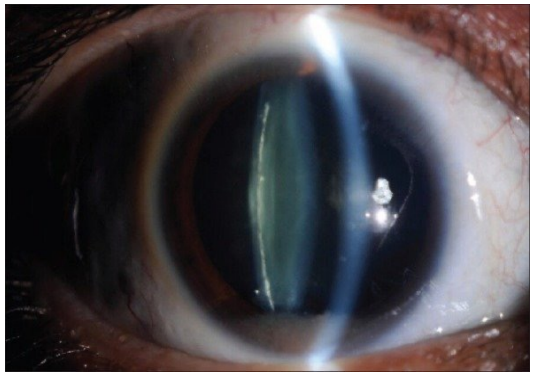


Fluctuating myopic shifts:

Cataract

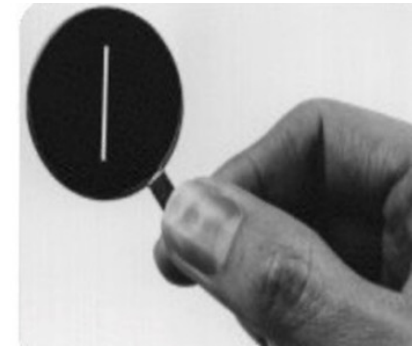
Second sight
LOV Day>night



Difficulty in bright light
Glare

Phacomorphic glaucoma
Phacolytic glaucoma
Phacotoxic glaucoma
Phacoanaphylactic uveitis

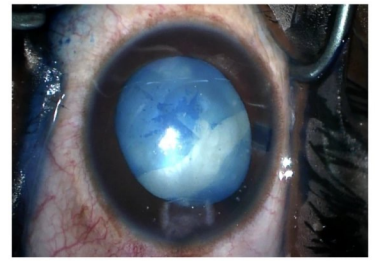
Polychromatic lustre / Breadcrumb:
MCC:
Glassblower's cataract:
Steroids NF2
Shield-like:
Amiodarone Chlorpromazine Au

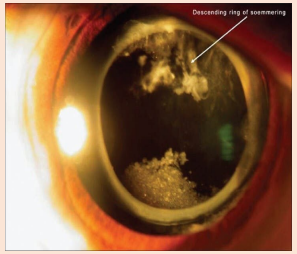


Cataract surgery

ECCE:
Conventional-
SICS-
Phacoemulsification-
MICS-
FLACS-

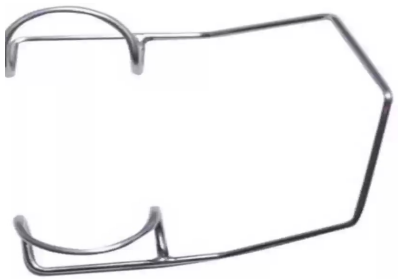
Intra-op:
- Posterior capsular rupture
- Vitreous loss
- UGH
- Expulsive choroidal hemorrhage

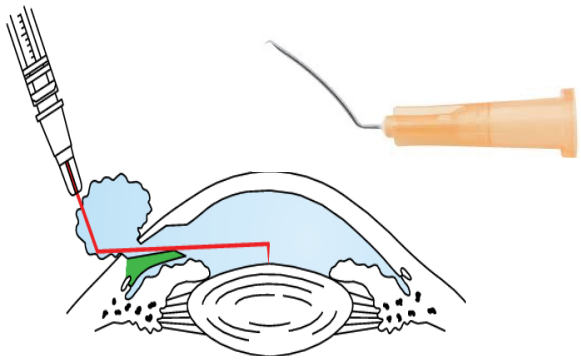




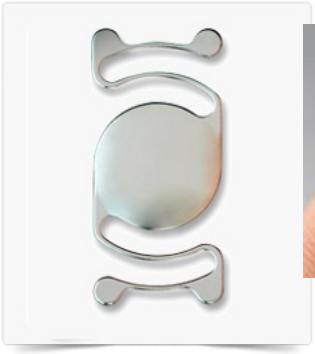
Post-op
- PCO
- Rx:
- Endophthalmitis
- TASS
- Irvin Gass syndrome
- IOL displacement
- Endophthalmitis:
- MCC early onset- Late onset(>6weeks)-
- Rx:

Cataract Instruments



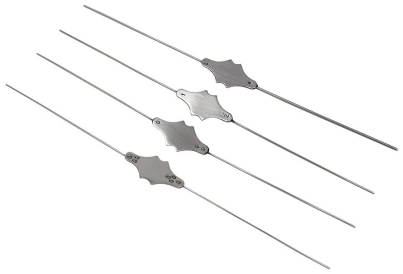


Trypan blue:



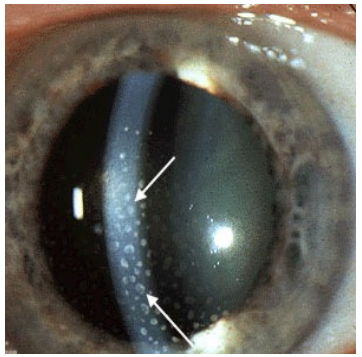
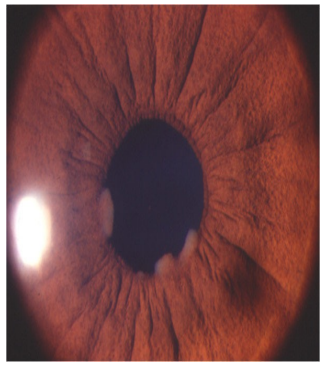
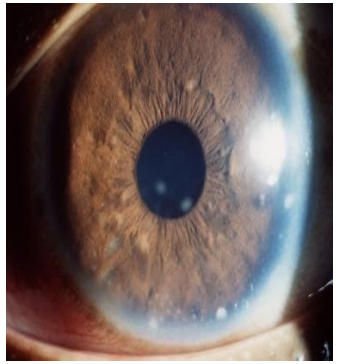
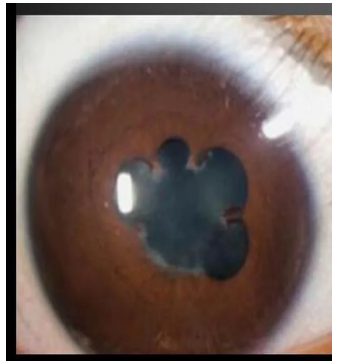
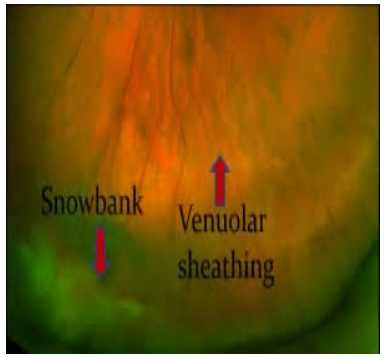
Biometry: Corneal curvature + Axial length
SRKT
Holladay / Hoffer Q
Myopic LASER: Haigis L

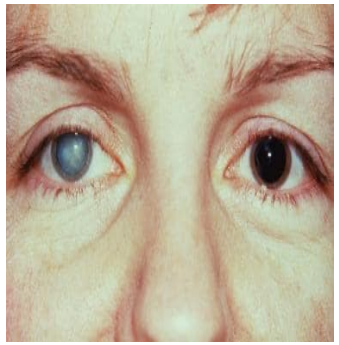
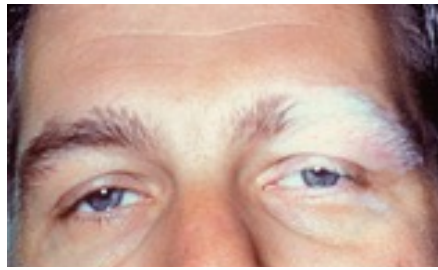
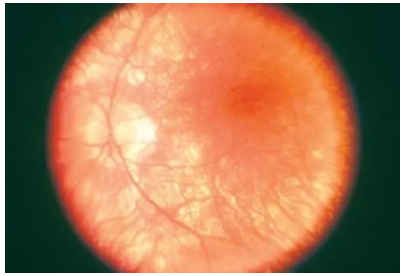
Instruments



Uveitis

Iris+ pars plicata
Management:
Pars planitis
Chorio-retinitis

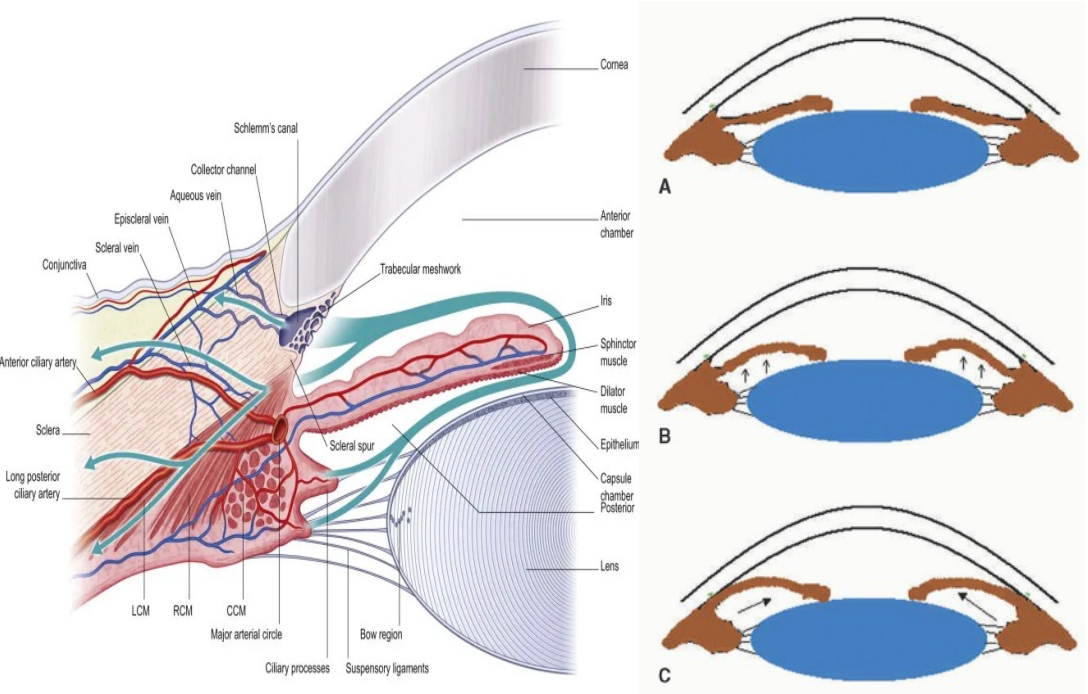




Mutton fat-
Fine granular-
Pigmented-
Stellate-

Amsler sign:

Suiguira sign

Glaucoma



Angle Closure Glaucoma

AC: (vs OAG:)

Triad:

Glaucomflecken (anterior subcapsular opacity)

Iris atrophy

Pigment dispersion on endothelium

Management of ACG:

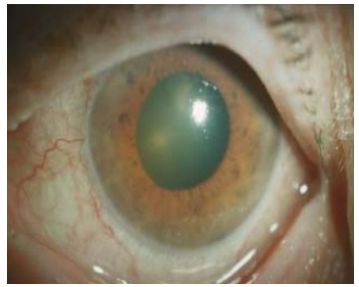
A

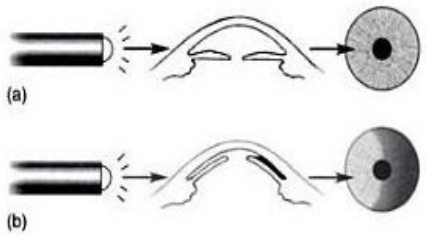
M

P

Surgery:

POAG:

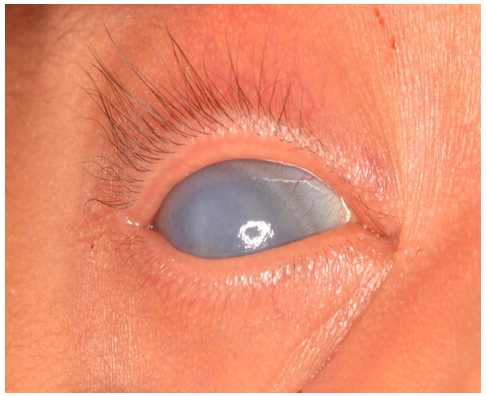




- **Unilateral IOP spikes + uveitis**
- **Malignant glaucoma/ ciliary block/ aqueous misdirection syndrome: Shallow AC**

DOC:

- **Krukenberg spindle**



Blepharospasm

Photophobia

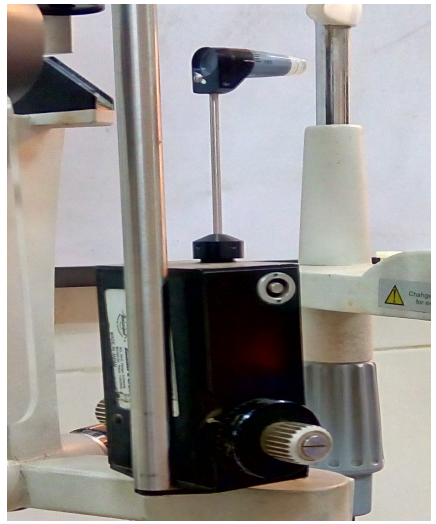
Lacrimation

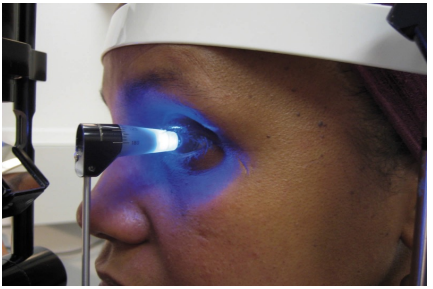
Striae:

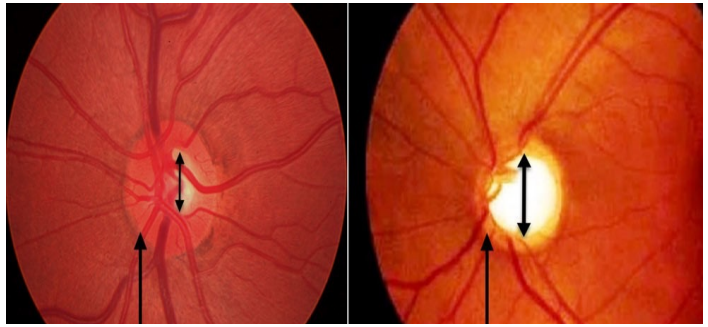
Corneal diameter>13mm

Rx:

Glaucoma - Investigations



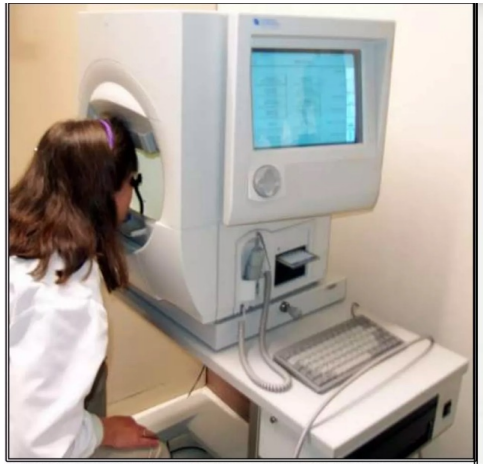


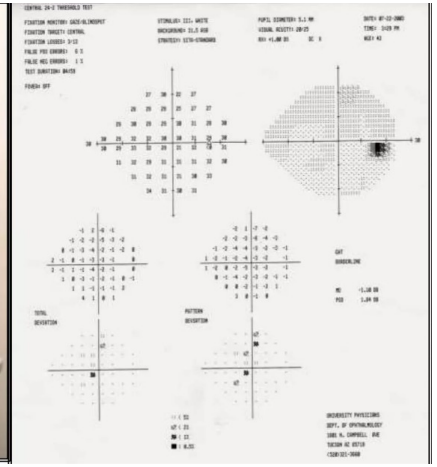


Mackay-Marg tonometer:

- Increased cup:disc ratio
- Thinning of neuro-retinal rim

- Shifting of vessels
- Laminar dot sign
- Bayonetting sign

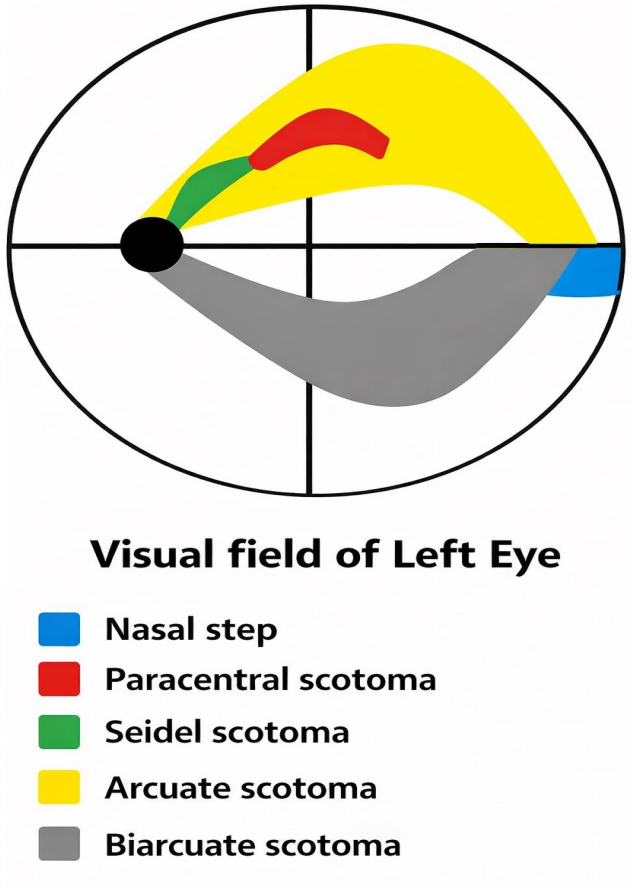




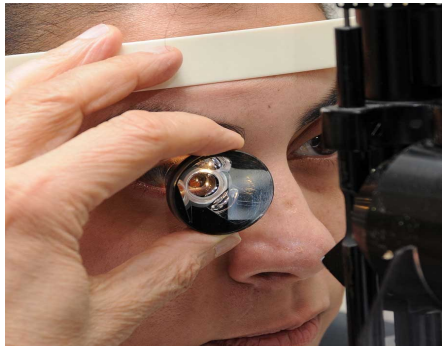
Humphrey/ Octopus/ Oculus:

Goldmann perimeter, Bjerrum, Lister:

Earliest-
Paracentral scotoma
Siedel's scotoma
Bjerrum/ Arcute scotoma
Ring/Double arcuate
Roenne's nasal step
Loss of central vision
Temporal crescent loss



Side	Range
Superior	50°–60°
Inferior	70°–80°
Nasal	60°
Temporal	100°–110°

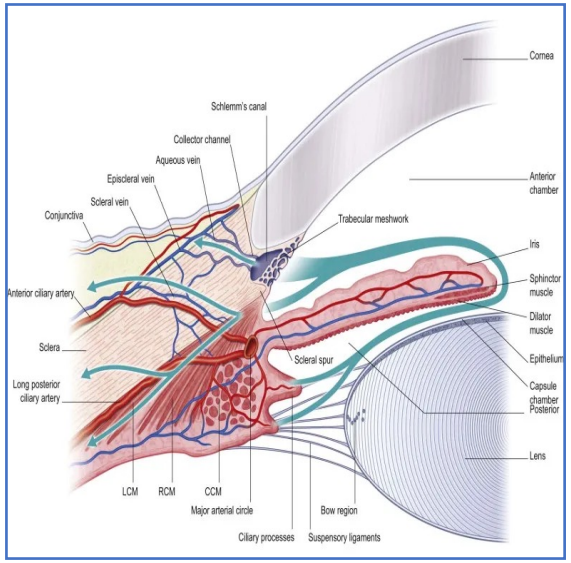


Total internal reflection

"I can see till Schwalbe's line"

Richardson/ Koeppe:

Zeiss/ Goldmann:



Anti-Glaucoma Drugs

Decrease Aqueous Production

Ocular Beta Blockers
1. Timolol
2. Betaxolol
3. Levobunolol
4. Carteolol

Nonselective Alpha Agonist
Dipivefrine

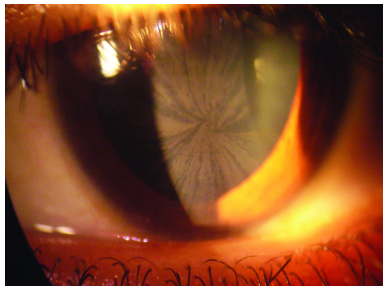
Alpha-2 Agonist
1. Apraclonidine
2. Brimonidine

Carbonic Anhydrase Inhibitors
1. Acetazolamide
2. Brinzolamide
3. Dorzolamide

Increase Trabecular Outflow

Cholinomimetic Drugs
Pilocarpine

Rho kinase inhibitor
Netrasudil

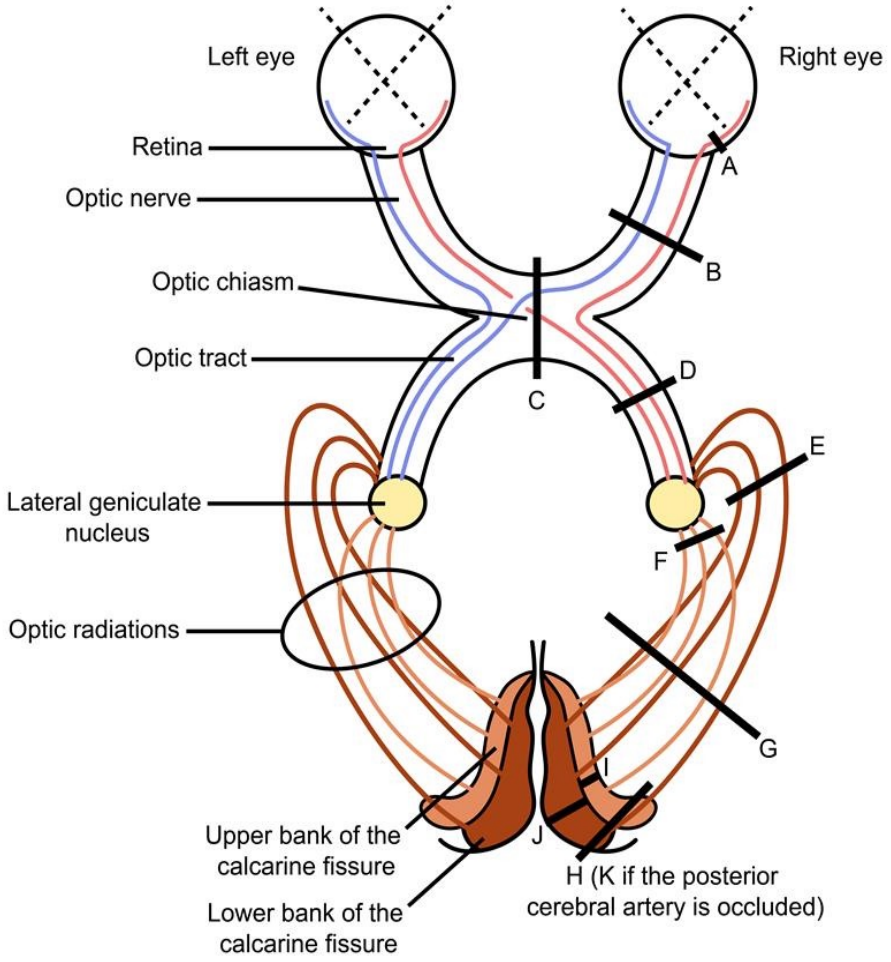


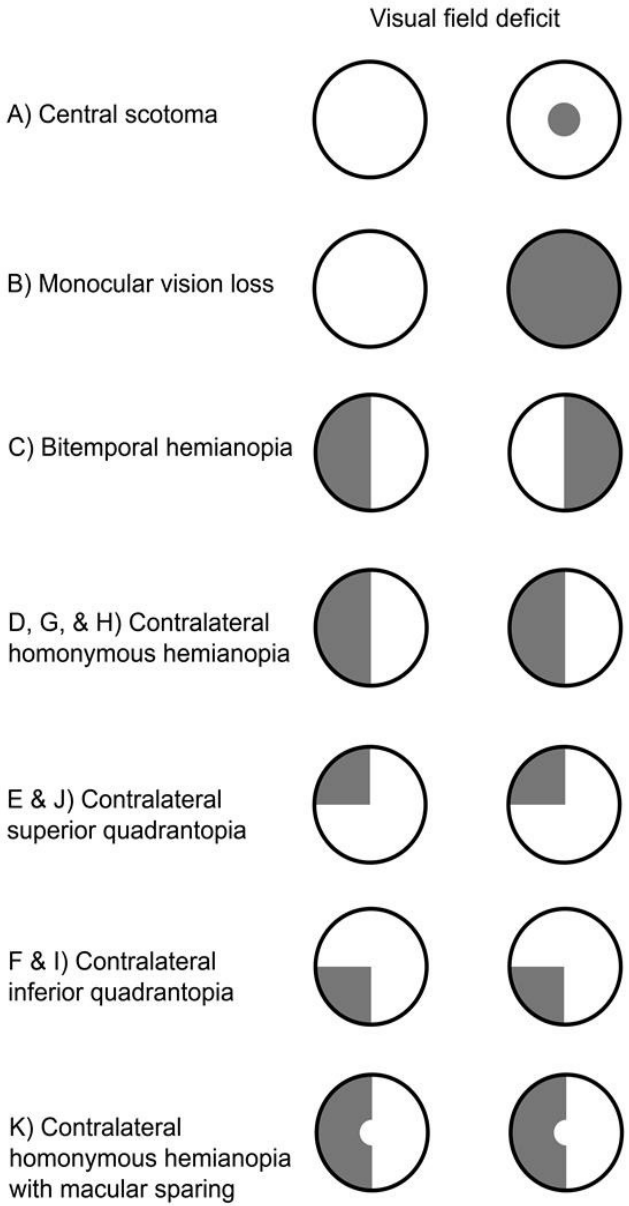
Increase Uveoscleral Outflow

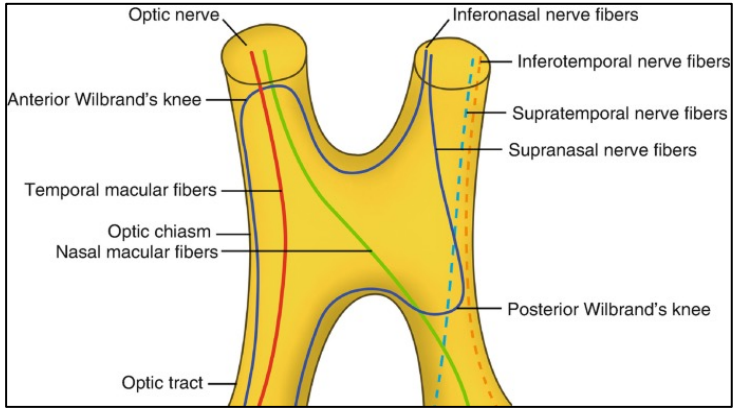
$PGF_{2\alpha}$ Analogues
1. Lantanoprost
2. Bimatoprost

