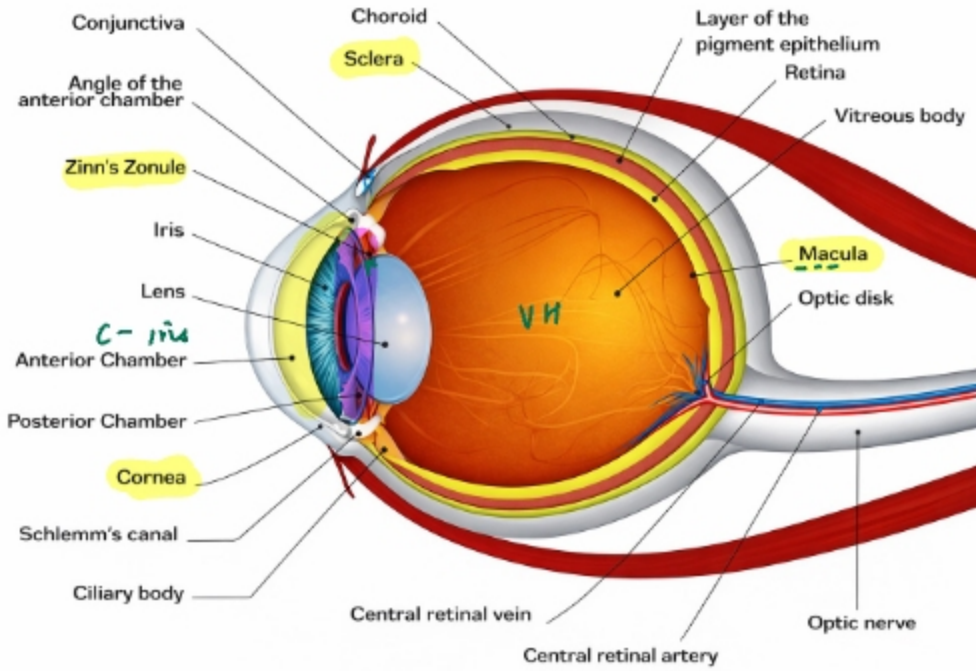


# OPHTHALMOLOGY

---

# Basic anatomy and embryology



surface ectoderm

**Lens**  
**Epithelium-Cornea, conjunctiva**  
**Lacrimal gland**

Neuro-ectoderm

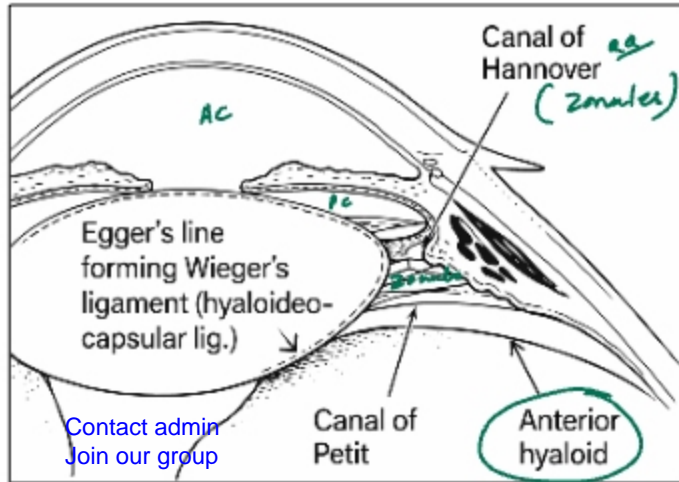
**ON**  
**Retina**  
**Iris and CB epithelium**  
**Sphincter, dilator pupillae**

NC cells

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

all germ layers

**Vitreous**



**Lamina Fusca** LA - lignocaine  
**Sclera proper**  
**Episclera** → subtenon = Nozite  
**Tenon capsule** → subconj space  
**Conjunctiva**

**Retrobulbar:** intracanal  
**Peribulbar:** extracanal space

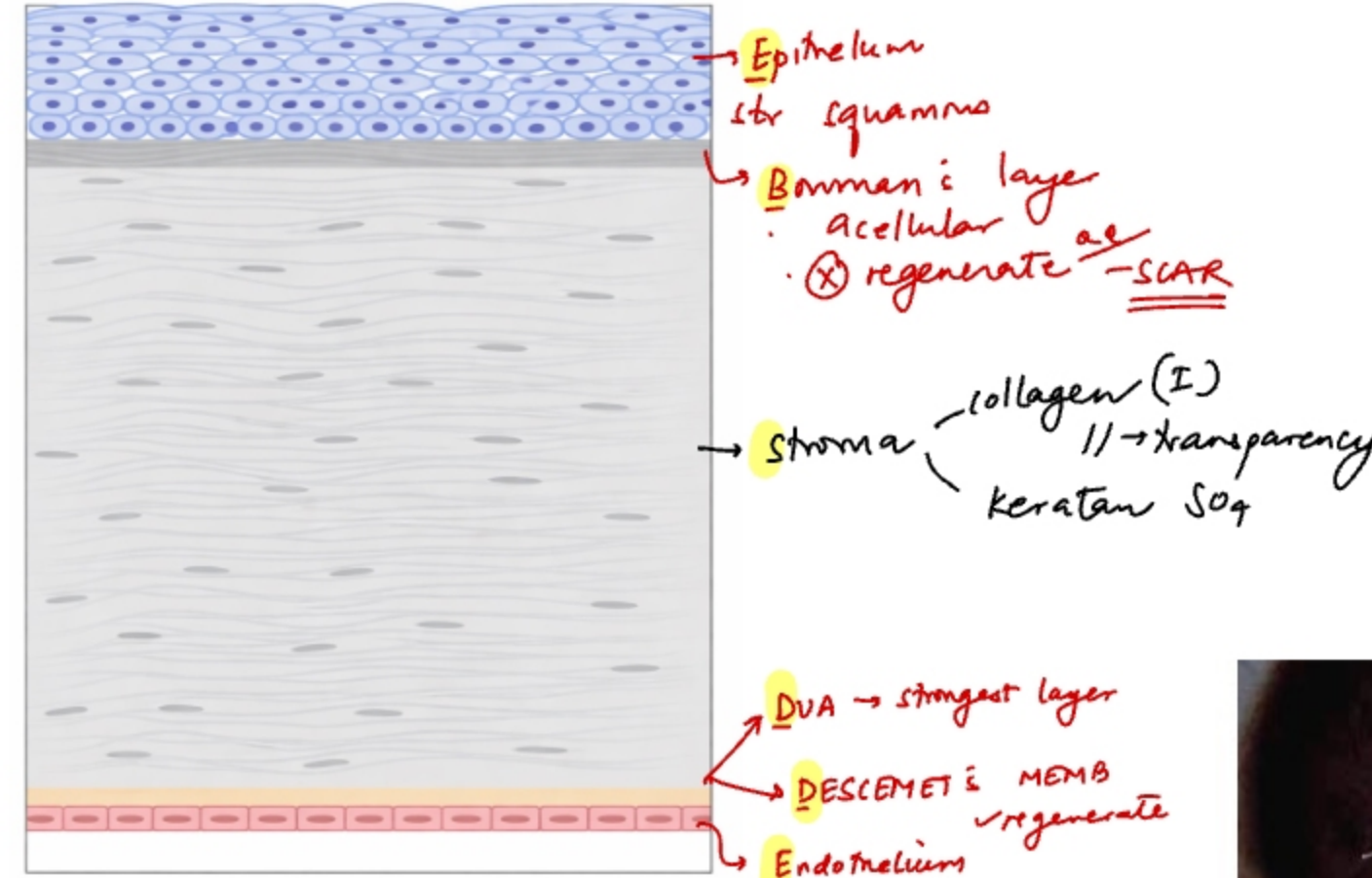


**Axial length:** 25mm  
**AC depth:** 2.5mm  
**Anisometropia:** > 2.5D difference  
**At birth:** +2.5D Hypermetropic  
**Total Refractive power:** 60D  
**Cornea** 45D  
**Purkinje images** 4

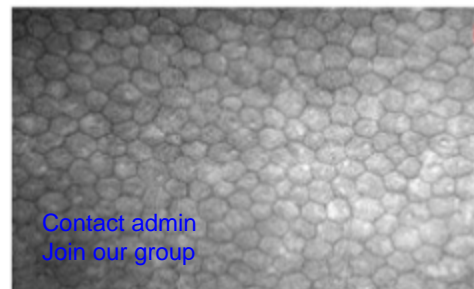
ALL VA - bys  
 Corneal diam -  
 Zya



# Cornea



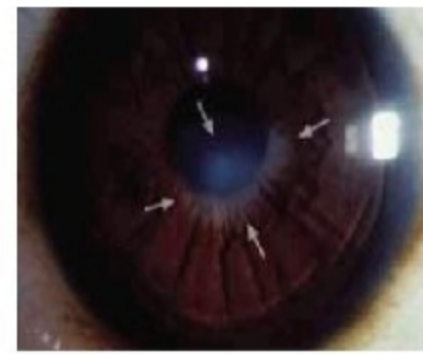
(N) 2500-3000/mm<sup>2</sup>  
 specular microscopy  
 |  
 < 500 - Bullous keratopathy  
 ↳ metab active  
 ↳ Na-K<sup>+</sup> ATP ae  
 ↳ dehydrated



Avascular - x HLA matching  
 Corneal blink reflex: aff: VI efferent: VII

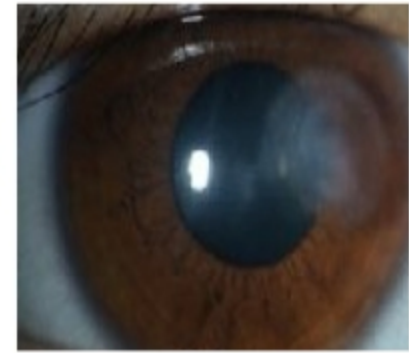
Corneal Anesthesia: HDL + B blocker  
 HSV-1 ↓ DM → leprosy (tropical)

Interstitial keratitis: · Cogan Sx : IK + SNHL  
 · Cong syphilis : IK + SNHL  
 · granulomatous → leprosy / TB / sarcoid