Omidenepag

Visual Field Defects



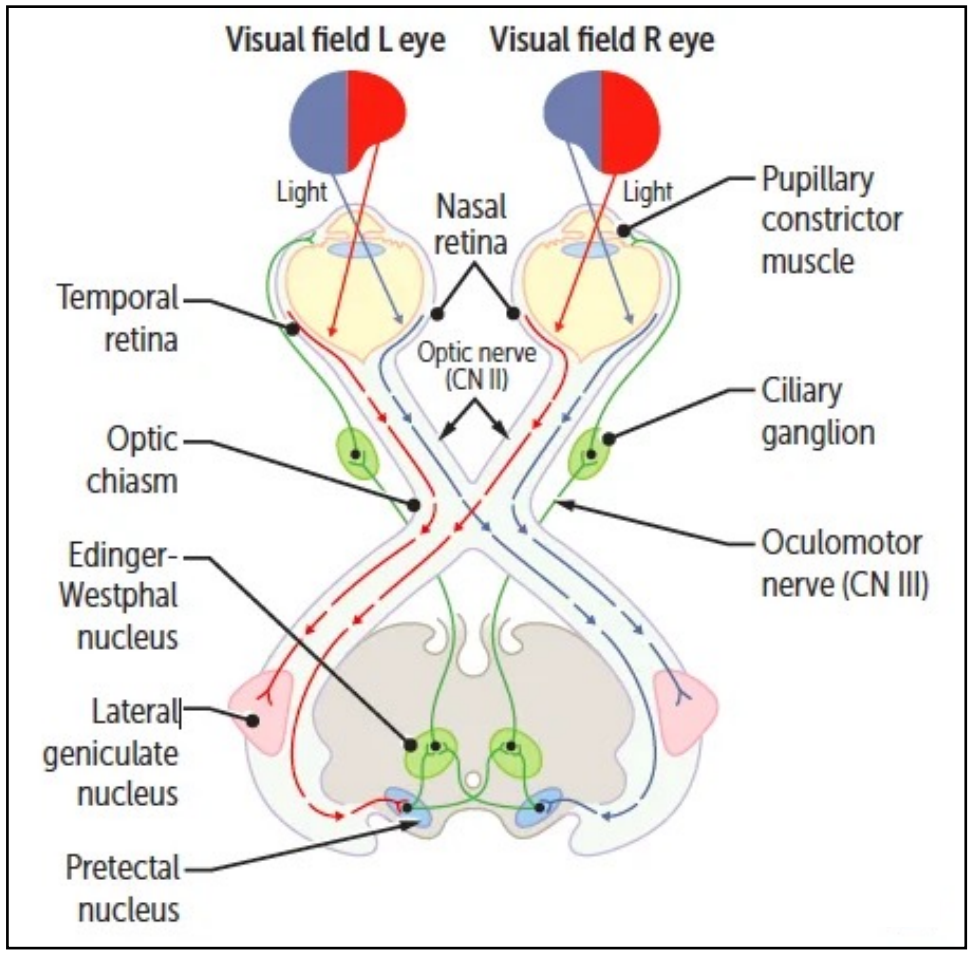


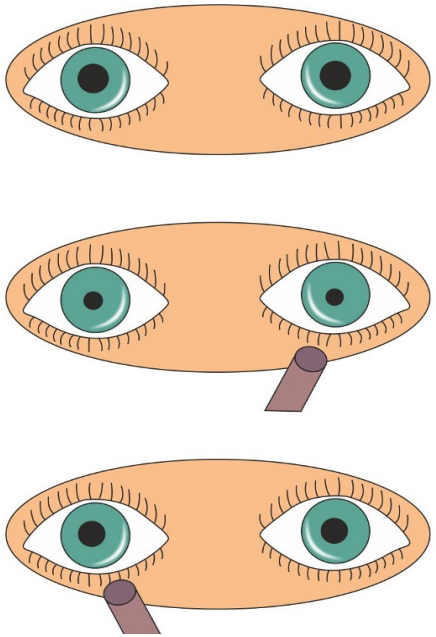


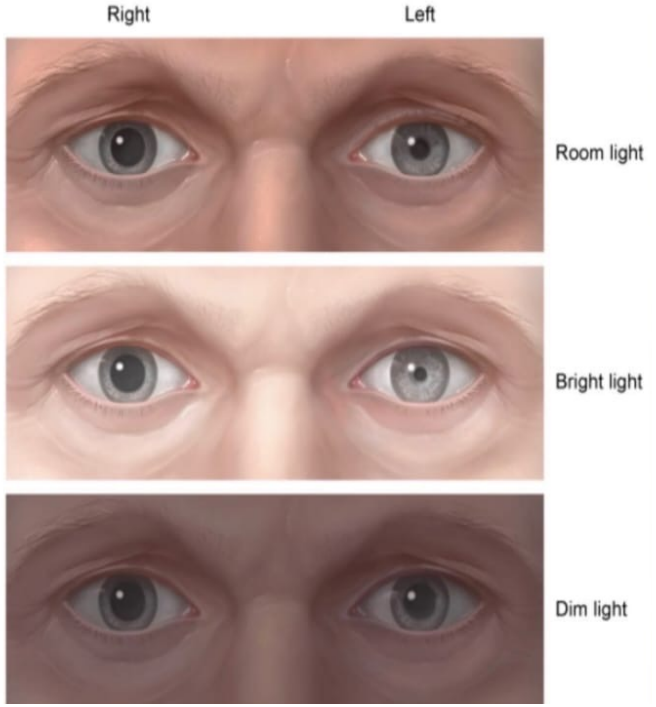
Wernicke's hemi-anopic pupil

Keyhole defect

Light Reflex

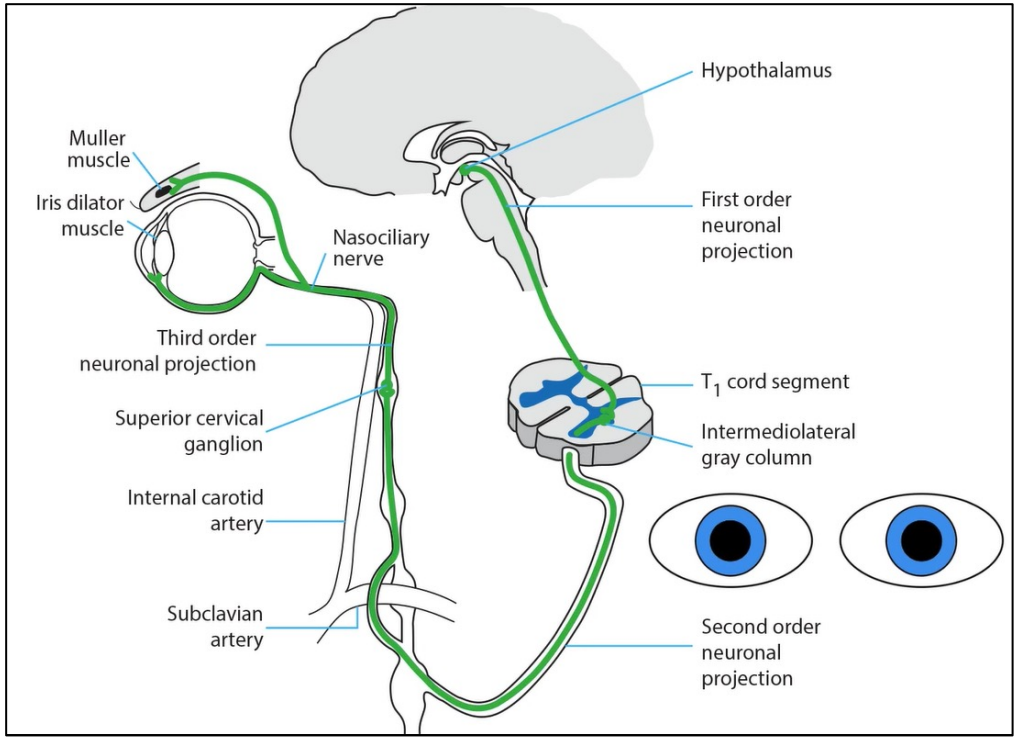


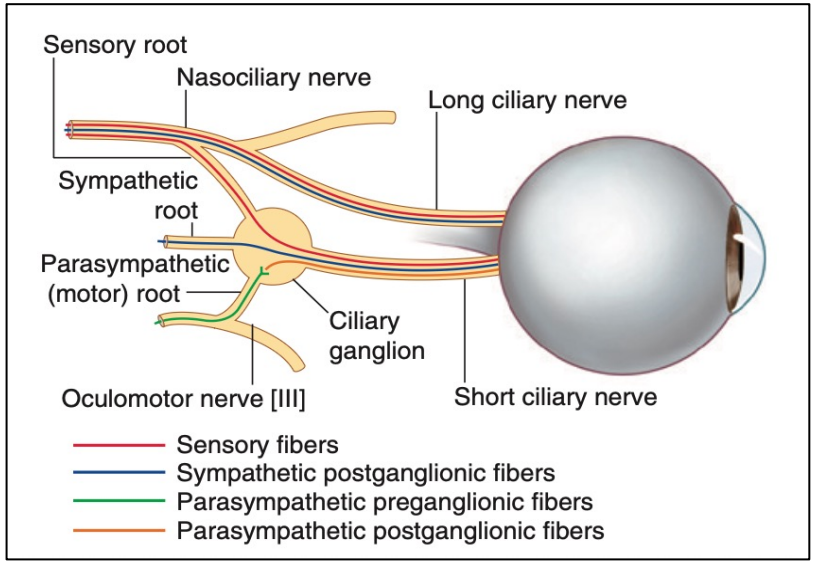




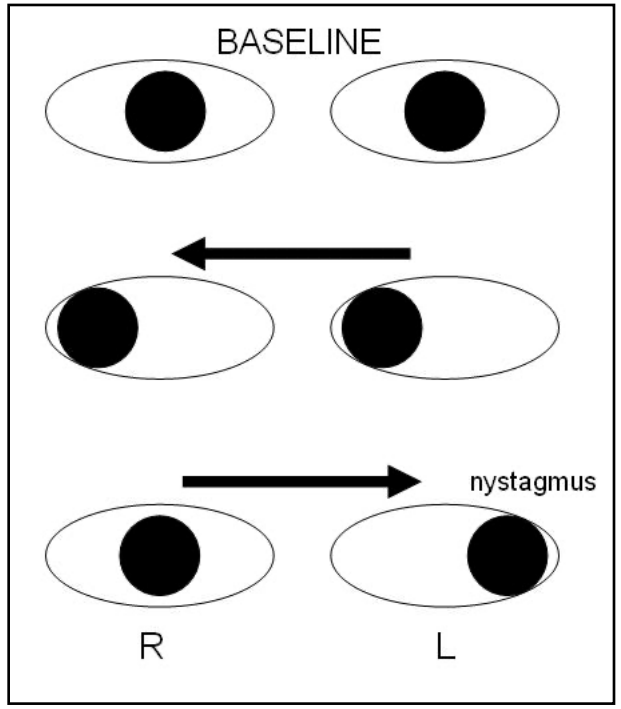
	Adie's Tonic pupil	Pharmacological mydriasis
I/L Dilated pupil		
Accommodation		
0.125% Pilocarpine		
1% Pilocarpine		

Sympathetic pathway





INO

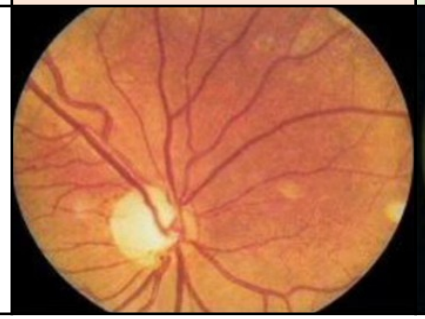
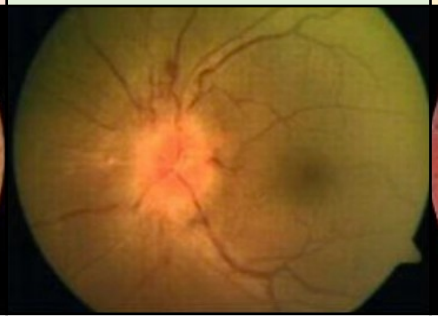
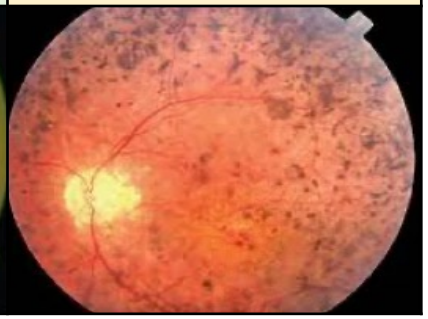


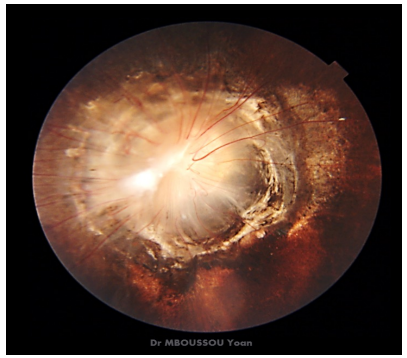
4% Cocaine test
Mechanism: Blocks NE reuptake
→ No NE in postsynaptic cleft
→ No dilation: Horner's syndrome

1% Apraclonidine test
•Mechanism: Denervation hypersensitivity of α_1 receptors
•Pupil dilates: Horner's syndrome

1% Amphetamine test
•Mechanism: Releases stored norepinephrine from presynaptic terminal
•Pupil dilates → Pre-ganglionic lesion
•Pupil does NOT dilate → Post-ganglionic lesion

Optic Atrophy

Sign	Primary	Secondary	Consecutive
Disc colour	Chalky white	Grey	Waxy pale
Disc margins	Distinct	Blurred	Attenuated arteries
Cause	• Optic N compression • Hereditary / Nutritional Optic Neuropathy	• Chronic papilloedema • Papillitis • Anterior Ischemic Optic Neuropathy	• Chorioretinal disease (e.g. RP) • Central Retinal Artery Occlusion
Image			



Multiple sclerosis
- Retrobulbar neuritis
- U/L LOV + No VFD
- Fundus normal
- Pulfrich sign
- Uthoff sign

IOC:
TOC:

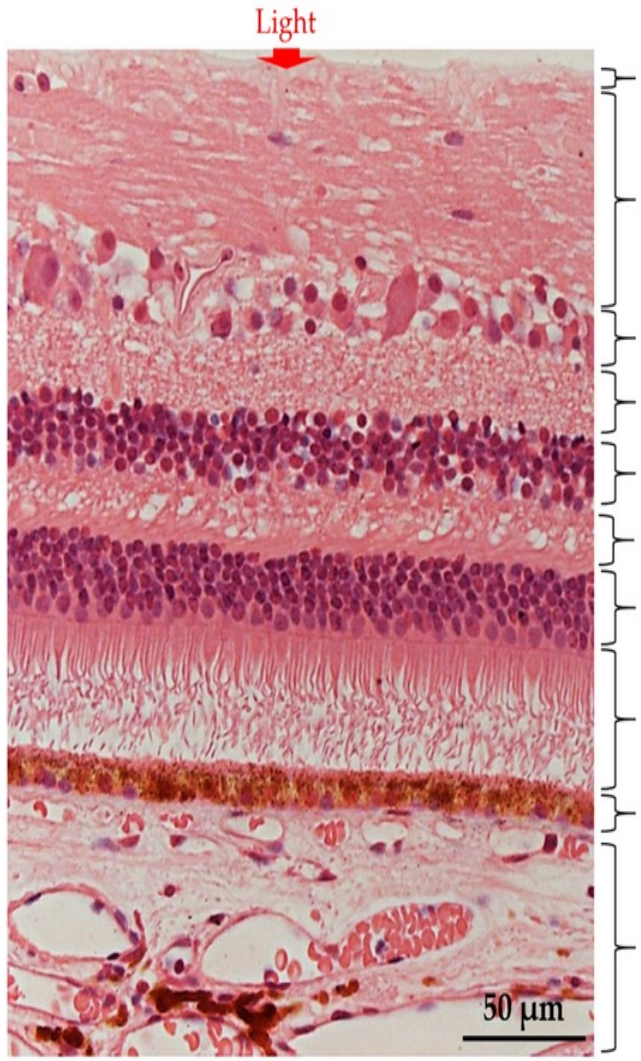
Papilledema

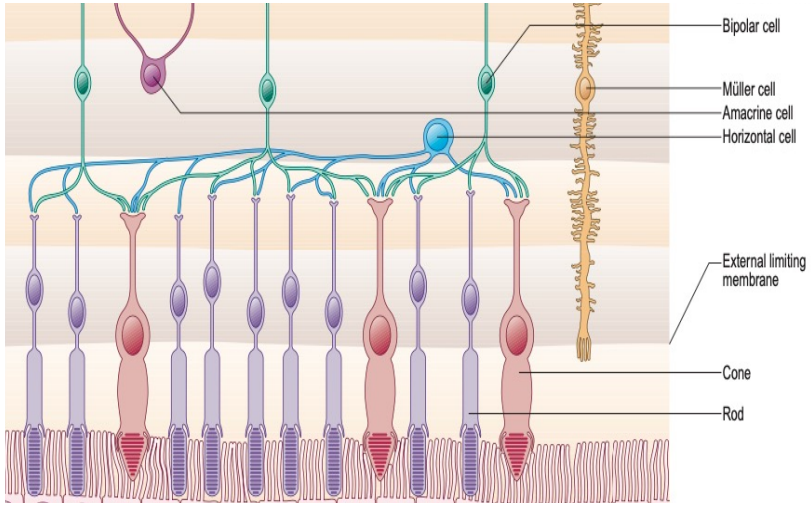
Painless B/L
VFD:
Paton's lines

Altitudinal defects:
- Glaucoma
- ON drusen
- AION

Absent lamina cribrosa
Retrodisplacement of ON

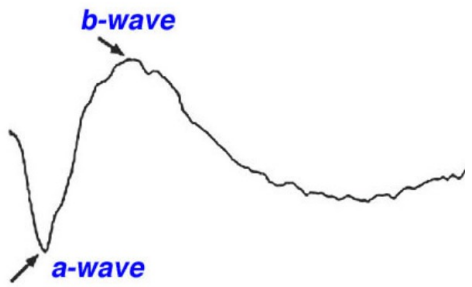
Retina

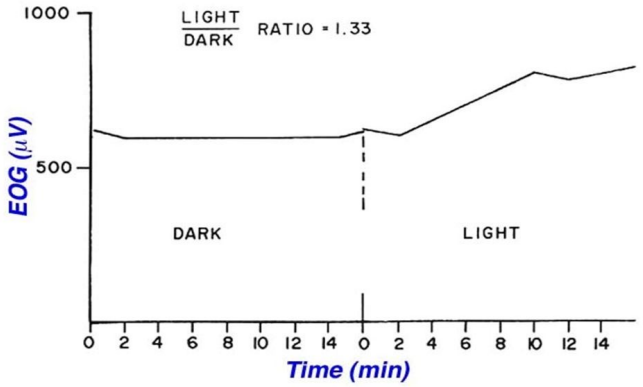


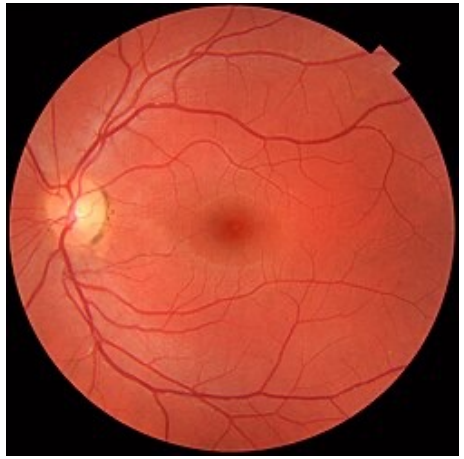


Feature	Direct	Indirect (+20 Lens)
Magnification	15X	3X
Field	2DD	8DD
Orientation	Direct	Inverted
Periphery	Limited	Full
Stereopsis	Absent	Present

Light: Hyperpolarisation in rods- Glutamate release decreases

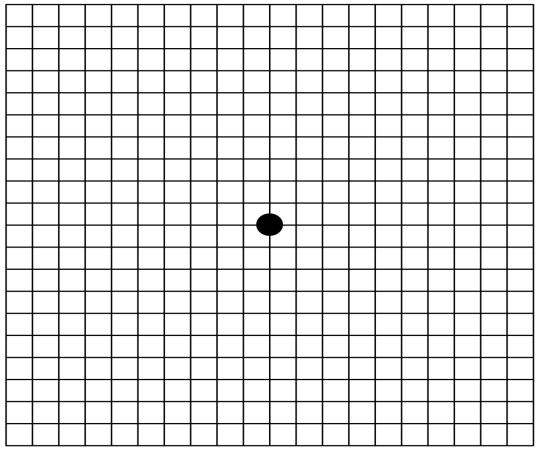


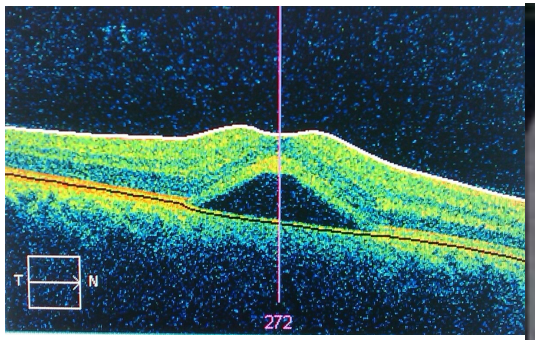


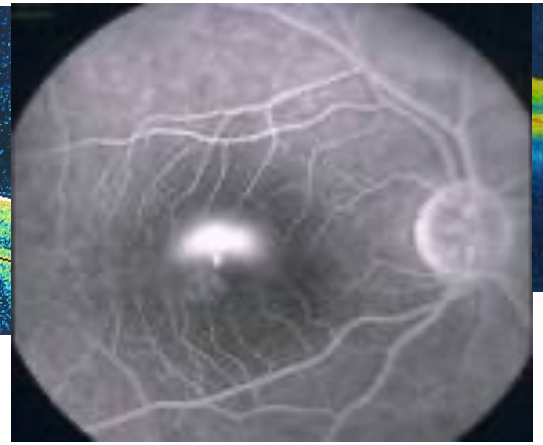


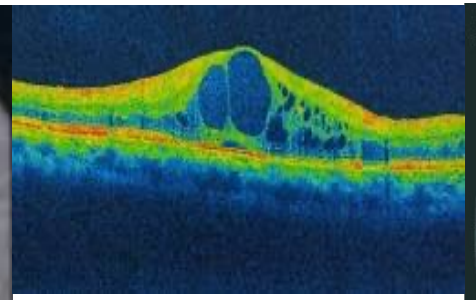
Blood supply:
Outer 4:
Inner 6:

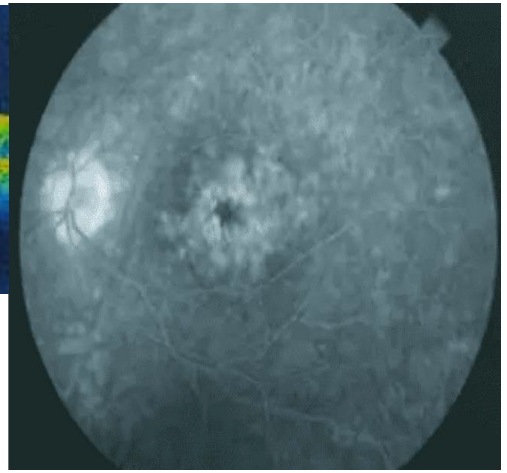
Macular Disorders & Investigations









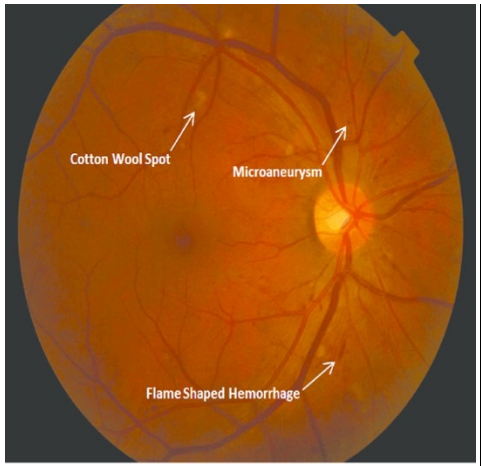


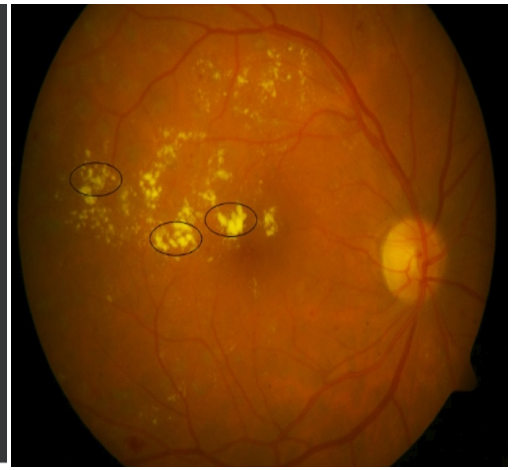
- Diagnosis-
- Layer-
- R/F: Steroids / Type A personality
- Rx:

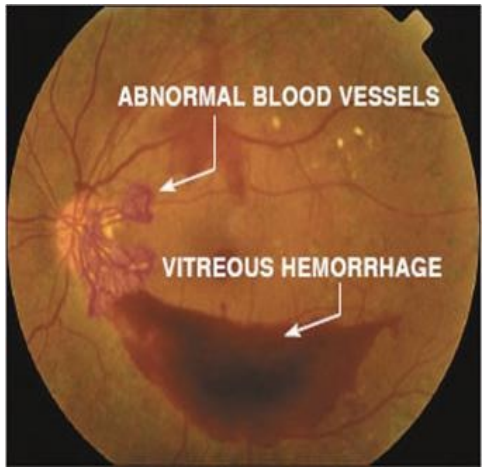
- Diagnosis-
- Layer-
- R/F- Irvine-Gass
- PG analogue
- Niacin toxicity
- DR
- Uveitis/ RP/ CRVO
- Rx-

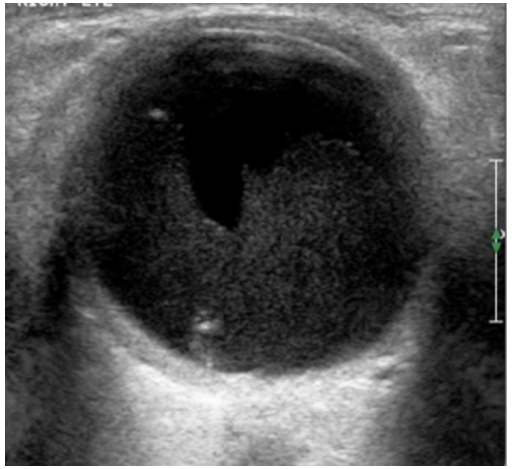
- BLOOD RETINAL BARRIER
- Outer : RPE
- Inner: Capillary Permeability

Diabetic Retinopathy









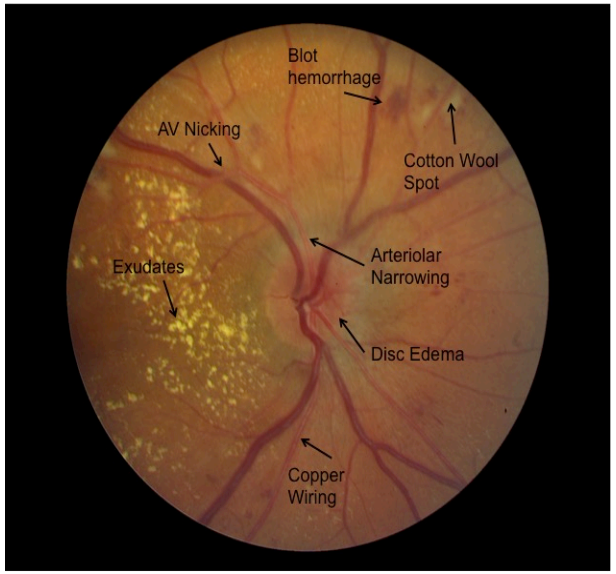
ETDRS
Microaneurysm:
Hemorrhages: Dot and bot:
Hard Exudates:
Flame shaped:
Cotton Wool/ Soft exudates:
Screening-
Type 1
Type 2
Most important R/F:

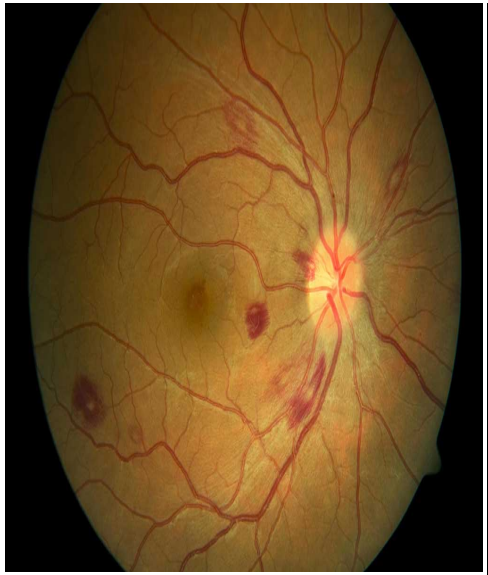
<u>Severe NPDR (4-2-1 rule):</u>
- **> 20 intraretinal hemorrhages in each of four quadrants**
- **Definite venous beading in two or more quadrants**
- **Prominent IRMA in one or more quadrants**

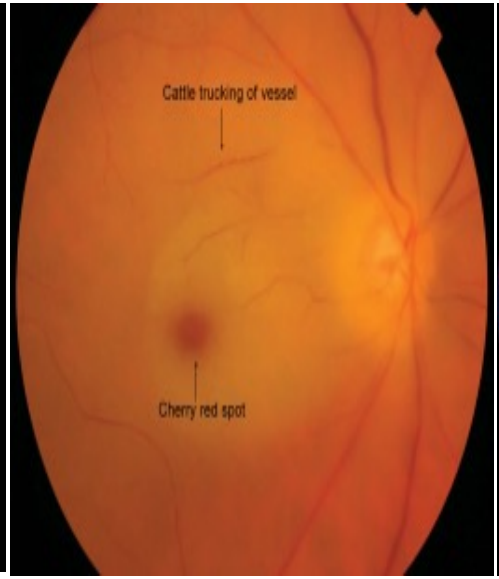
<u>Advanced Diabetic Eye Disease</u>:
Persistent vitreous hemorrhage
Tractional retinal detachment
Neovascular glaucoma

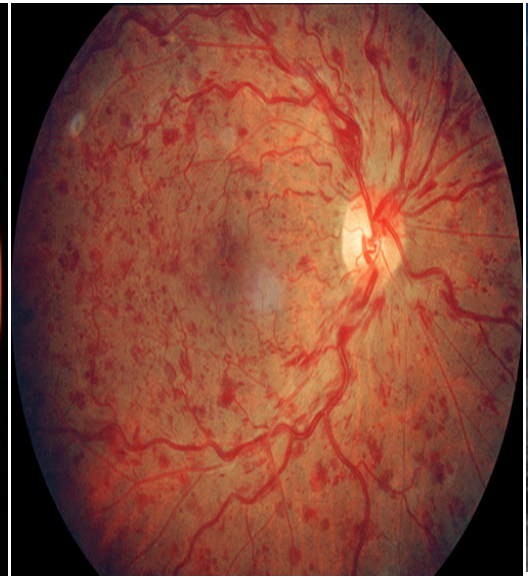
Bevacizumab
Ranibizumab
Brolucizumab
Ramuciruzumab
Aflibercept
Pegaptanib

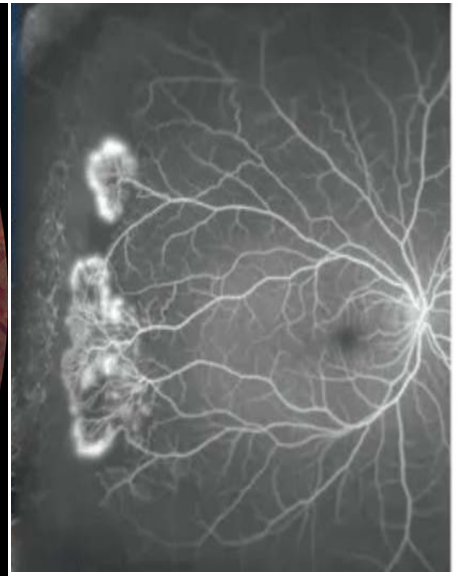
Retina pathologies



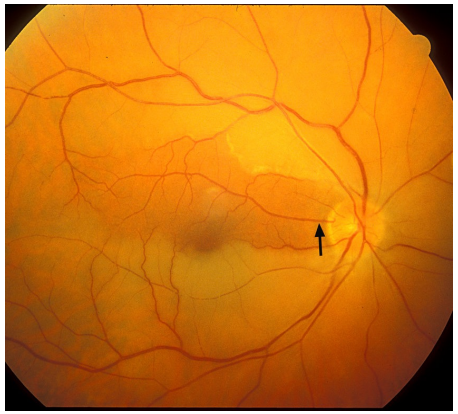


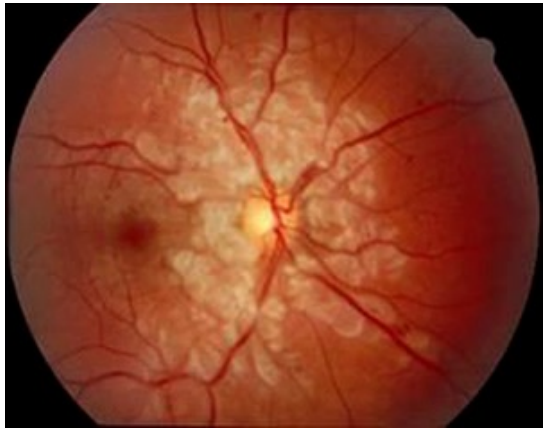


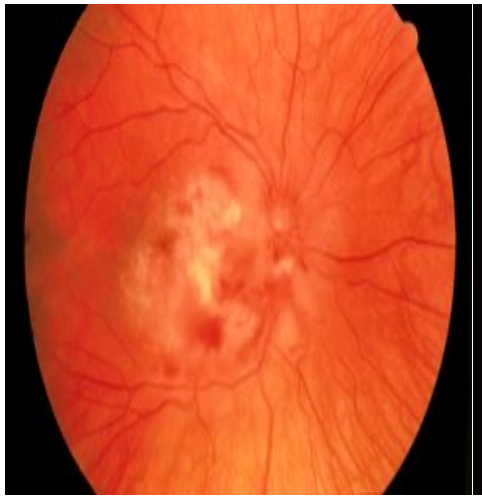
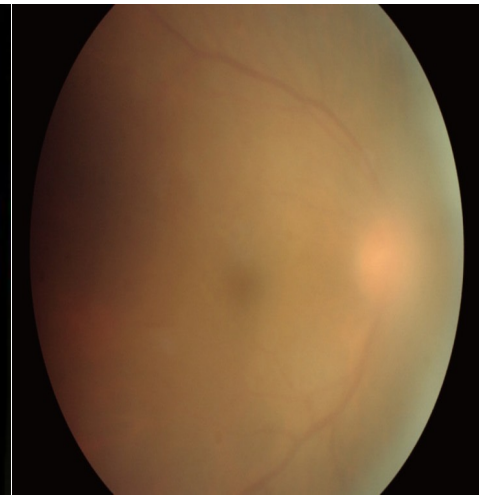
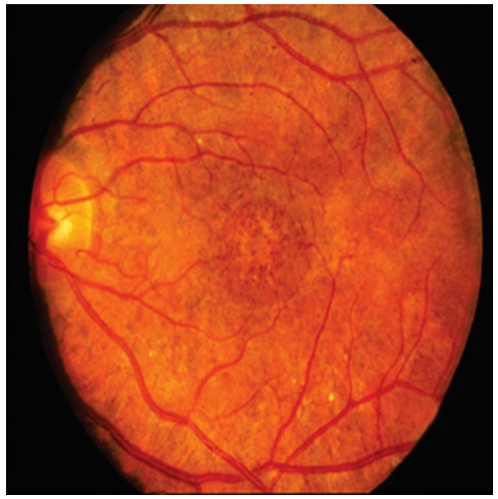
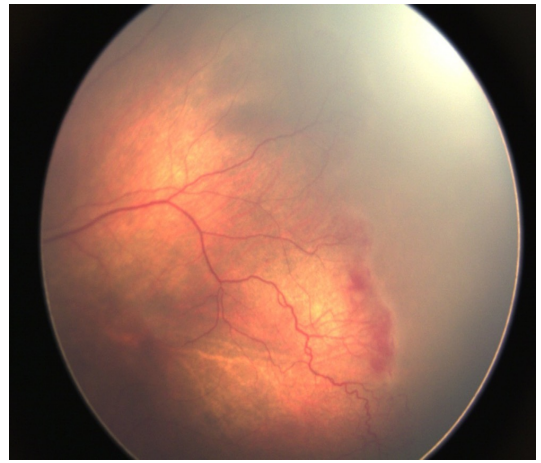
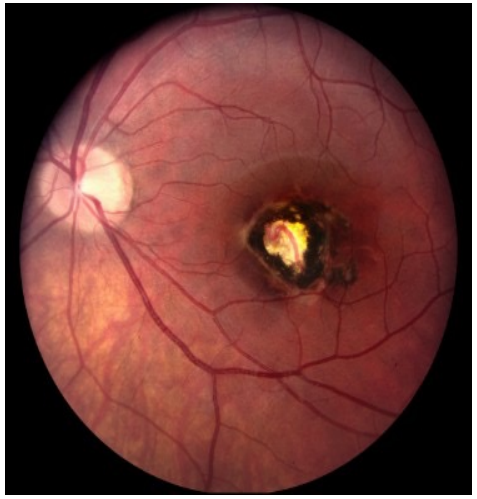