**Nebula**

i ✓  
 p ✓



**Macula**

i x  
 p ✓



**Leucoma**

i x  
 p x

# Cornea Investigations



Pachymeter

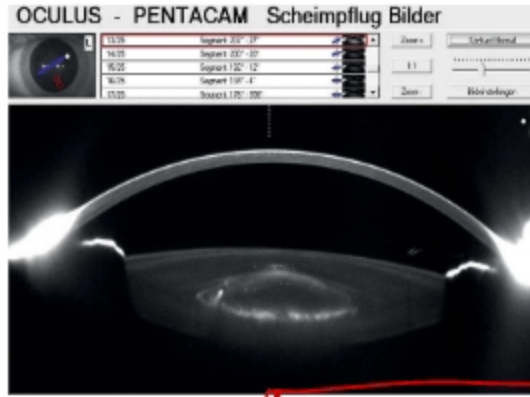
Corneal Thickness  
520 - 540  $\mu$ m

• LASIC prior  
• prior to IOP  
CT  $\downarrow$  - underestimate IOP

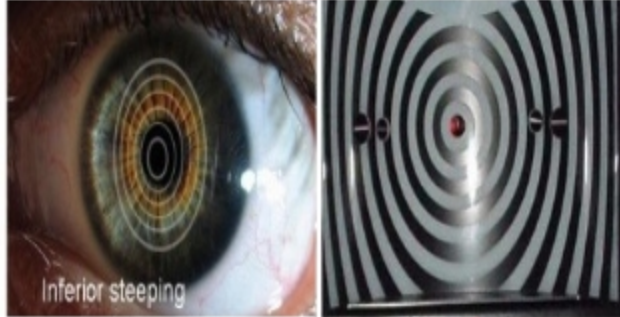


Keratometer

Corneal Curvature



Pentacam



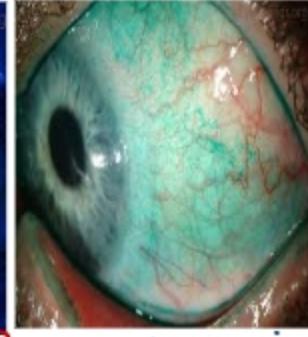
Placido disc  
 $\downarrow$   
corneal surface



Fluorescein

- ✓ Corneal ulcer base
- ✓ Goldmann tonometer
- ✓ Siedl's test
- leak of aqueous

COBALT BLUE



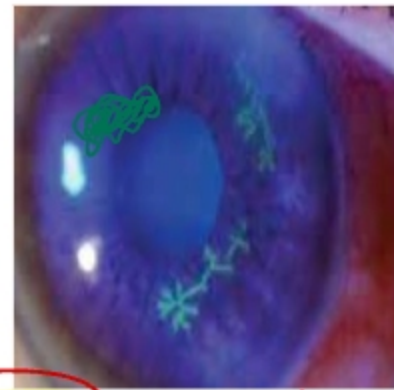
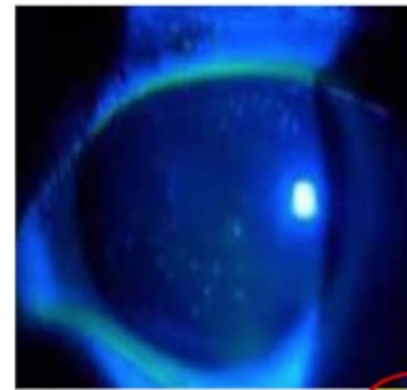
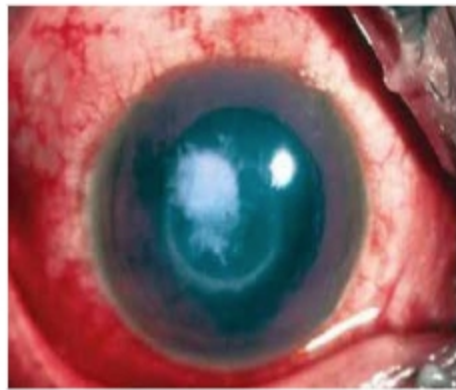
Lissamine green



Rose bengal

dead cells.  
 $\downarrow$   
LAST - stings

# Cornea Infections



**Hypopyon:**  
Sterile, mobile - Bacterial  
**Asterile, immobile - Fungal**  
**Ulcer serpens:** *Pneumococcus*

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

**Acanthameba**  
- Ring abscess  
- **Pseudo-dendrites**  
- H/o contact lens misuse  
- **PAIN!!** <sup>ee</sup> - perineuritis  
- Stain: Calcofluor white

SPK  
superficial punctate keratitis  
dendritic ulcer  
geographic ulcer  
R - Acyclovir

**Stromal / disciform keratitis**  
steroids + acyclovir

*Pseudomonas* → CL users  
↳ perform r/o

physical findings > pain

R - Natamycin  
≅ cycloplegia  
Latropine

R - PHMB

Bacteria - invade intact cornea:  
- *Neisseria*  
- *Corynebacterium*  
- *Listeria*  
- *Haemophilus*

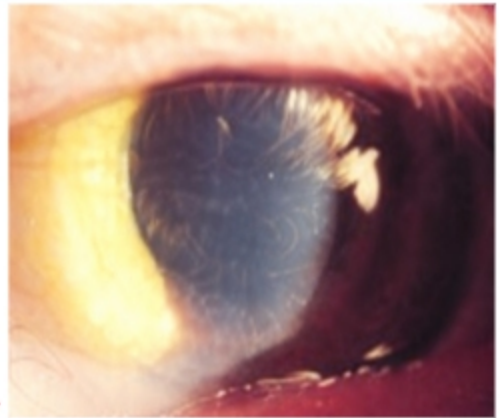
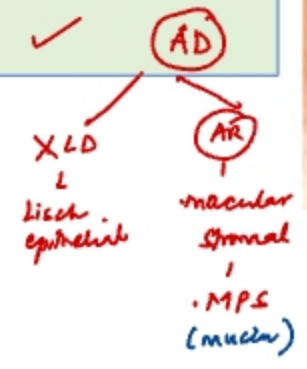


VZV - Herpes zoster ophthalmicus  
↓  
V3

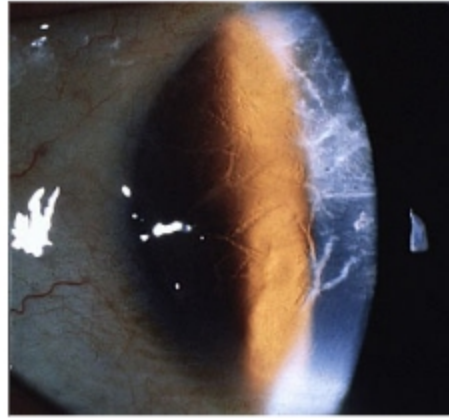
Hutchinson sign:  
→ tip of nose

# Corneal Dystrophies

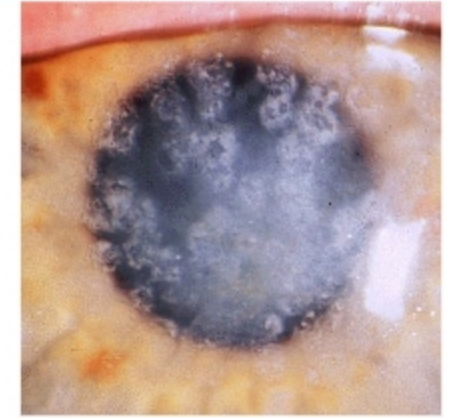
Inflammatory? *No*  
 Progressive? *✓*  
 B/L? *✓*  
 Inherited? *✓*



*finger print*  
*Cogan's epithelial*



*Lattice*  
*↓*  
*amyloid*



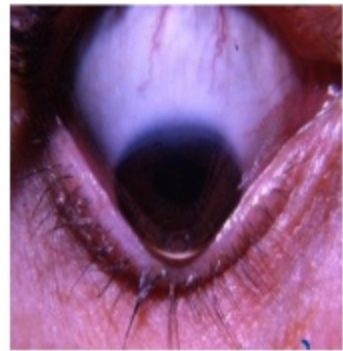
*Bread crumb*  
*Granular*  
*↓*  
*Hyaline*

*stromal*

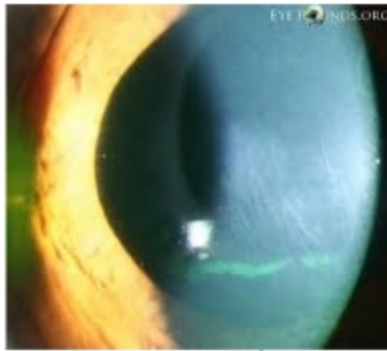


*BSK*  
*Band shaped keratopathy*  
*Ca<sup>2+</sup>*  
*Bonnan's layer*  
*↑ Ca<sup>2+</sup>*  
*post-lveitis*  
*↓*  
*JIA*  
*Rp - EDTA*  
*Chelator*

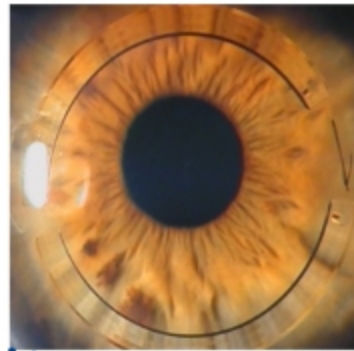
# Other corneal-scleral pathologies



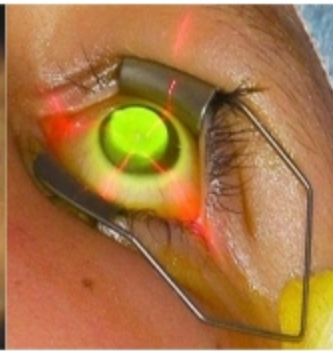
Munson sign



Vogt's - vertical  
DM  
disappear on pressure



R - INTACS



C3R  
Collagen  
cross-linking  
riboflavin



Scleritis



Episcleritis

Keratoconus



curvature myopia

Pain:	✓	-
2.5% phenylephrine:	-	blanch
Association:	RA	⊖

KCS > scleritis

Irregular myopic astigmatism

Munson sign

Vogt's striae

Fleischer ring - Fe - epithelium

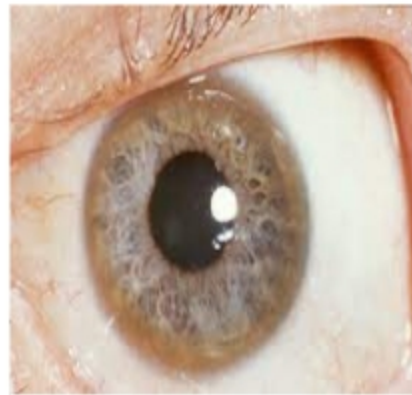
Pseudo-Fleischer ring: Hypermetropia

Rizutti sign

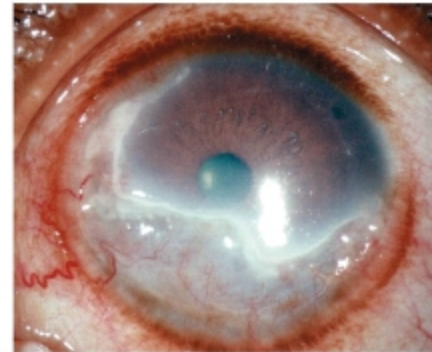
Oil droplet ("Charleaux" sign):

optalmoscopy

Scissoring: Retinoscopy



KF rings - Cu - DM  
↳ Wilson's



"serpiginous ulcer"  
creeping  
Autoimmune disorder  
MOOREN'S ULCER

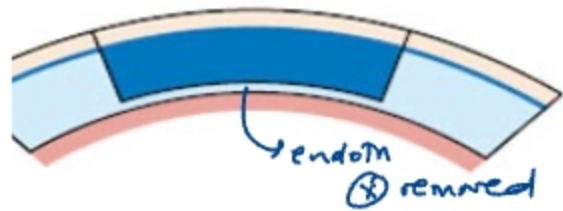


RA  
Scleromalacia  
perforans  
D/O → Staphylococcus

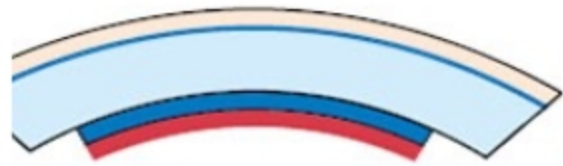
# Keratoplasty trauma / ulcer / dystrophy / BK



PK - penetrating keratoplasty



DALK - deep ant lamellar keratopl

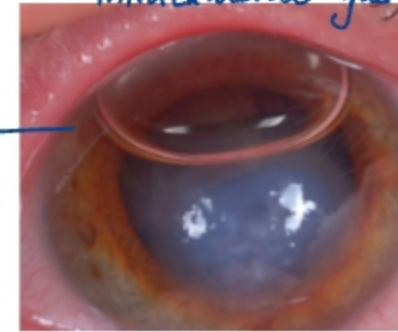


DSEK - Descemet stripping & endothelium keratoplasty

SF6 / C3F8

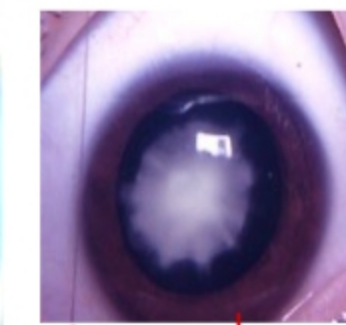
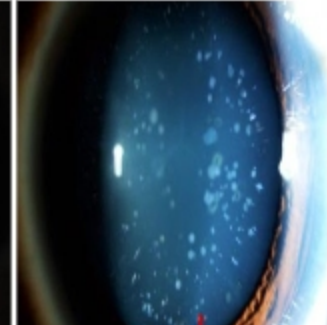
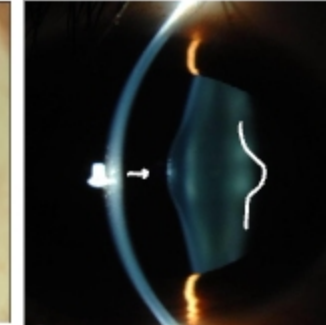
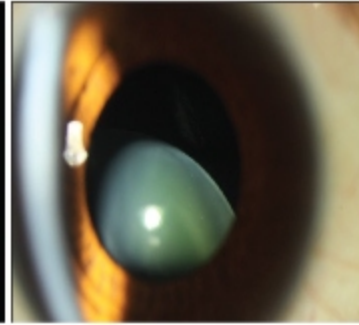
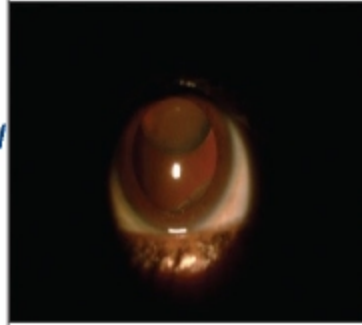
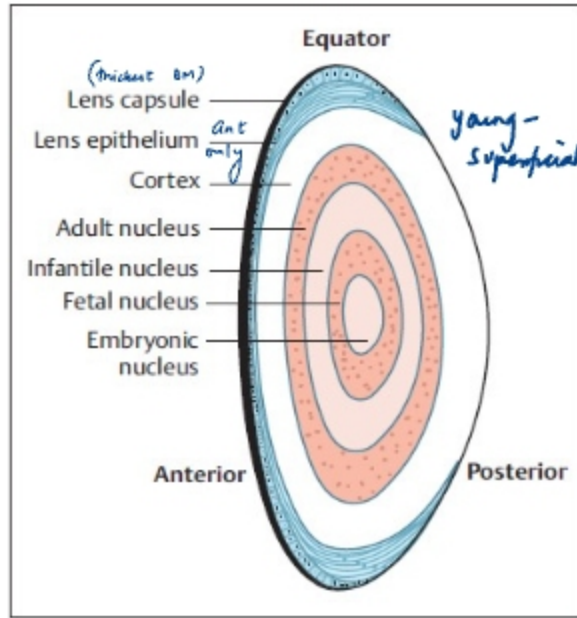
Intracameral gas

Keratoconus  
↓ DM tear  
↓ Corneal hydrops



McCarey Kauffman medium : 48-72h  
Nylon sutures  
Kayes dots: Subepithelial  
Khoda-daust line } reject

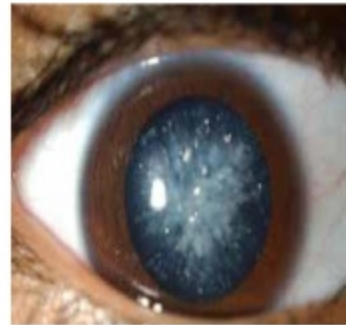
# Lens



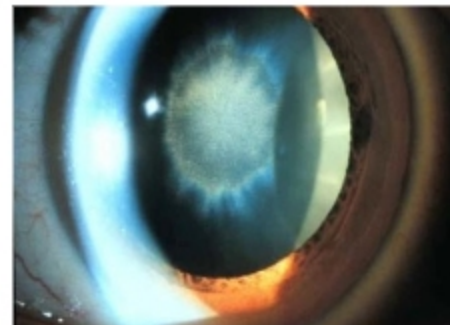
**Superotemporal:** Marfan  
**Inferonasal:** Homocystinuria  
**Microspherophakia:** ant positional myopia  
 Weil-Marchesani Sx

ant lenticulous → AL post  
 post → Lowe's Sx  
 BLUE DOT (mc)  
 Congenital (cataract) Lamellar Zonular "rider"  
 • mc VI  
 • ass 2 vickets

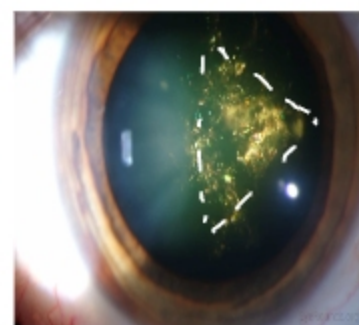
**Patellar fossa**  
**Avascular**  
**Refractive index-1.41 - N 1.38- C**  
**Water soluble = crystallins**  
**MC:  $\beta$  Largest:  $\alpha$**   
**HM1,2 - Water soluble**



Snowflake - DM - Sorbitol



Sunflower  
 |  
 • Wilson's  
 • Chalcosis



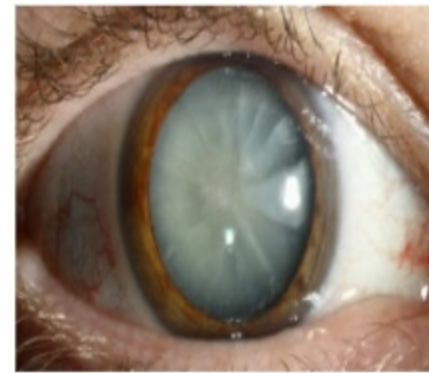
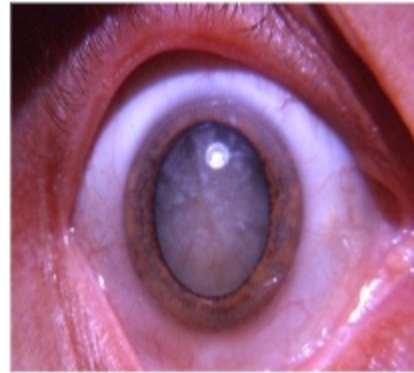
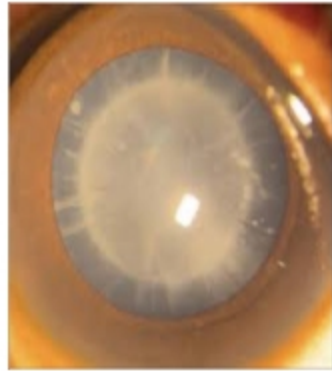
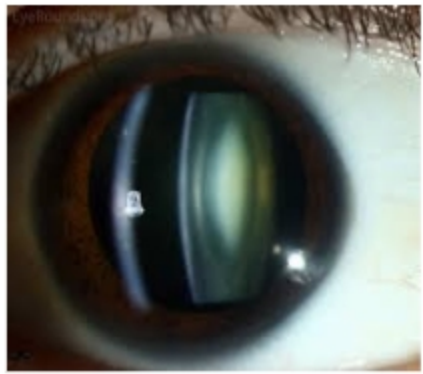
CTG  
 19  
 AD  
 Christmas tree  
 Cataract  
 |  
 Myotonic D