Grade 1	Arteriolar narrowing
Grade 2	Salu sign-S shaped deflection of veins
Grade 3	• GUNN: Tapering of vein at either end • BONNET: Dilatation of vein at junction • Flame shaped Hemorrhage • Cotton Wool spots • Copper wiring
Grade 4	Silver wiring Papilledema



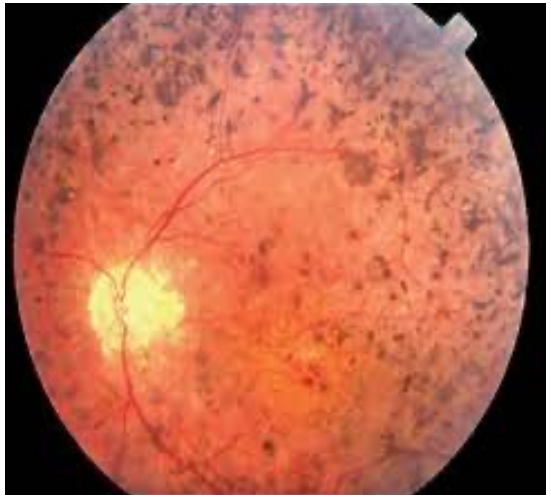


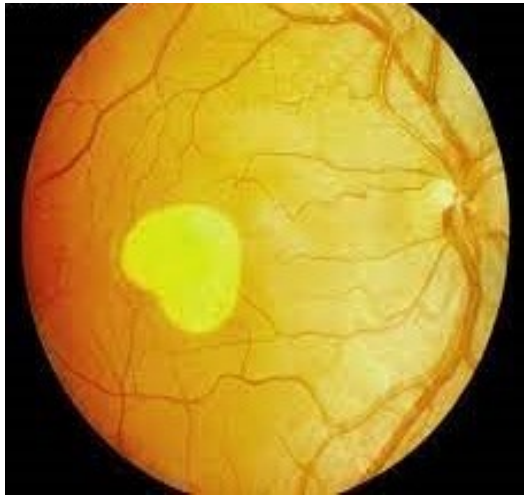
- R/F: Birth weight <1750g
- Gestational age ≤ 34 weeks
- Sick infants (oxygen therapy, sepsis)
- Screening:

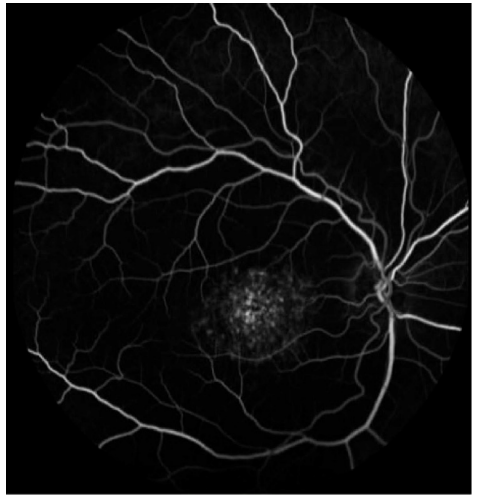
Stage 1	Demarcation line between vascular and avascular retina
Stage 2	Elevated ridge at the demarcation line
Stage 3	Ridge with extraretinal fibrovascular proliferation
Stage 4	Partial retinal detachment
Stage 5	Total retinal detachment

ROD dystrophy



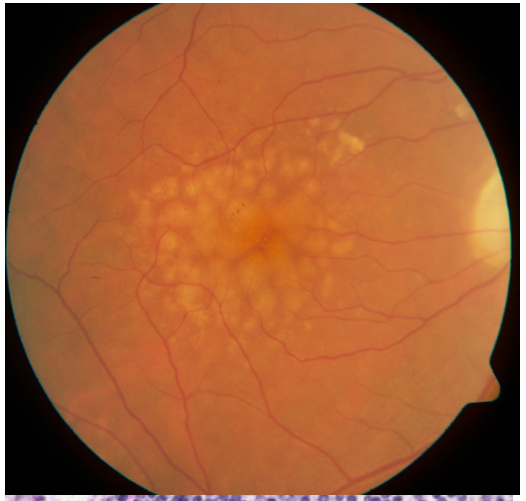
CONE dystrophy

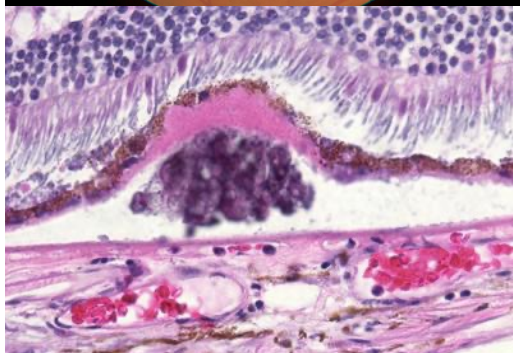




- MC Inheritance:
- TRIAD:

- C/F:
- IOC:
- Docosahexanoic acid ↓
- Usher, Refsum, Kearns-Sayre, Bardet-Beidl

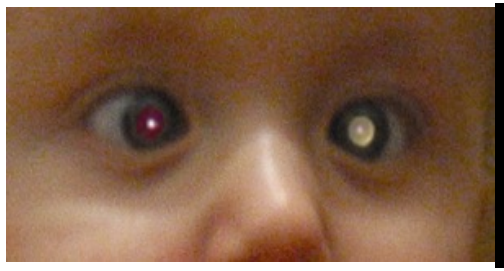


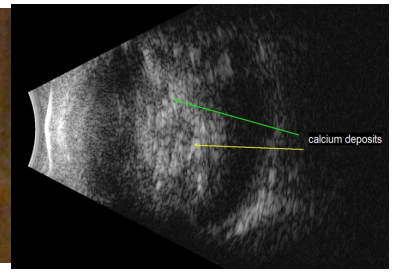


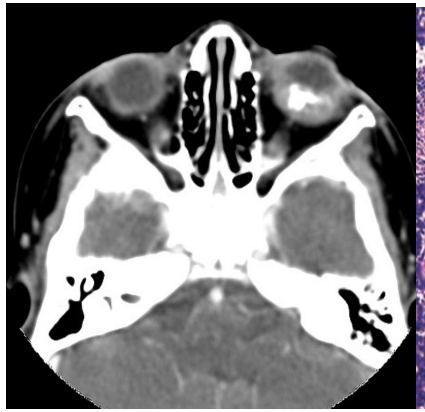
AREDS2-
Vitamin C, E, Zn, Cu, Lutein, Zeaxanthin

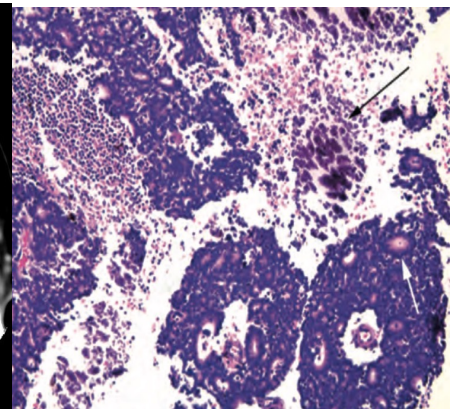
Oguchi's disease/ congenital stationary night blindness:
Mizuo-nakamura phenomenon

Retinoblastoma



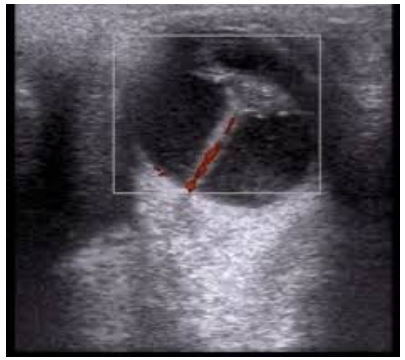


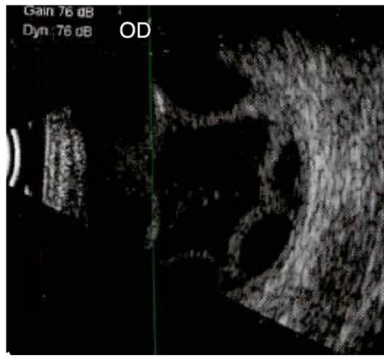


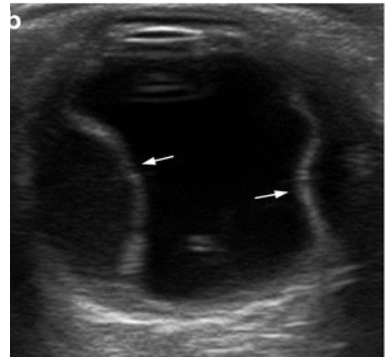


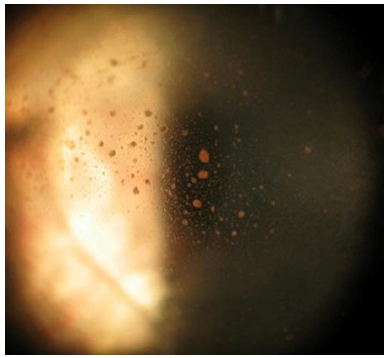
Sporadic: Hereditary:
Gene/ inheritance:
Trilateral RB:
MC association:
C/F-
IOC-
IOC for spread-
TOC-

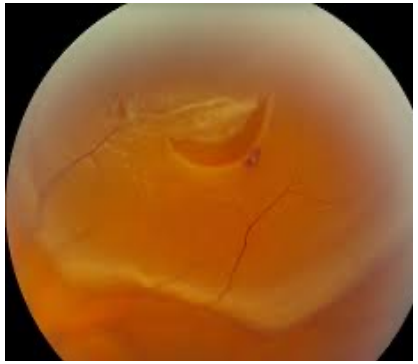
Retinal detachment

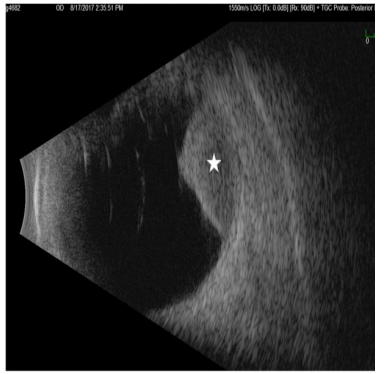


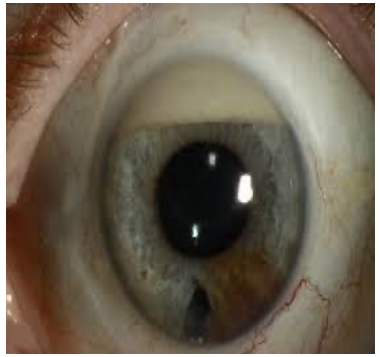






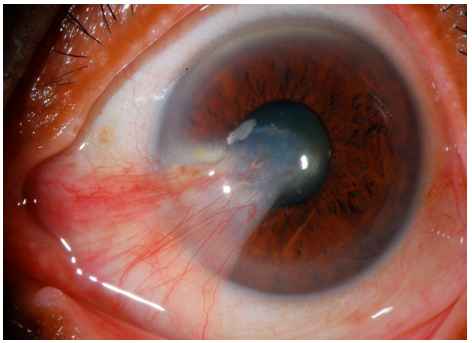




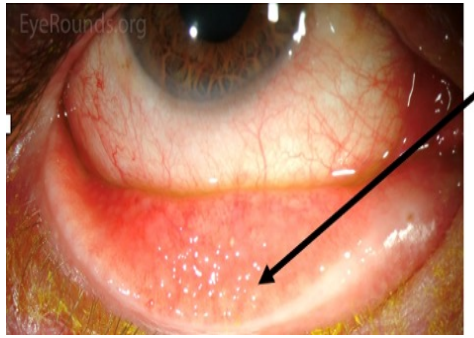


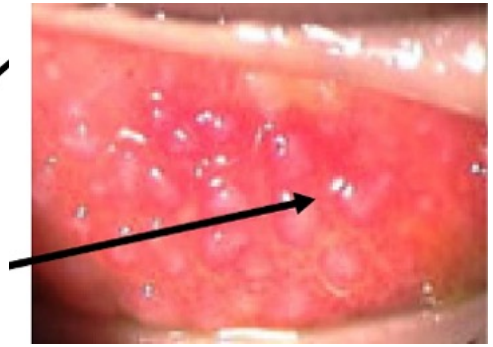
Rhegmatogeneous- Trauma/myopia/surgery
"Curtain falling in front of eye"
Exudative-
Young boys + U/L lipid exudation:
Tractional-
Rx:

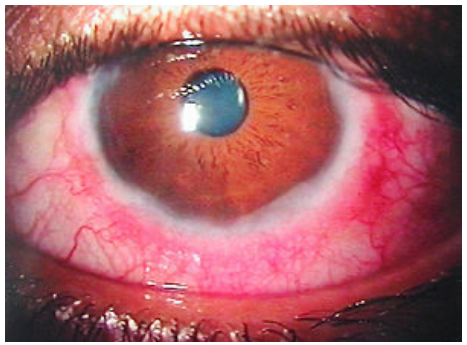
Conjunctiva

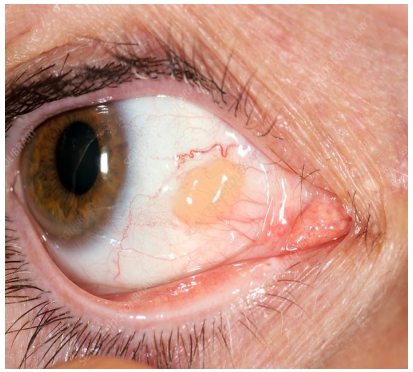


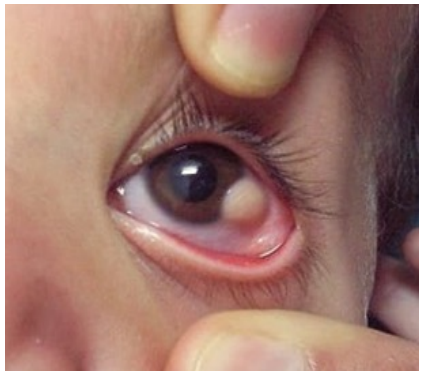
Diagnosis:
C/F:
Limbus Stem cells
ABCG2, CD34
Rx:







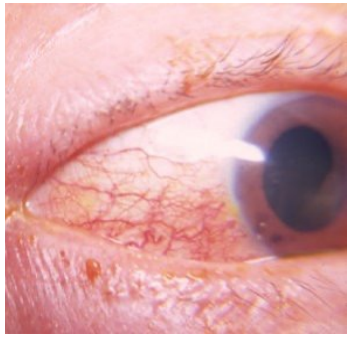


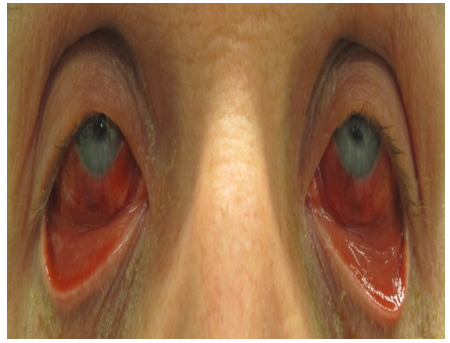


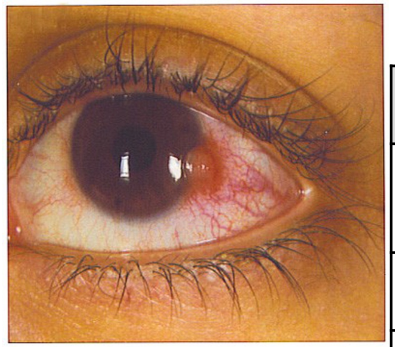
- Toxins (e.g., Apraclonidine)
- Viruses (e.g. COVID-19)
- Chlamydia