Pseudo-exfoliation  
 Sx  
 - elderly  
 - degen  
 - "Hoarfrost sign"

**Fluctuating myopic shifts:**  
 DM "osmotic imbalance"

# Cataract



Nuclear cataract  
"Second sight"  
LOV Day > night

Cortical -  
"Cuneiform"  
Index myopia  
night > day

Immature →  
✓ IS  
✓ cortex spared

Mature  
x IS  
x cortex

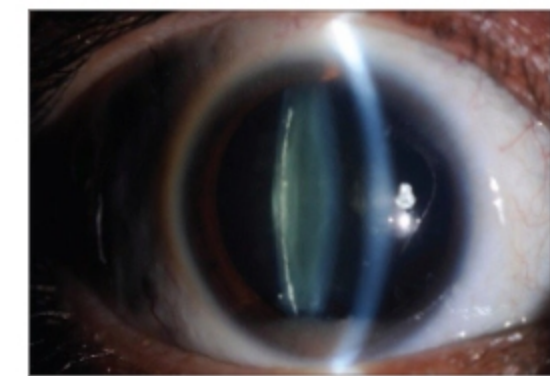
Hypermature  
OR  
Morgagnian  
cx liquefied  
Sclerotic  
cx absorbed

Phacomorphic glaucoma - Intumescent stage - shallow AC -  $ACG^2$   
Phacolytic glaucoma  $2^{\circ}$  OAG - deep AC  
Phacotoxic glaucoma  
Phacoanaphylactic uveitis } Capsule x intact

Polychromatic lustre / Breadcrumb: Complicated cataract  
MCC: uveitis  
Glassblower's cataract: IR rays  
Steroids NF2  
Shield-like: atopic dermatitis  
Amiodarone Chlorpromazine Au } Ant subcaps



Coloured haloes  
Coneal edema  
ACG  
↓  
haloes persist  
Cataract  
↓  
haloes break



Post subcapsular type  
Difficulty in bright light  
Glare

# Cataract surgery

## ECCE:

Conventional- 7-8mm

✓ SICS- 5-7mm - sclerolamellar tunnel

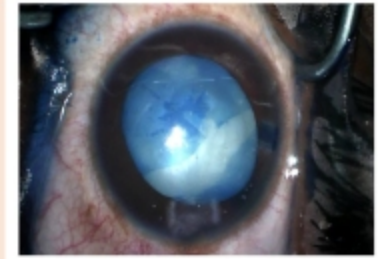
Phacoemulsification- Piezoelectric crystals 3-3.5mm clear corneal incision

MICS- 1.8mm

FLACS- Femtolaser : Nd:YAG 1054nm 40kHz

## Intra-op:

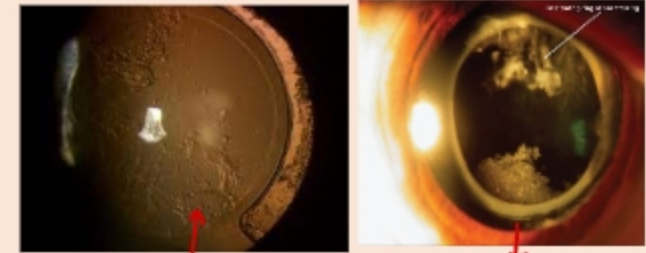
- Posterior capsular rupture
- Vitreous loss
- UGH *uveitis - glaucoma - hyphema*
- Expulsive choroidal hemorrhage



*Argentinean flag sign*

## Post-op

- PCO (mc)
- Rx: Nd:Yag 1064nm
- Endophthalmitis
- TASS *aa* - visco-gel
- Irvin Gass syndrome - CME delayed
- IOL displacement
- ✓ Endophthalmitis:
  - MCC early onset-CONS Late onset(>6weeks)- P.acnes <sup>2/</sup>
  - Rx: Intravitreal Ab  $\rightarrow$  Vitrectomy  $\rightarrow$  Enucleation



*Elschnig pearls > Sommering*

*(X) role of systemic Ab*

# Cataract Instruments



TOPICAL

Dur: 10-20 min



eyelid speculum

povidone iodine  
conjunctional sac



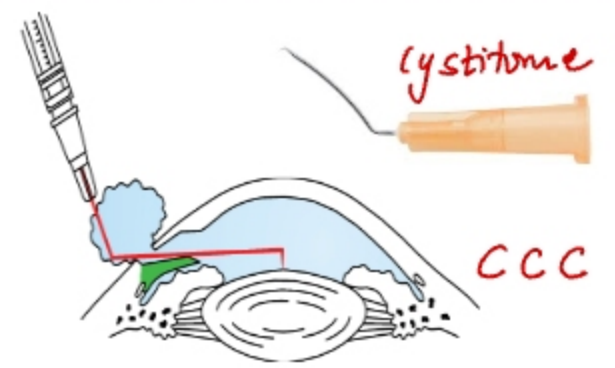
SR holding forceps



Keratome - corneal incising



MVR - side port



cystitome

CCC

Trypan blue: ant capsule



Wire vectis



Simcoe's irrigator &  
suction cannula  
Hydrodissection - Hydrodebrication



IOL holder



IOL dialer

Rigid IOL  
PMMA



Soft IOL injector

HEMA



AC-IOL



PC-IOL

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

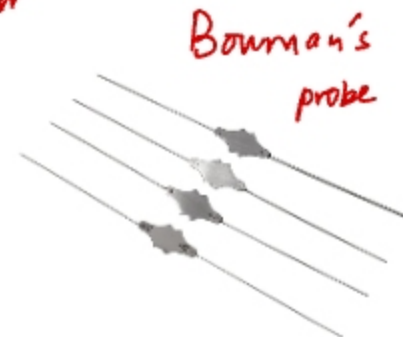
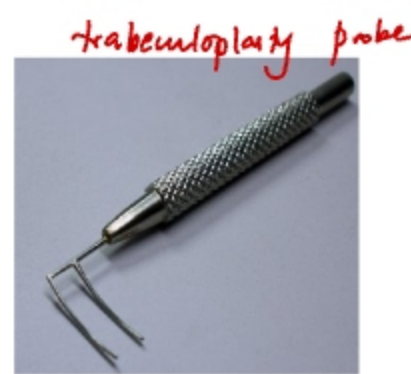
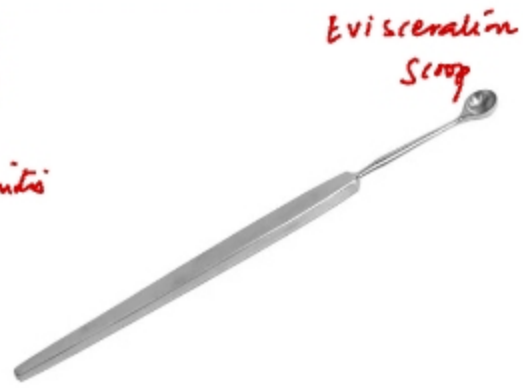
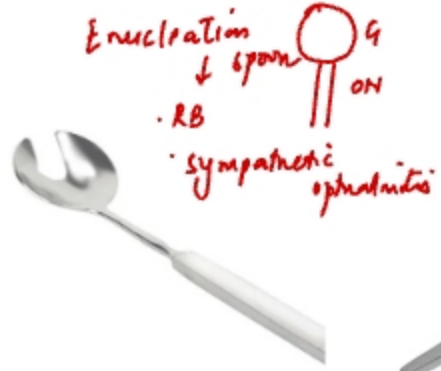
Keratometry

A-scan

long Axial length



# Instruments



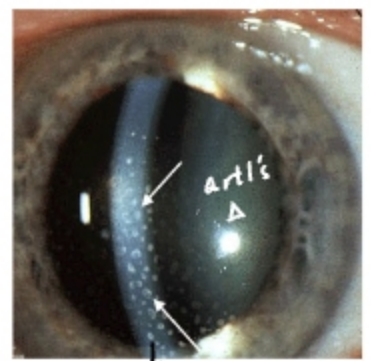
# Uveitis

Iris+ pars plicata - Ant uveitis - PAINFUL ↑↑ + RED

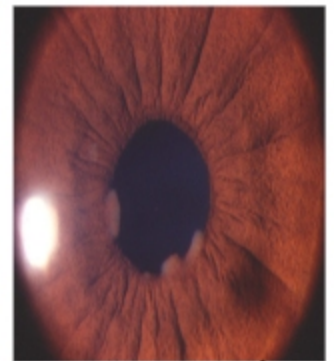
Management: steroids + cycloplegics

Pars planitis - Intermediate uveitis

Chorio-retinitis - Painless xx



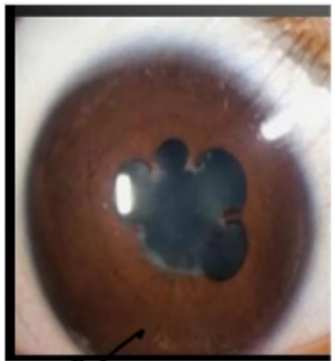
KPs  
Keratinic ppt  
Ant



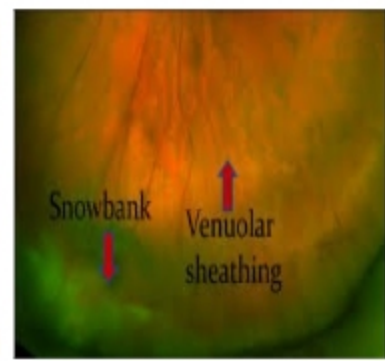
Koeppe's nodules  
pupillary margin



Busacca's nodules  
iris stroma



festooned pupil  
synechiae



- snowbanking  
- venular sheathing



Fuchs  
FHI  
V/L  
- recurrent uveitis  
- painless  
- complicated cataract



Mutton fat- Granulomatous - TB / sarcoid / Leprosy / Syphilis

Fine granular- NG = Lymphocytic → CTD → Behcet's / ank spond

Pigmented- JIA

Stellate- HSV / Toxo / FHI = Fuchs' heterochromic iridocyclitis

Amsler sign:

paracentesis - AC - bleeding

(X) synechiae

Suiguira sign

VKH - Vogt's Sx

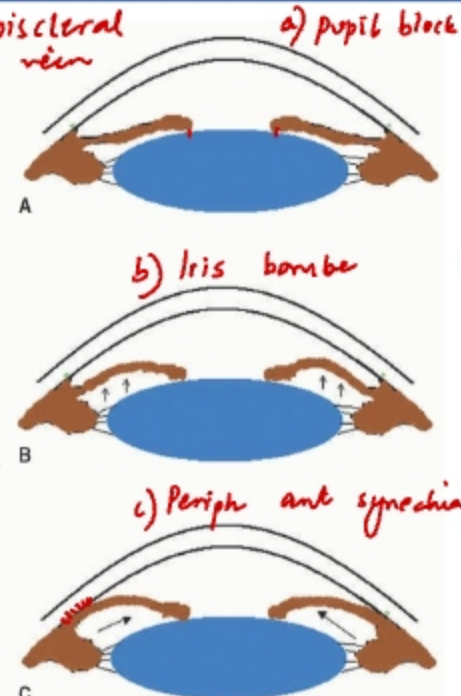
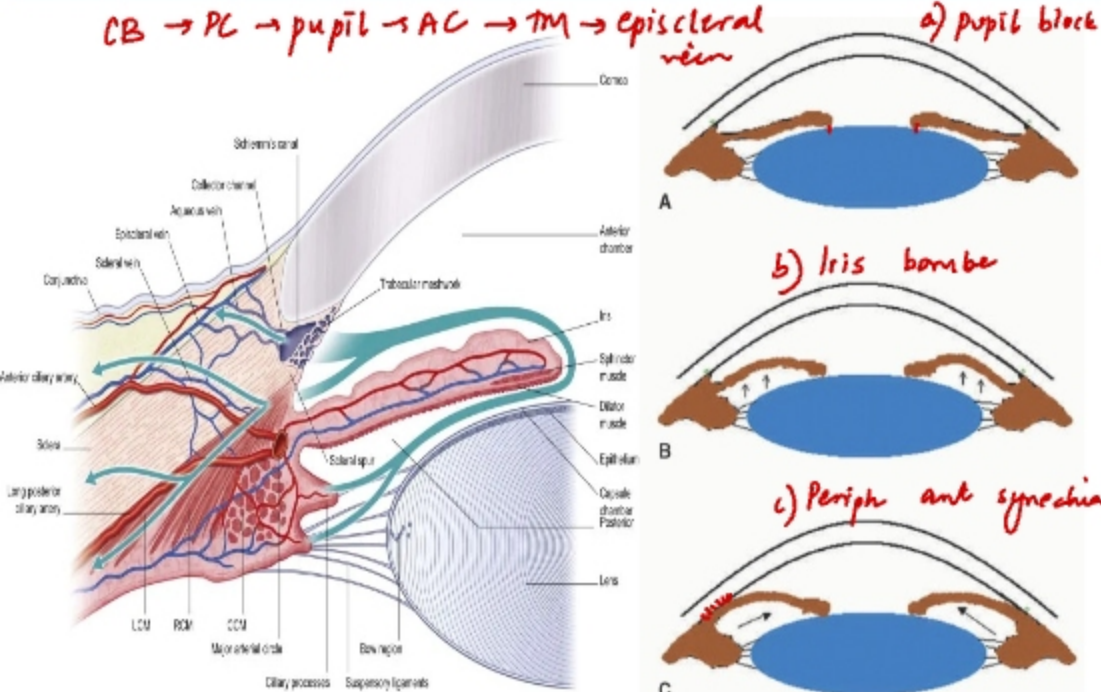
- melanocytes
- meninges
- B/L granul paraneoplastic

HLA DR4

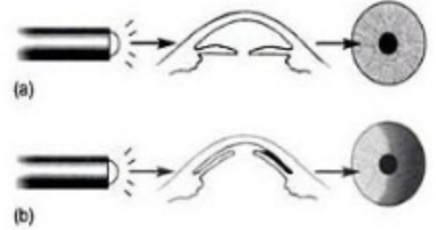
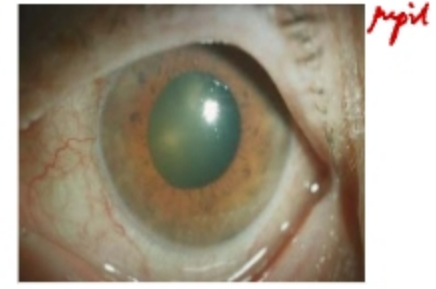
# Glaucoma

fixed mid-dilated pupil

CB → PC → pupil → AC → TM → episcleral vein

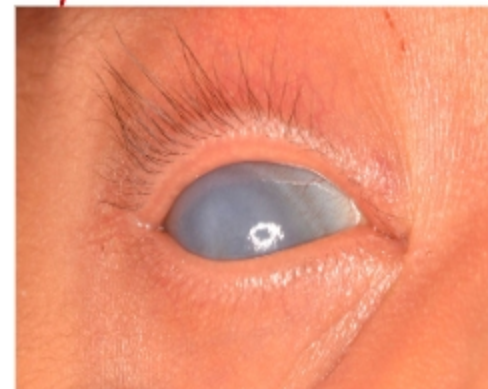


**Angle Closure Glaucoma** acute painful LOV  
 AC: shallow (vs OAG: deep AC)  
 VOGT Triad:  
 Glaucomflecken (anterior subcapsular opacity)  
 Iris atrophy  
 Pigment dispersion on endothelium  
**Management of ACG:** ATROPINE CI  
 Acetazolamide  
 Mannitol  
 Pilocarpine  
 Surgery: Peripheral <sup>B/L</sup> iridotomy Nd Yag 1064nm  
**POAG:** DRUGS → <sup>B/L</sup> Laser trabeculoplasty



gradually progressive <sup>B/L</sup> painless Nd Yag 532nm double fog

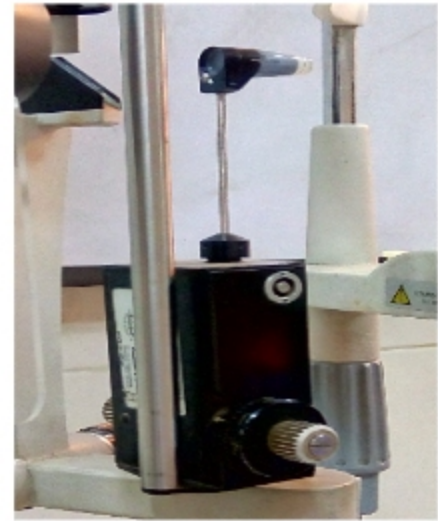
- Unilateral IOP spikes + uveitis Posner-Schlossman sx  
 Rx - Topical BB x PG / miotics
- Malignant glaucoma/ ciliary block/ aqueous misdirection syndrome: Shallow AC
- DOC: Atropine = (inverse)
- Krukenberg spindle - pigmentary glaucoma



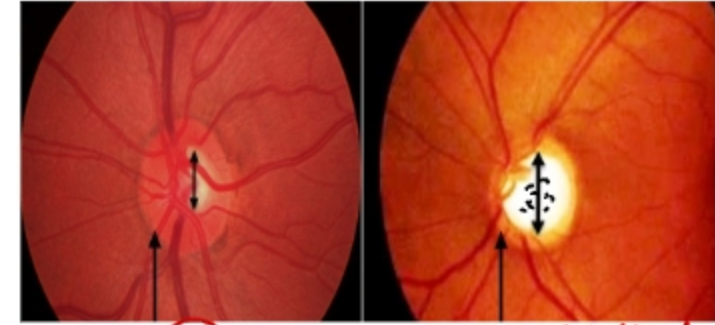
- Blepharospasm <sup>trabeculodysgenesis</sup> <sup>Chng.</sup>
- Photophobia <sup>duphthalmos</sup>
- Lacrimation
- Striae: Horizontal - Haab's (DM)
- Corneal diameter > 13mm
- Rx: Goniotomy → <sup>x</sup> Trabeculectomy + <sup>x</sup> trabeculectomy

# Glaucoma - Investigations

↑ IOP (N): 10-21 mmHg  
Fundus VFD



Rebound / digital



(N) C:D = 0.3:1 . vertical

Glaucoma:  
≥ 0.5:1  
C:D

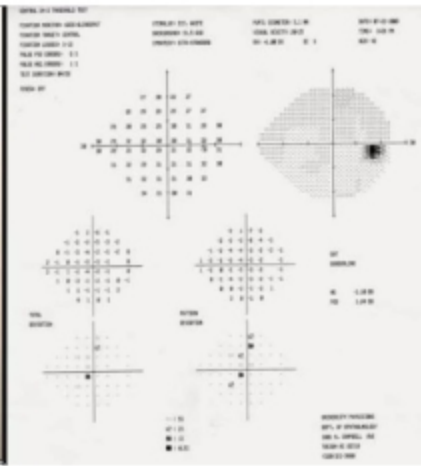


Goldmann applanation

Imbert-Fick law:  $P = \frac{F}{A}$   
(fixed area:  
3.06 mm<sup>2</sup>)

Mackay-Marg tonometer: irregular corneal surface

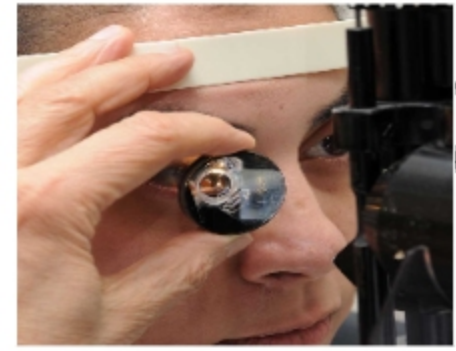
- Increased cup:disc ratio
- Thinning of neuro-retinal rim
- (N) ISNT rule
- Shifting of vessels - nasal
- Lamellar dot sign - lamina cribrosa
- Bayonetting sign