- Bacterial
- Allergic (AKC, VKC)
- Foreign Body
- GPC

- 5-14yr boys
- Ropy discharge
- Hysn:
- Shield ulcer
- Cobblestone papilla
- Horner-Tranta dots
- Pseudogerontoxon
- DOC:

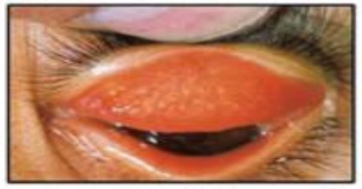






Neonatal conjunctivitis	Onset age	Treatment
Chemical Crede method	<24 hr	Eye lubricant
Gonococcal	24-48hrs	Ceftriaxone
Chlamydial (D-K)	5-14 days	Erythromycin

Trachoma

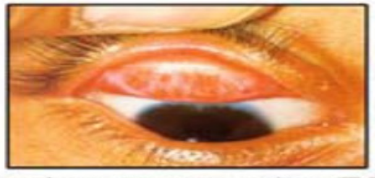


Trachomatous inflammation-follicular (TF)

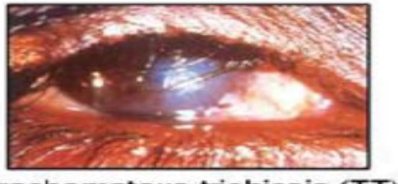
Five or more follicles of >0.5 mm on the upper tarsal conjunctiva

Trachomatous inflammation-follicular and intense (TI)

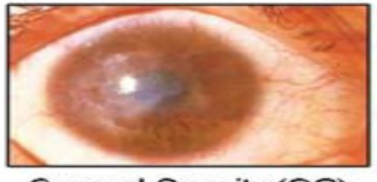
Inflammatory thickening obscuring more than half of the normal deep tarsal vessels



Trachomatous scarring (TS)



Trachomatous trichiasis (TT)



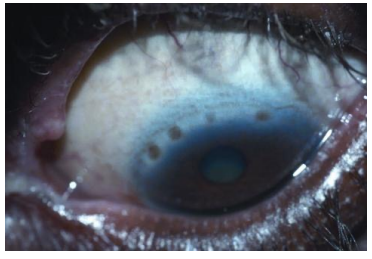
Corneal Opacity (CO)

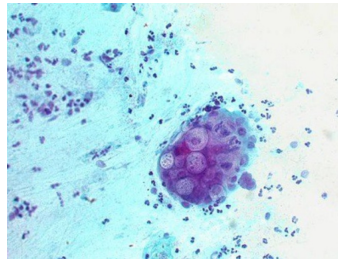
Surgery

Antibiotics

Facial cleaning

Environmental change

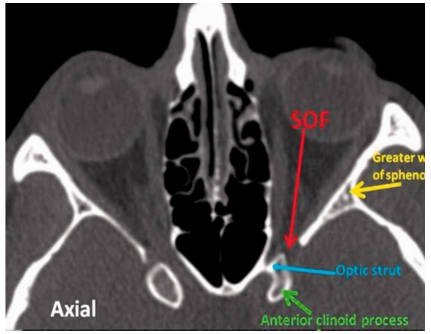


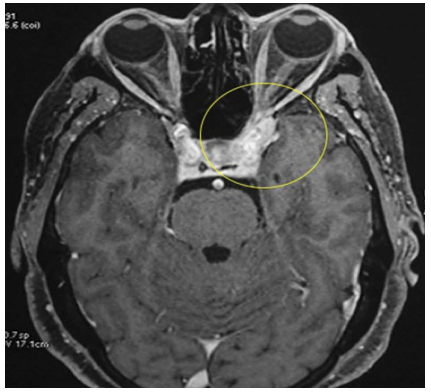


ELIMINATION CRITERIA:
TF of < 5% in children aged 1 to 9 years
TT <0.2%/<1/1000 in adults >15yrs

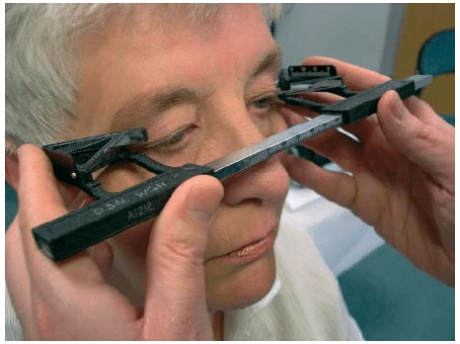
Orbit

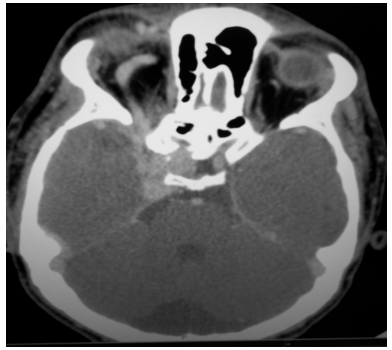
Proptosis:
MCC:
Pulsatile:
Increases on bending/ Valsalva:
Increases on crying:
Increases with URTI:
MCC of orbital mets:
Child-
Adult-
MC primary orbital tumor in child
Benign- Malignant-
MC orbital tumor in adult
Benign- Malignant-
MC lacrimal gland neoplasm:

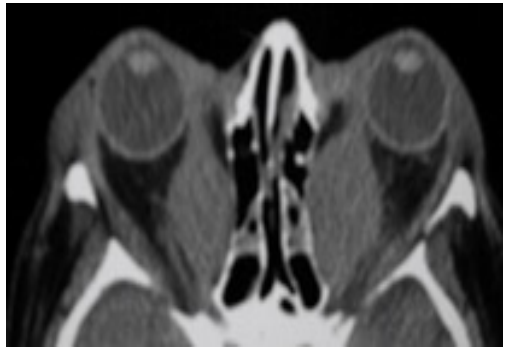


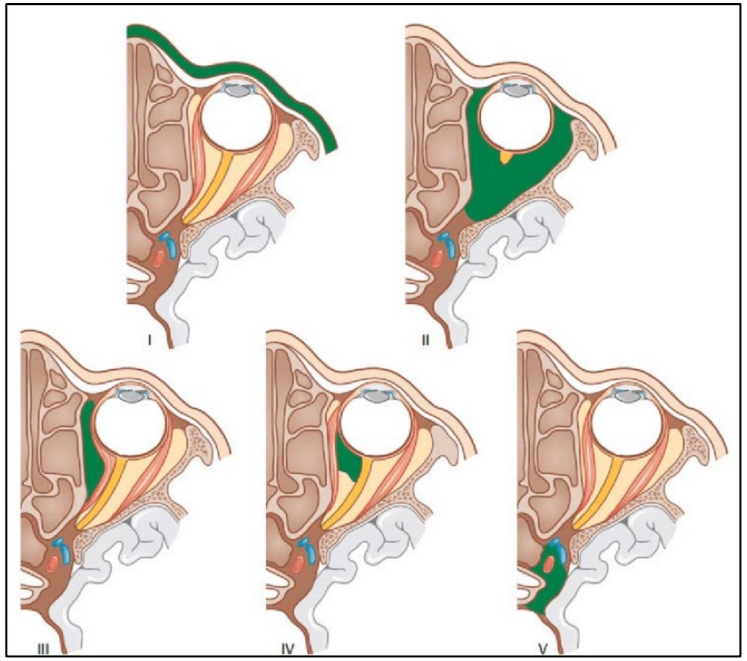


	ORBITAL APEX SX	CST
NERVES		
OPTHALMOPLEGIA		
VISION LOSS		
U/L OR B/L		
CHEMOSIS, PROPTOSIS		
ONSET		









Lacrimal Apparatus

Watering eye

Syringing and probing

Obstruction+

Obstruction-

Hard stop:
Soft stop:

Jones dye test-1

Opacify+

Opacify-

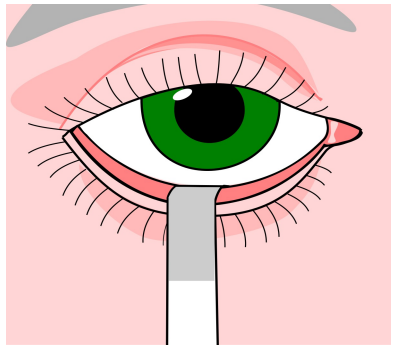
Jones dye test-2

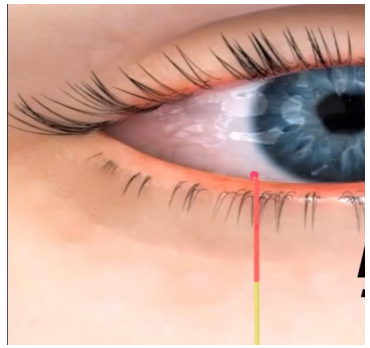
Opacify+

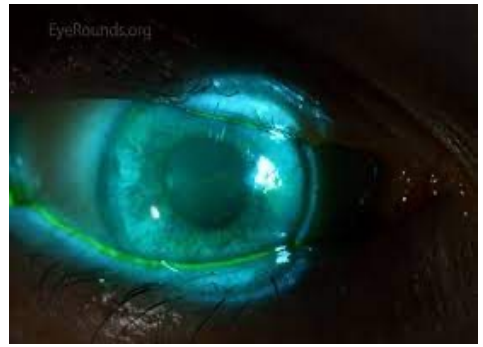
Opacify-

Tear film: Inner-
Middle-
Outer-

Dry eye

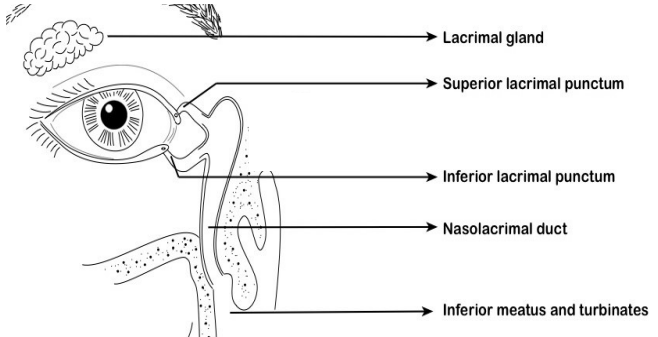






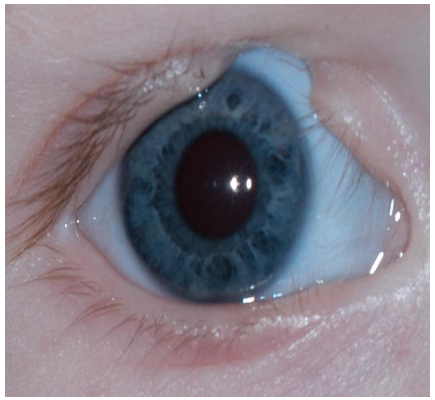
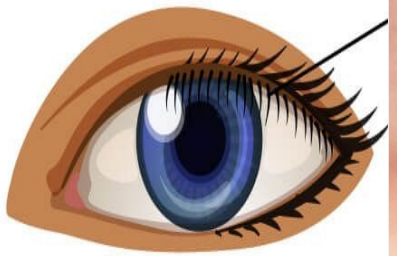
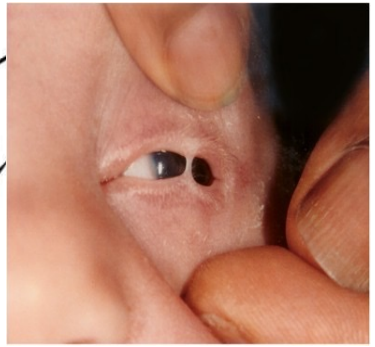
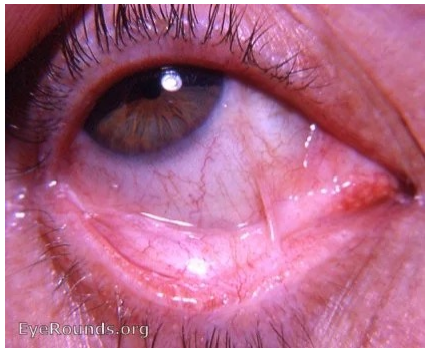
Congenital dacryocystitis: MCC:
Mx:

Chronic dacryocystitis:



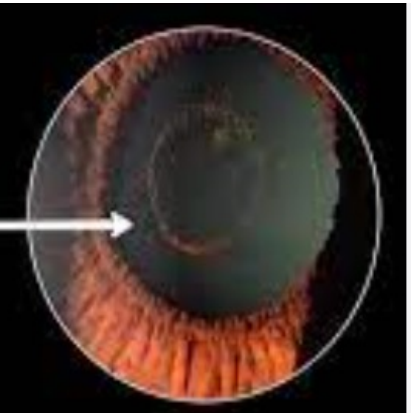
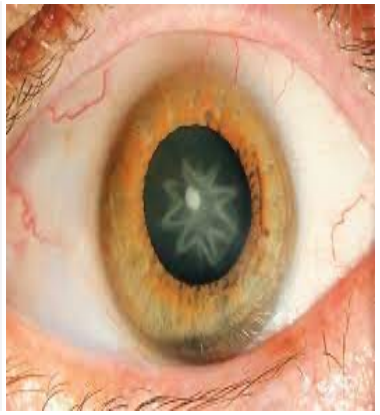
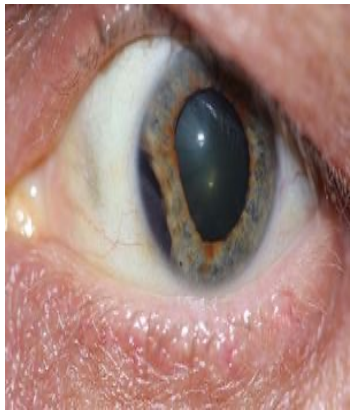
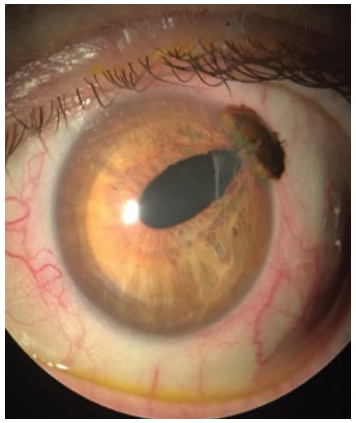
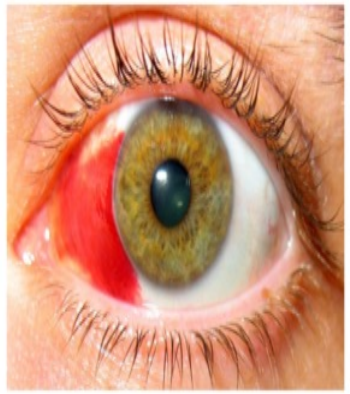
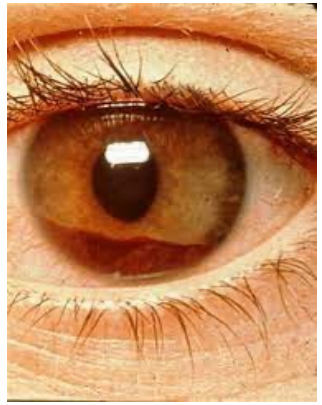
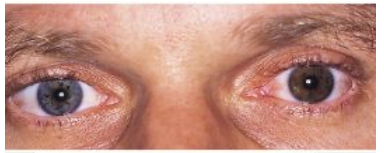
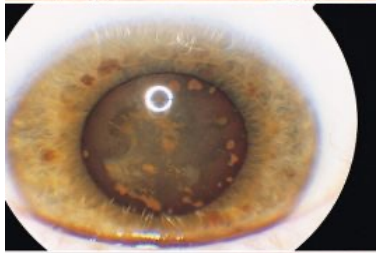
Eyelids

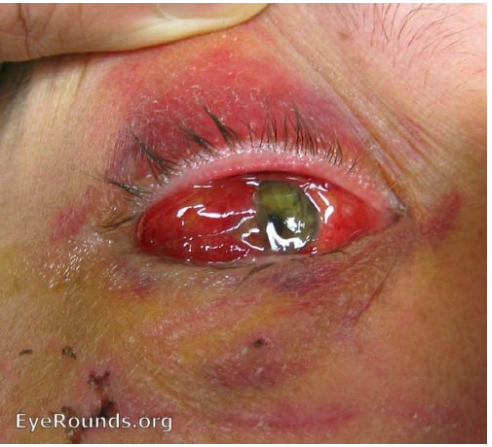


Madarosis:
Ectropion:
Tylosis:

Eye Trauma



Penetrating trauma
Ciliary body
Granulomatous panuveitis in C/L eye in 2 weeks
Dalen Fuch nodules

Hudson-Stahli line
Iron deposition around pterygium:
Iron deposition around filtering bleb:

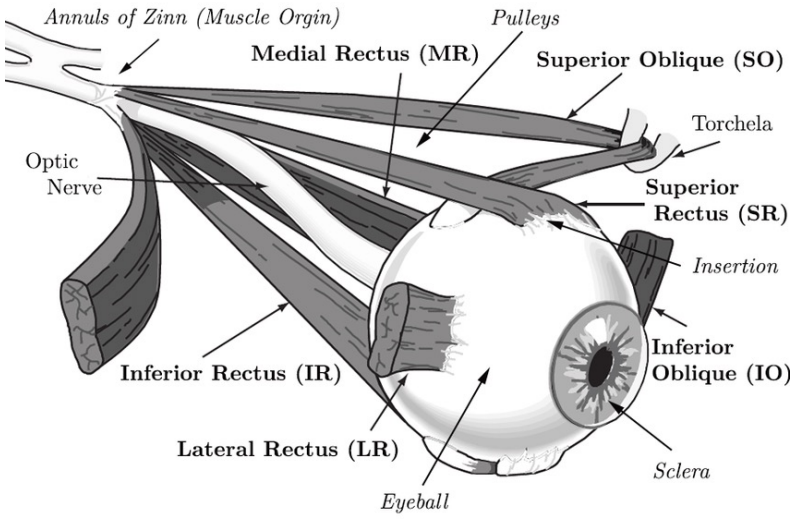
Enucleation

Evisceration

Exenteration

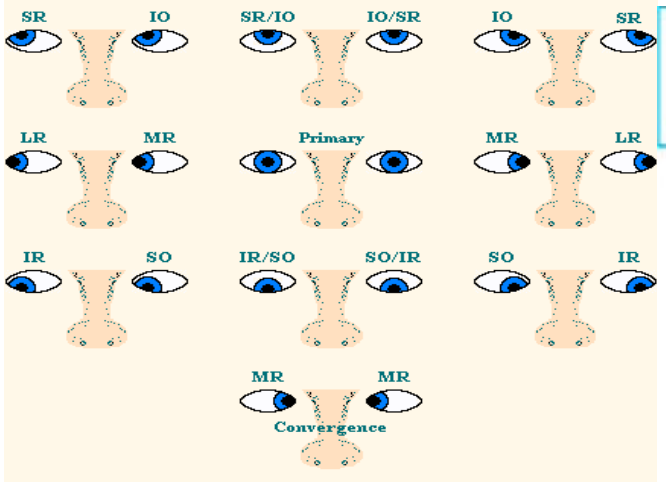
SQUINT – EOM

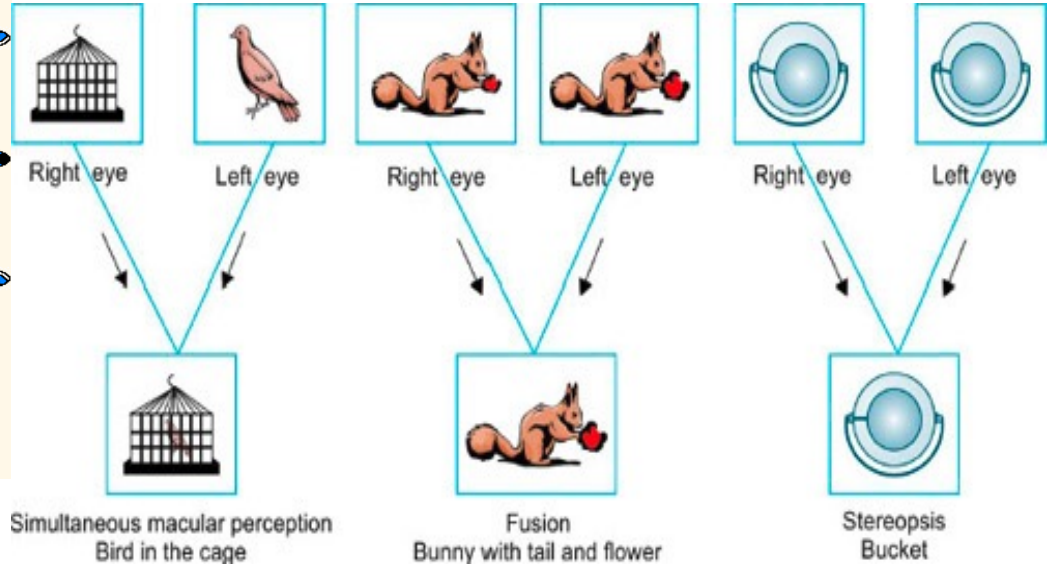
Misalignment of visual axis
Muscle not arising from Annulus:
Longest muscle:



Muscle	Nerve Supply	Primary Action	Secondary Action	Tertiary Action
MR			-	-
LR			-	-
SR				
IR				
SO				
IO				

HERRING:
SHERRINGTON:



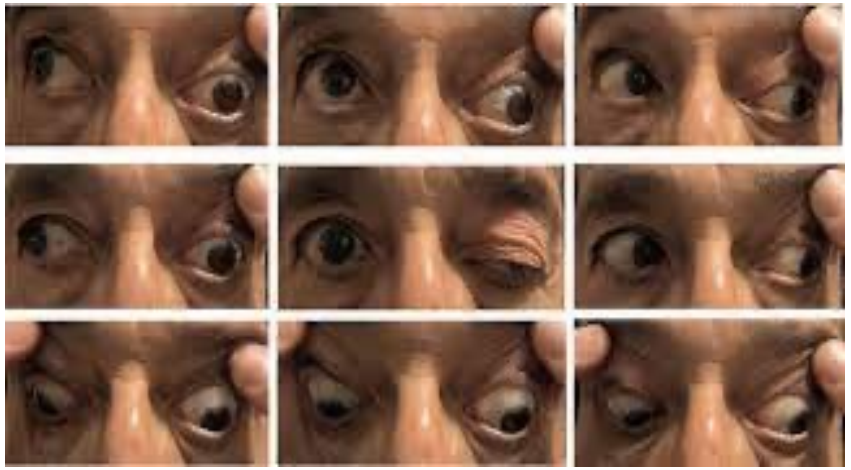


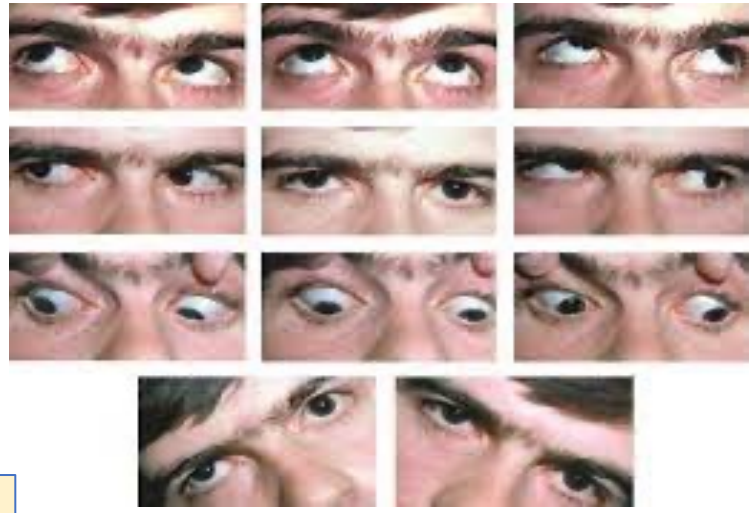
SQUINT – Types

Apparent/Pseudo:
Tropia:
Phoria:
Eso-
Causes:
Exo-
Hyper-
Hypo-

Crossed Diplopia:
Uncrossed Diplopia:

1= 2 deviation:
2 > 1 deviation:
Forced duction test:





Ptosis + dilated pupil:
Ptosis + constricted pupil:
Ptosis + normal light reflex

Park 3 step test

"IGI and ITO"

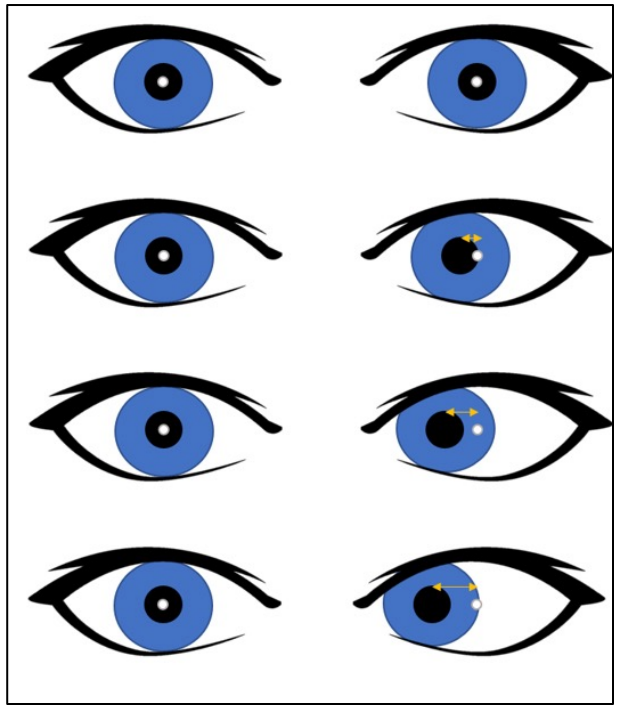
Left hypertropia-Increases on right tilt and right gaze

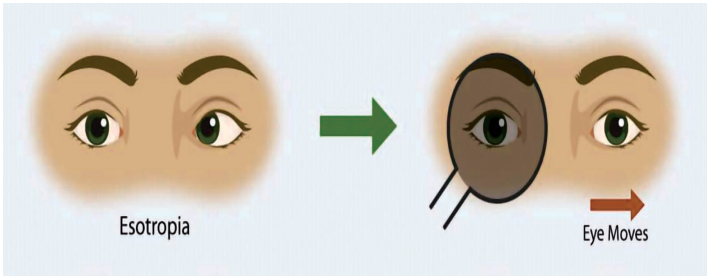
Right hypotropia-Increases on left tilt and right gaze

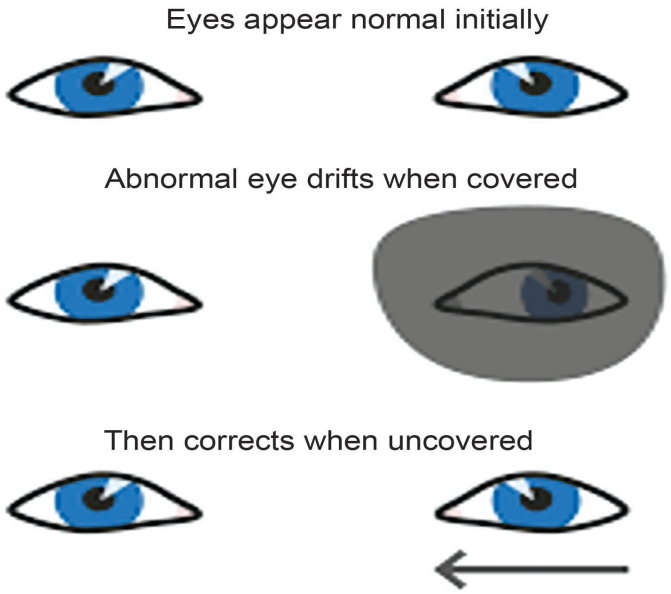
A patient presents with left-sided head tilt which on straightening leads to right hypotropia. This increases on dextroversion and right head tilt. Paralysis of which of the following muscles is involved?

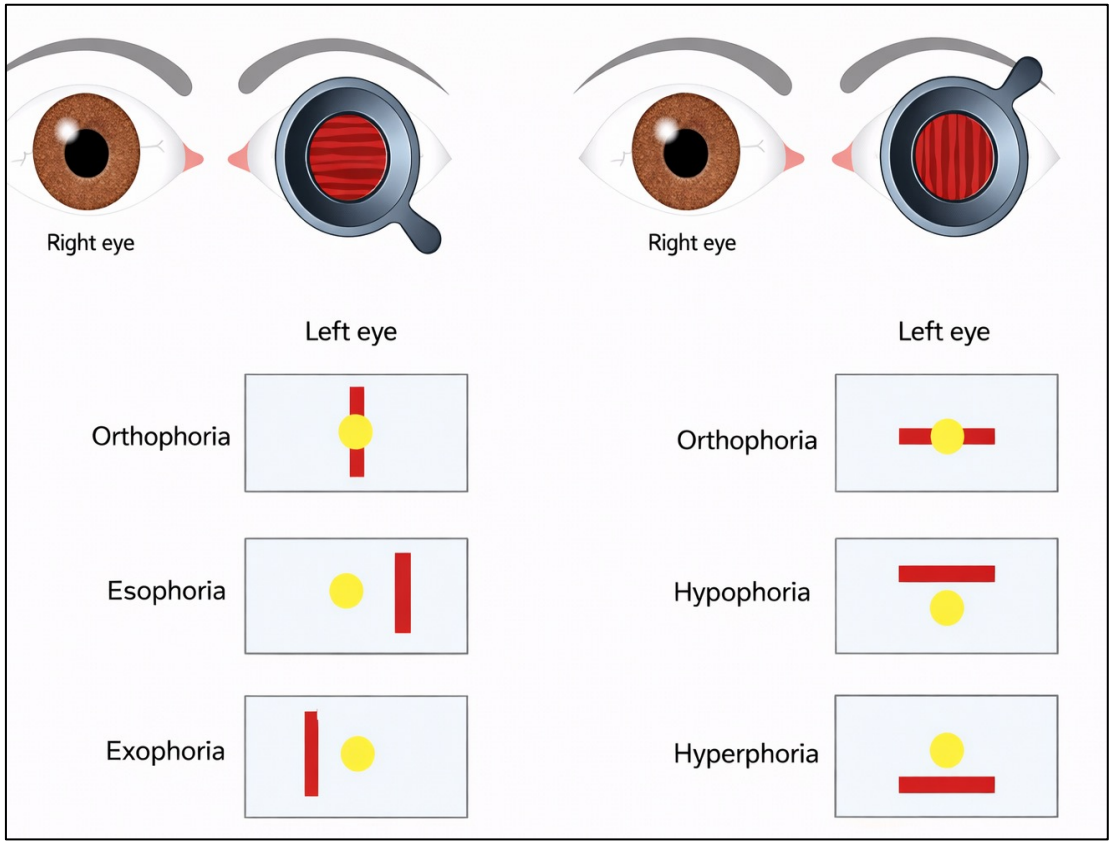
A) Right superior oblique
B) Right superior rectus
C) Right inferior oblique
D) Left inferior oblique

SQUINT – TESTS









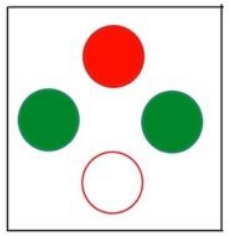
Hirschberg test:
Amount of squint

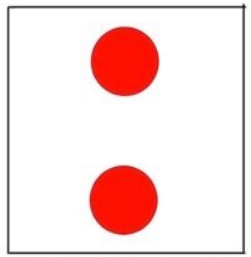
Remove fusion of the two eyes
Lens: Point source -> line perpendicular to axis
Keep Maddox rod // to axis of squint

In a patient of left eye exophoria, Maddox rod was placed in front of the right eye, with its axis horizontal. Patient will see bright spot in relation to the red line as:

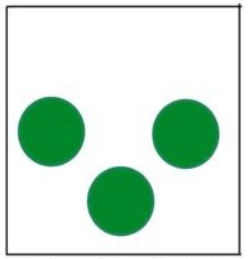
A. Horizontal red line with bright spot above it
B. Horizontal red line with bright spot below it
C. Vertical red line with bright spot right to it
D. Vertical red line with bright spot left to it