Visual field of Left Eye

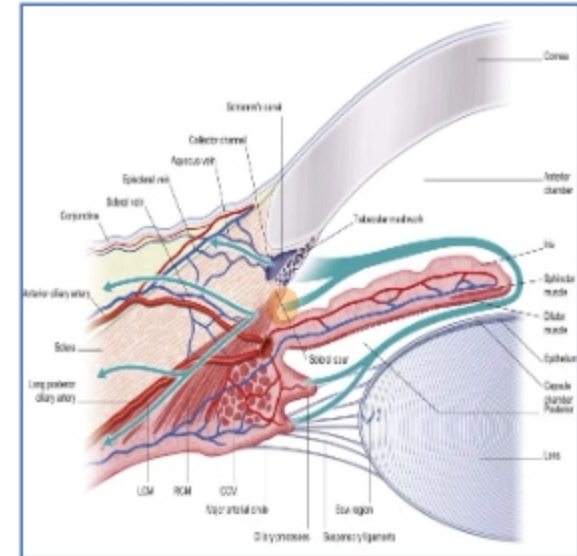
- Nasal step
- Paracentral scotoma
- Seidel scotoma
- Arcuate scotoma
- Biarcuate scotoma

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



Gonioscopy

**Total internal reflection**  
 critical  $\angle = 46^\circ$   
 "I can see till Schwalbe's line"  
 Iris CB Scleral spur TM Descemet's memb.  
 Richardson/ Koeppe: DIRECT  
 Zeiss/ Goldmann: INDIRECT



**Humphrey/ Octopus/ Oculus:** static

**Goldmann perimeter, Bjerrum, Lister:** kinetic

VFD

Earliest "change" → isoptic contraction  
 Paracentral scotoma "central 20-30"  
 Siedel's scotoma  
 Bjerrum/ Arcuate scotoma  
 Ring/Double arcuate  
 Roenne's nasal step  
 Loss of central vision  
 Temporal crescent loss - last

# Anti-Glaucoma Drugs

## Decrease Aqueous Production

### Ocular Beta Blockers

1. Timolol *s/e: Corneal sn ↓*
2. Betaxolol
3. Levobunolol
4. Carteolol

**Nonselective Alpha Agonist** ABCD  
**Dipivefrine** *s/e: black conjunctiva*

### Alpha-2 Agonist

1. Apraclonidine *s/e: Lid retrac<sup>n</sup>*
2. Brimonidine *s/e: apnea*

### Carbonic Anhydrase Inhibitors

1. Acetazolamide *"acid" / sulfa drug.*
2. Brinzolamide
3. Dorzolamide

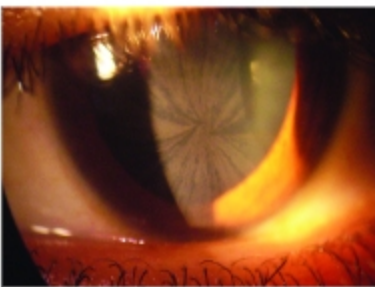
## Increase Trabecular Outflow

### Cholinomimetic Drugs

**Pilocarpine** = miosis  
*s/e - NLD stenosis*

### Rho kinase inhibitor

**Netrasudil** *ae*  
*s/e: vortex keratopathy /  
cornea verticalata*



## Increase Uveoscleral Outflow

### PGF<sub>2α</sub> Analogues - Doc

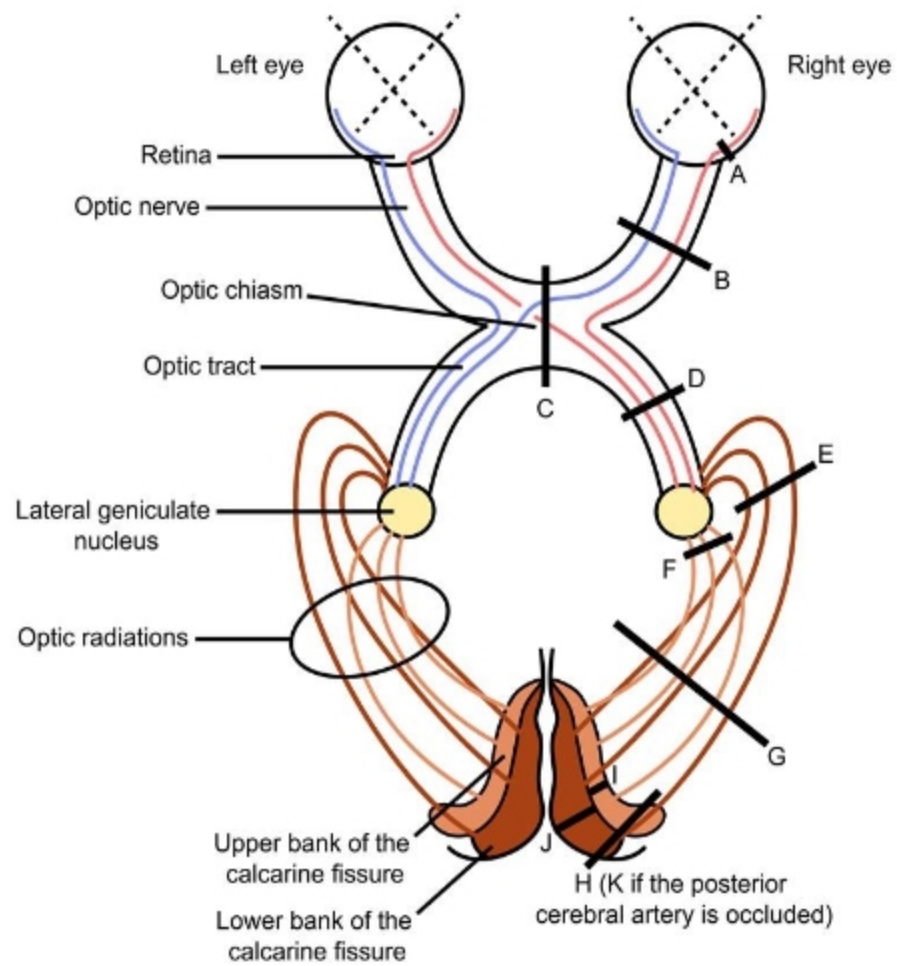
1. Lantanoprost
2. Bimatoprost

*s/e: Hypertrophic eyelash /  
Heterochromia / CME / ↑uveitis*

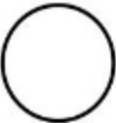

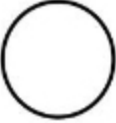











**Omidenepag** *ae* *PGF<sub>2α</sub> agonist*  
*↓ s/e*

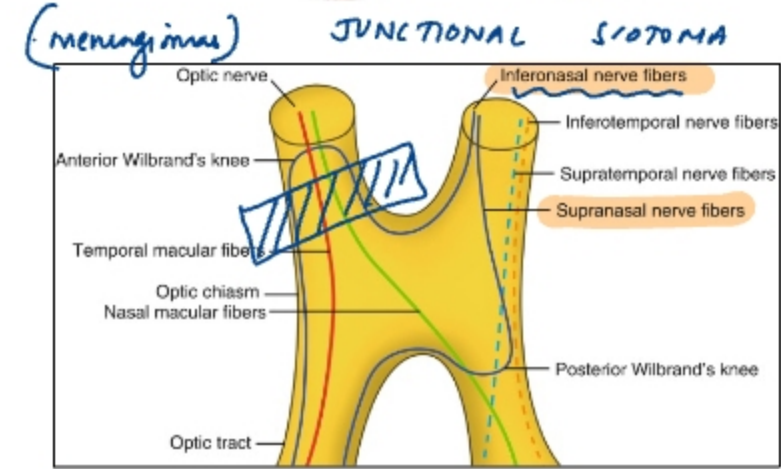
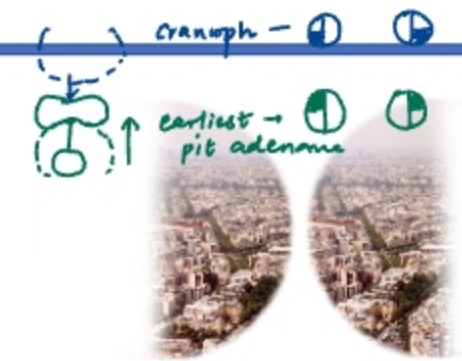
I C A (N) T → Tamoxifen  
↓ Anidarsone  
Indometacin  
- Chlorpromazine  
- Chloroquine

# Visual Field Defects



Visual field deficit

- A) Central scotoma  
- B) Monocular vision loss *optic nerve*  
- C) Bitemporal hemianopia *optic chiasma*  
- D, G, & H) Contralateral homonymous hemianopia *pit / ACM aneurysm* *optic tract*  
- E & J) Contralateral superior quadrantanopia *STEMI* *'pie in the sky'*  
- F & I) Contralateral inferior quadrantanopia *parietal lobe* *Baum's loops*  
- K) Contralateral homonymous hemianopia with macular sparing *PCA* *LMA*  



OPTIC TRACT:

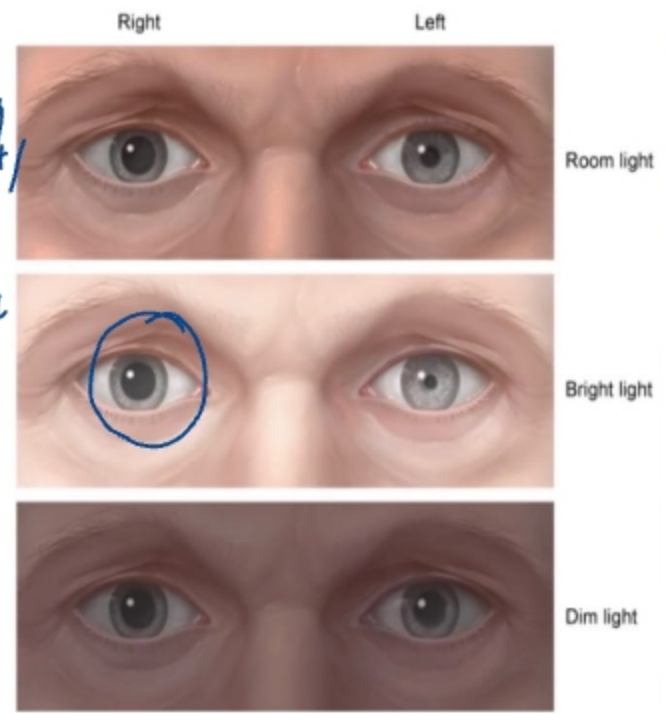
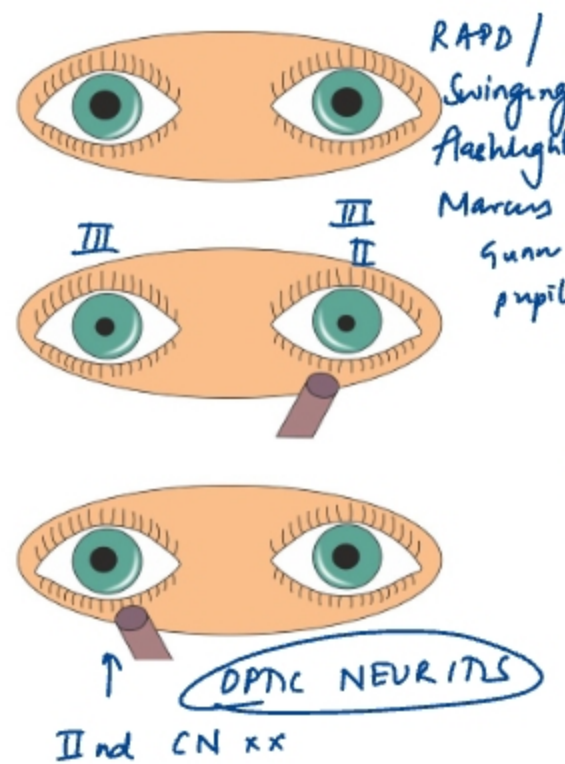
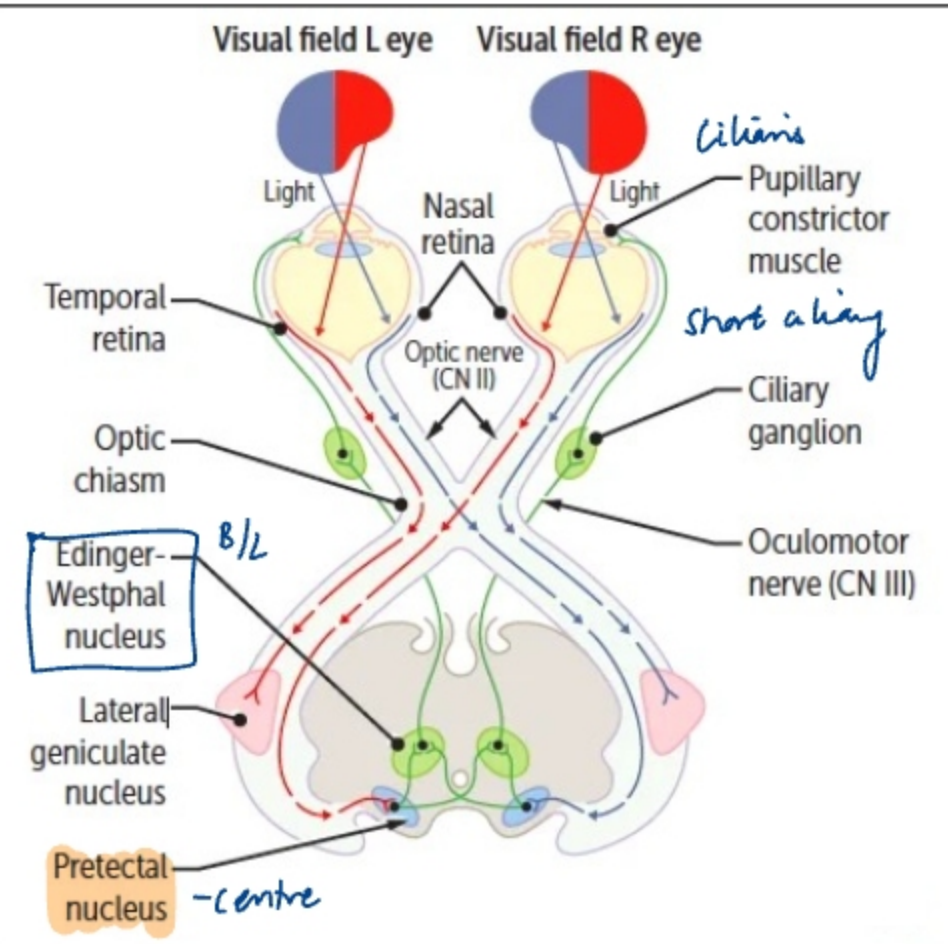
**Wernicke's hemi-anopic pupil**

LGB:

**Keyhole defect**



# Light Reflex



RE parasymp pathway  
↑  
defect

Receptor upregulation    Light near dissociation    anisocoria

	Adie's Tonic pupil	Pharmacological mydriasis
I/L Dilated pupil	✓✓	✓✓
Accommodation	(N)	xx
0.125% Pilocarpine	Constrict	xx
1% Pilocarpine	Constrict	xx



# Optic Atrophy

Sign	Primary	Secondary	Consecutive
Disc colour	Chalky white	Grey	Waxy pale
Disc margins	Distinct	Blurred	Attenuated arteries
Cause	<ul style="list-style-type: none"> <li>Optic N compression</li> <li>Hereditary / Nutritional Optic Neuropathy</li> </ul>	<ul style="list-style-type: none"> <li>Chronic papilloedema</li> <li>Papillitis</li> <li>Anterior Ischemic Optic Neuropathy</li> </ul>	<ul style="list-style-type: none"> <li>Chorioretinal disease (e.g. RP)</li> <li>Central Retinal Artery Occlusion</li> </ul>
Image			

**Multiple sclerosis**

- Retrobulbar neuritis 50% MS lifetime
- U/L LOV + No VFD 25% present ON
- Fundus normal
- Pulfrich sign - altered depth percep<sup>n</sup>
- Uthoff sign - hot bath - aggravated

IOC: CE-MRI  
 TOC: iv Ig methylpred x 3d → oral steroids

**Papilledema** ↑ ICP

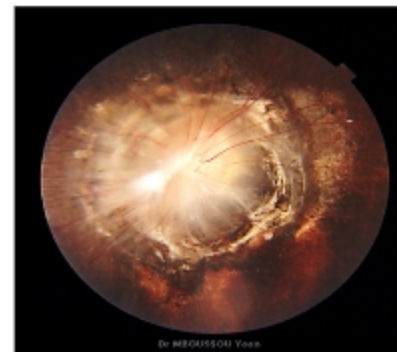
Painless B/L 'blurring of OD'  
 VFD: enlargement of blind spot  
 Paton's lines

**Altitudinal defects:**

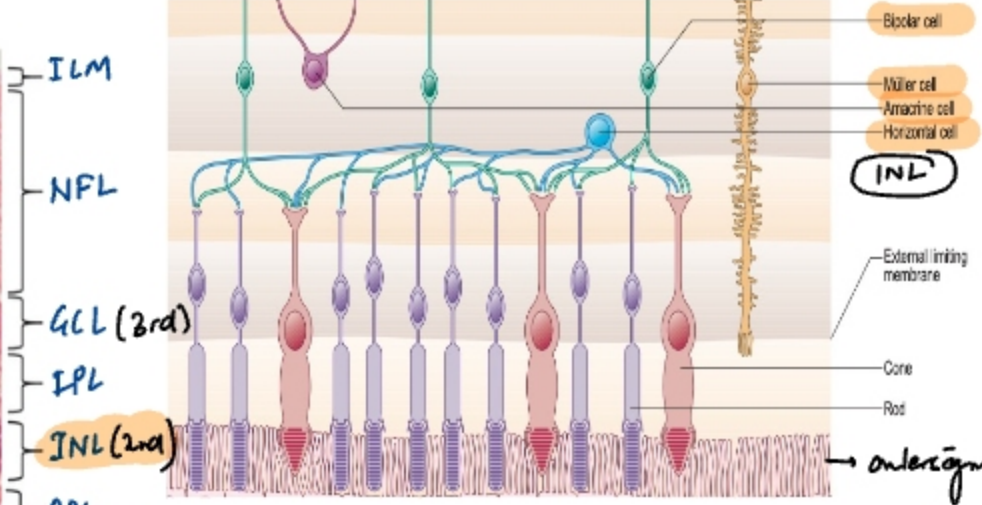
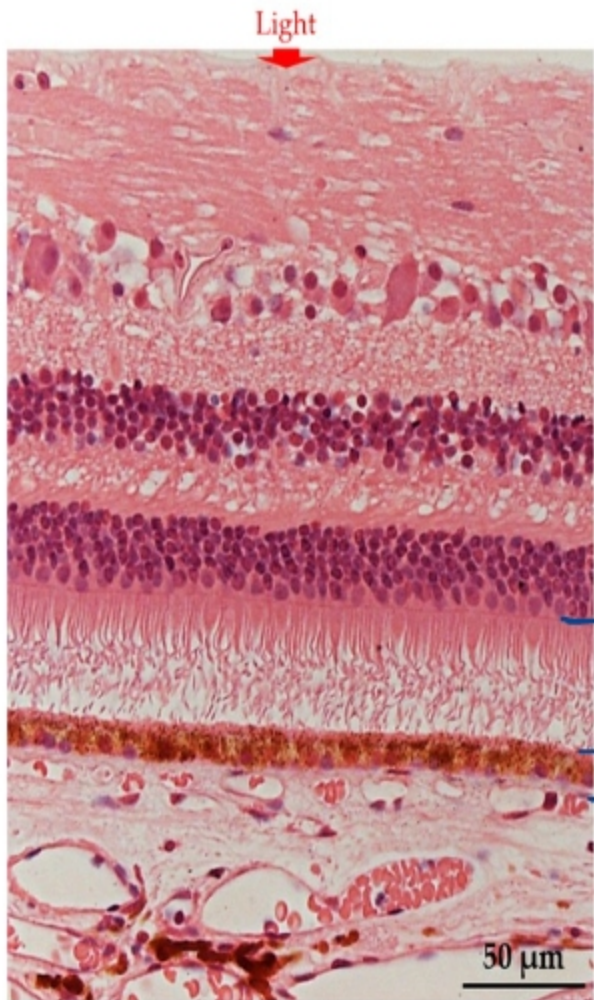
- Glaucoma
- ON drusen
- AION "curtain falling" → GCA <sup>eg</sup>