SQUINT – TESTS

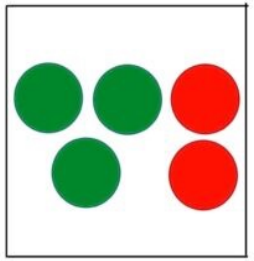




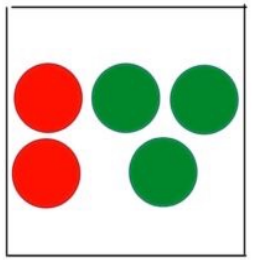
LE SUPPRESSION



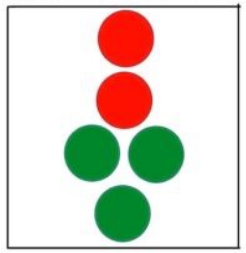
RE SUPPRESSION



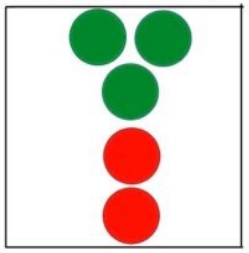
UNCROSSED DIPLOPIA



CROSSED DIPLOPIA

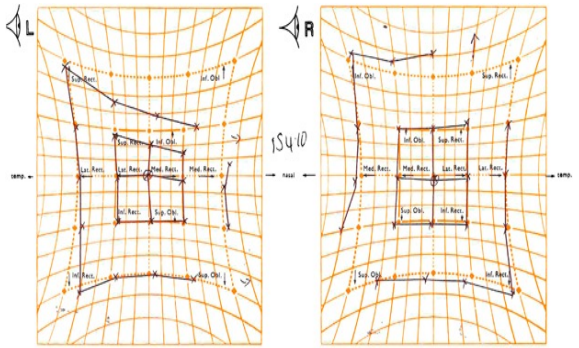


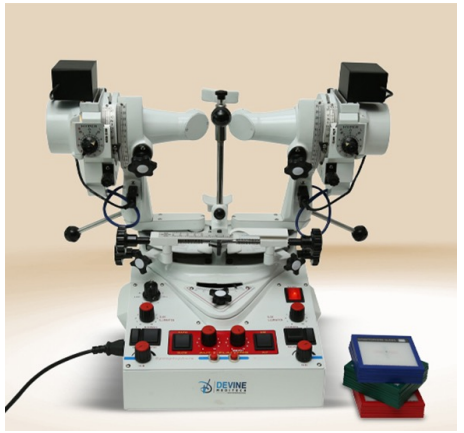
LEFT HYPER DEVIATION



RIGHT HYPER DEVIATION

Most accurate for degree of tropia
Eso: Base
Exo: Base
Hypo: Base
Hyper: Base





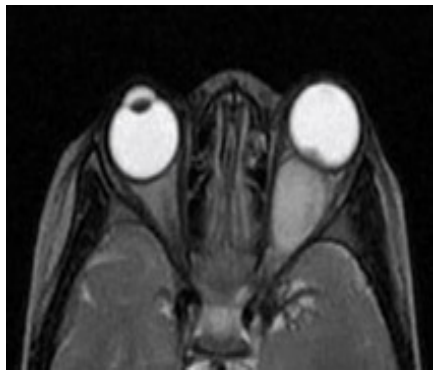
Miscellaneous

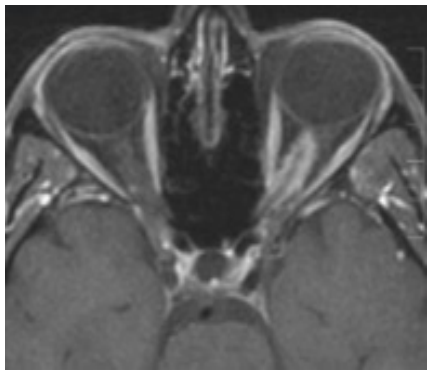
Amblyopia (Lazy eye)
Loss of vision without organic cause
Prevention:
Rx of strabismus: Recession
Resection

Synkinetic phenomenon b/w V and III CN:

Surgery	Levator Action
Fasanella–Servat	Good (Horner's syndrome) Mild ptosis
Levator Resection	Moderate
Frontalis/ Fascia lata Suspension	Poor (Severe ptosis) Congenital/ Marcus-Gunn ptosis

Defective elevation in adduction, normal elevation in abduction

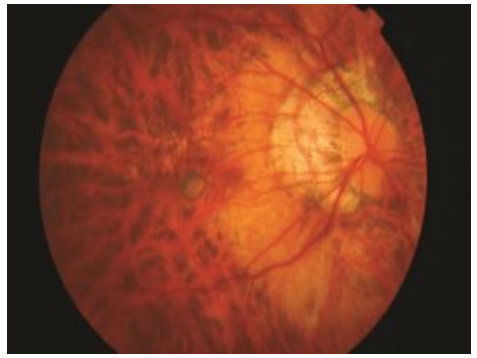




Refractory Errors

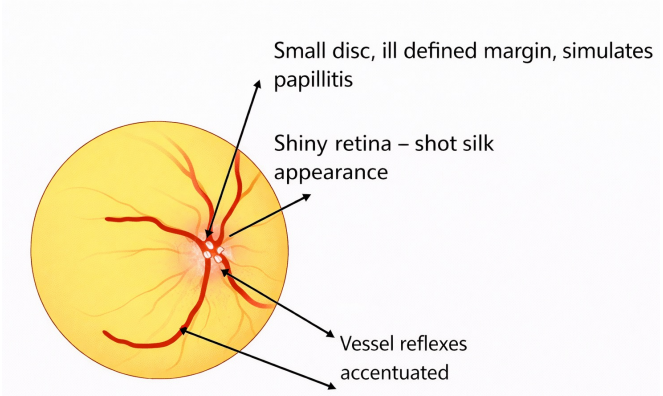
MYOPIA
Axial length:
AC:
Squint:

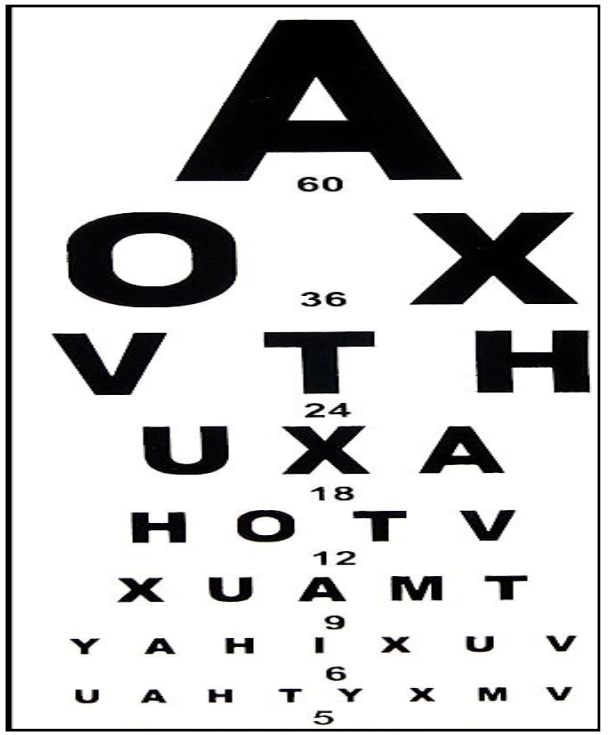
Axial myopia:
Curvature myopia:
Index myopia:
Positional myopia:



Tigroid appearance
Chorioretinal atrophy
Foster Fuch spots
Lacquer cracks
Rhegmatogenous RD
Post staphyloma

HYPERMETROPIA
Axial length:
AC:
Squint:
Aphakia





Treatment of myopia :
Radial keratotomy
LASIK: Laser-Assisted In Situ Keratomileusis
CI: <18yrs, unstable power, CT <450um
SMILE: Small Incision Lenticule Extraction
Phakic refractive lens (PRL)/ implantable collamer lens (ICL)

Each letter subtends angle of 5min of arc when viewed from respective distance

Angle subtended by topmost letter when viewed from 6m:

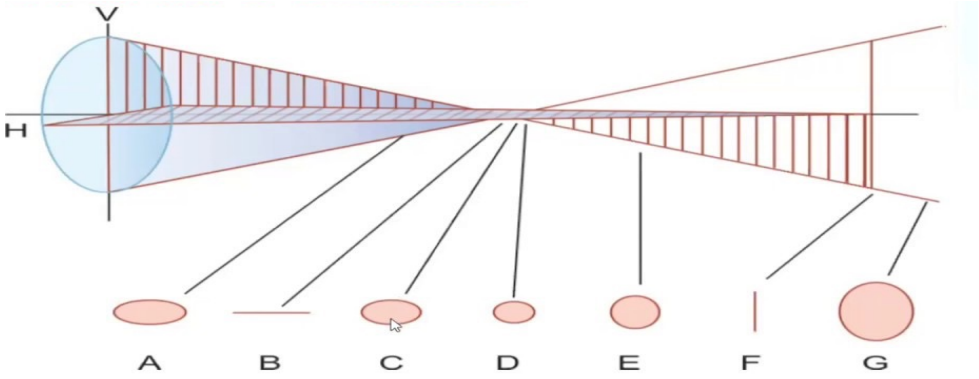
Landolt C chart
ETDRS
Tellers chart, Optokinetic drum

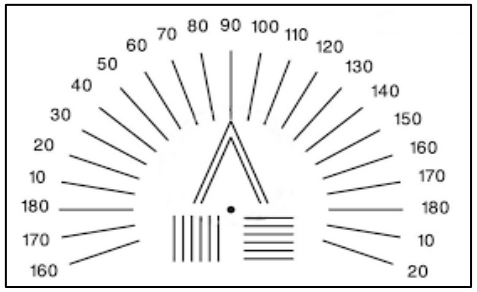
ASTIGMATISM

Unequal curvature of eye in different meridians of the eye

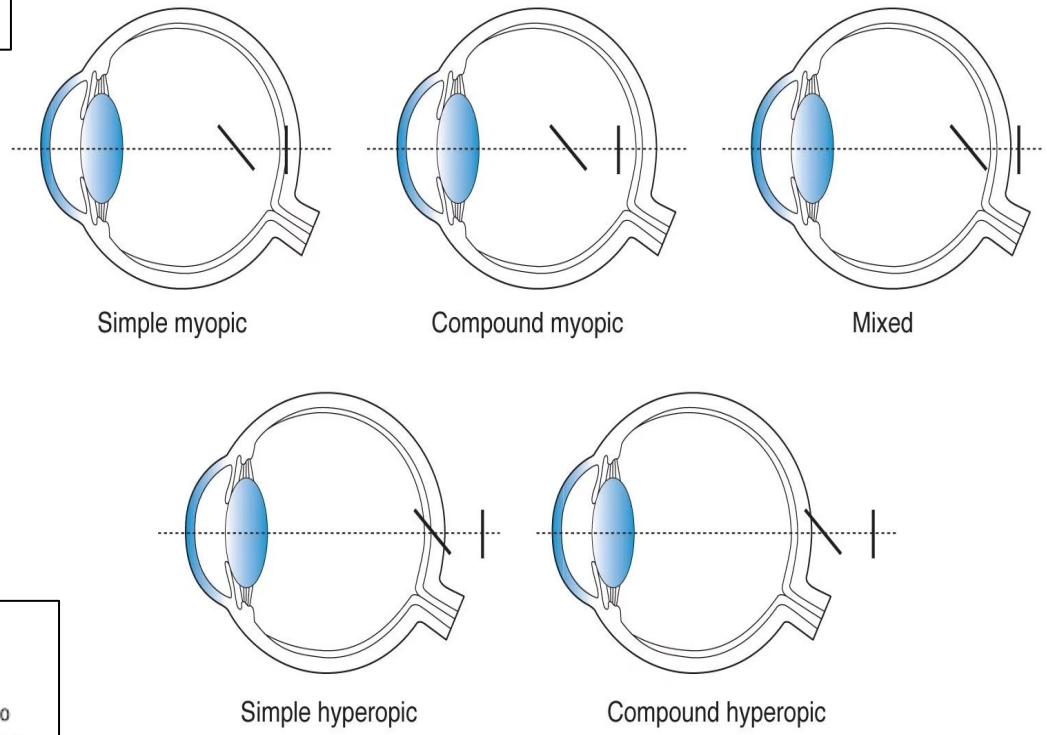
Regular: 2 principal meridians perpendicular to each other

Regular astigmatism		180	90
WTR Vertical more curved			
ATR Horizontal more curved			



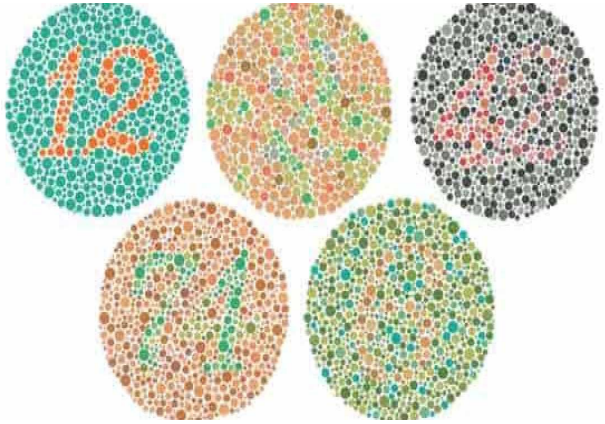


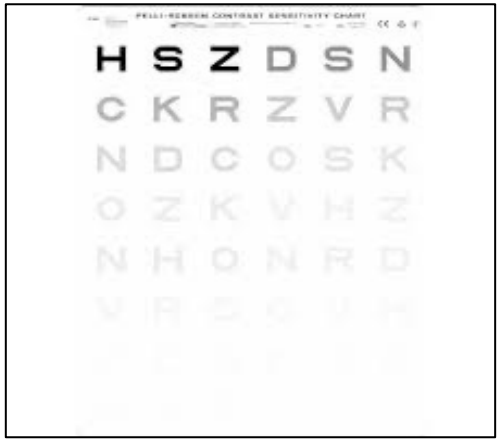
Simple: One meridian emmetropic



-2cyl @180:
-1DS /-2DC @180
-3DS/ -4DC @90:

Miscellaneous





Retinoscopy
Examination distance:
No mvt:
Against:
With:

Prota Deutra Trita
Inheritance:
MC:

Photocoagulation
Double freq Nd-Yag (532nm)
Argon laser

Photoablation
Argon fluoride Excimer (193nm)

Photodisruption
Nd-Yag (1064nm)

Nd Glass (1053nm)

Clinical presentations-Localisation:
Gradual progressive painless DOV:
Sudden painful red eye + DOV:
Sudden painless DOV:
Floaters:
Metamorphopsia:

GTCS

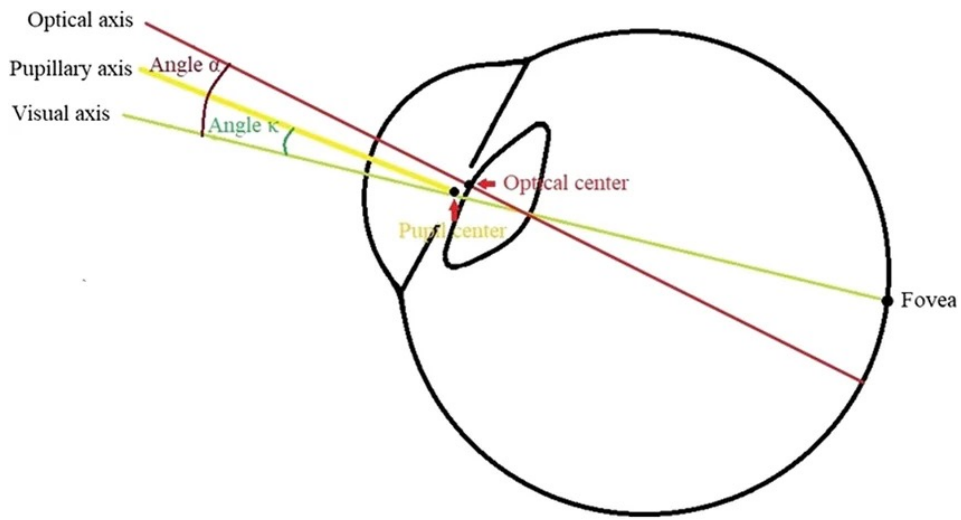
Asteroid hyalosis

Synchysis scintillans

≥ 6/18
< 6/18 – 6/60
< 6/60 – 3/60
< 3/60 – 1/60
< 1/60 – LP+
NLP

Eye drop -> ointment

Chemical injury to eye:



Alpha – between visual axis and optical axis
Gamma – between fixation axis and optical axis
Kappa – between visual axis and pupillary plane