Morning glory Sx

Absent lamina cribrosa  
 Retrodisplacement of ON

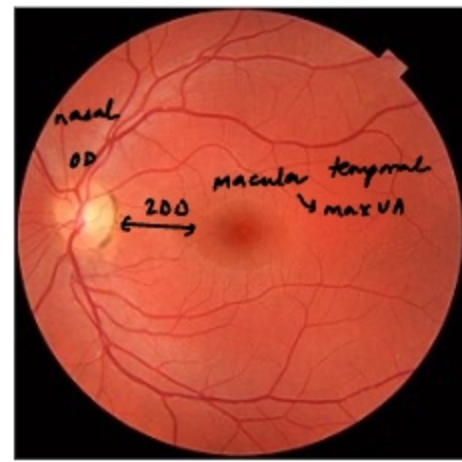
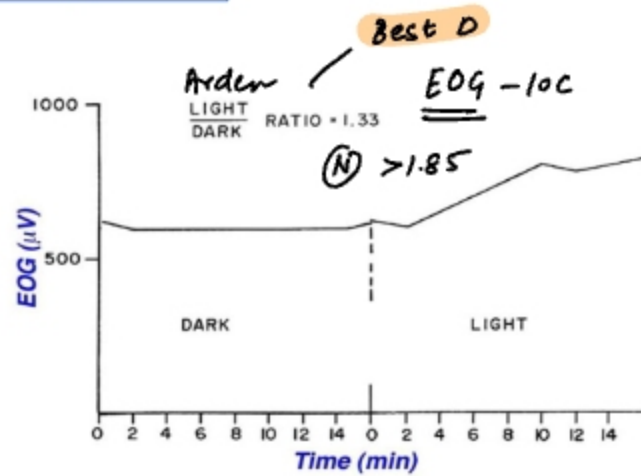
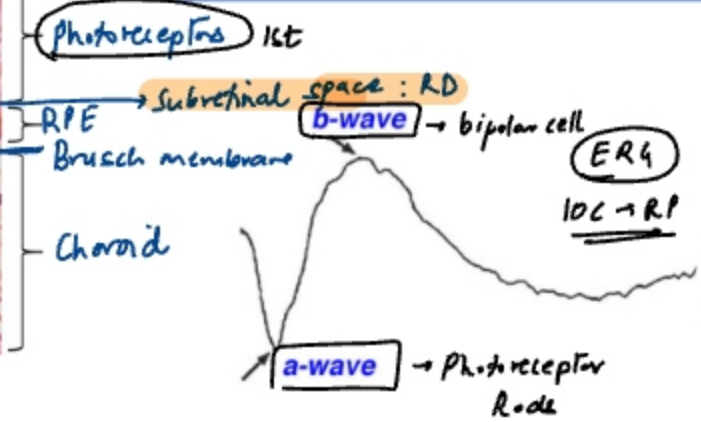


# Retina



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

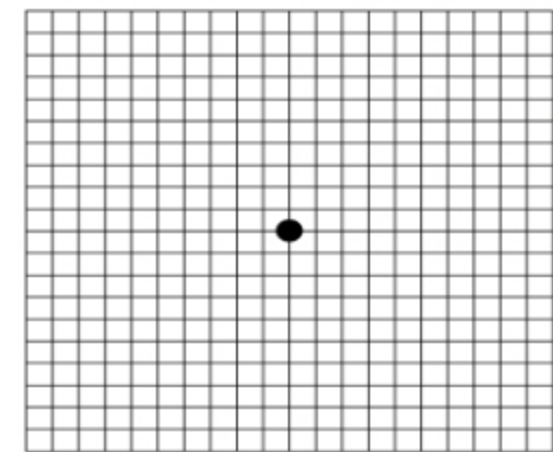
Light: Hyperpolarisation in rods-  
Glutamate release decreases



Blood supply:  
Outer 4: SPCA  
Inner 6: CRA

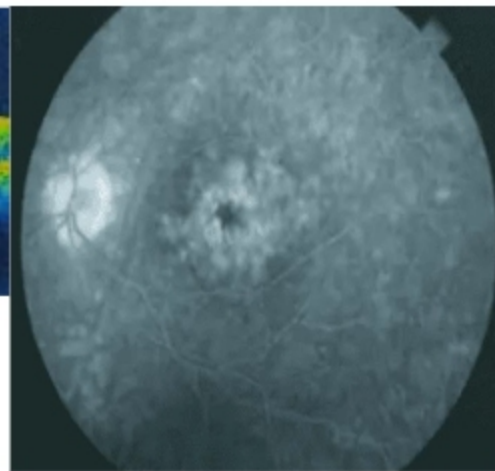
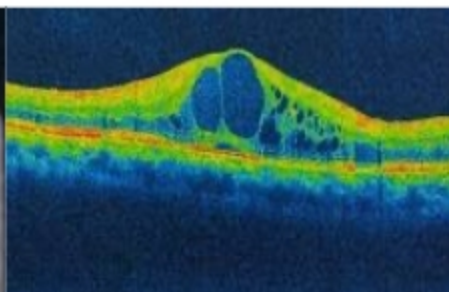
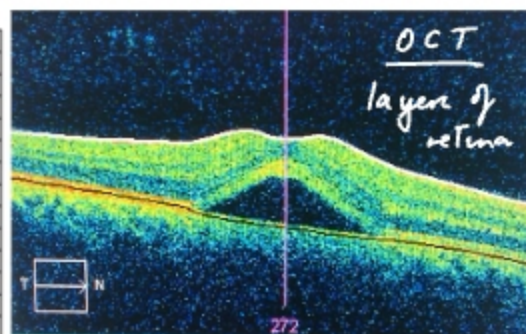
Contact admin  
Join our group

# Macular Disorders & Investigations



• Amsterdam grid  
(metamorphosia)

• PHOTOSTRESS TEST



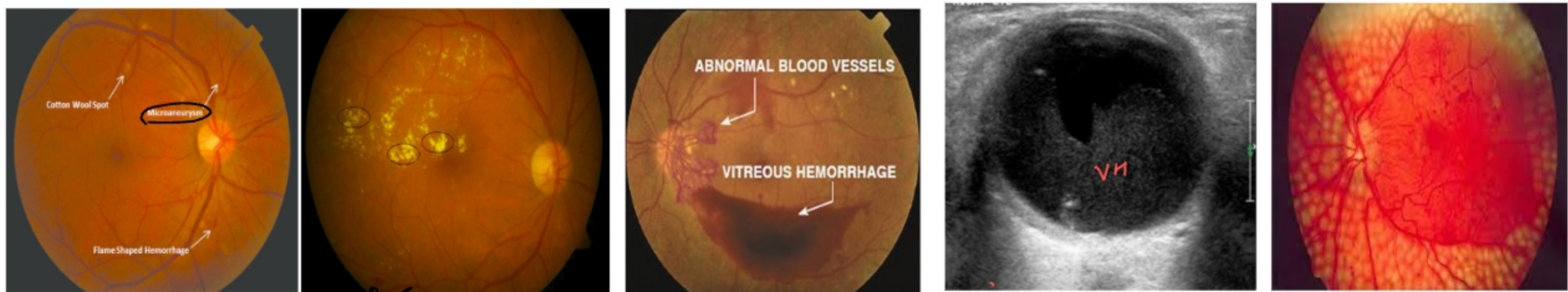
- Diagnosis- CSR Central serous retinopathy
- Layer- RPE
- R/F: Steroids / Type A personality
- Rx: Photodynamic therapy - Verteporfin

- Diagnosis- CME (cystoid macular edema) "petalloid" edema
- Layer- OPL
- R/F- Irvine-Gass
- PG analogue
- Niacin toxicity
- DR (sudden vision loss)
- Uveitis/ RP/ CRVO
- Rx- NSAIDs / steroids

- BLOOD RETINAL BARRIER
- Outer : RPE → CSR
- Inner: Capillary Permeability → CME

# Diabetic Retinopathy

"Floaters"



- Hyperfluorescent DOTS  
Hard exudates - LIPID

PDR - neovangiogenesis  
VH / subhyaloid hge "boat"  
B-mode USG  
D/D - PDR trauma, Entes-vasculitis "recurrent", VH

R<sub>2</sub> - PRP  
Nd:Yag double freq 532nm

ETDRS NPDR  
Microaneurysm: earliest → MINL  
Hemorrhages: Dot and bot: } OPL HOPL  
Hard Exudates: } lipid  
Flame shaped: } axonal debris } NFL  
Cotton Wool/ Soft exudates: }

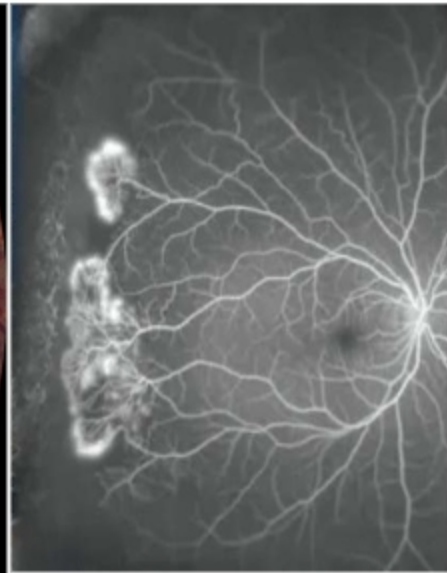
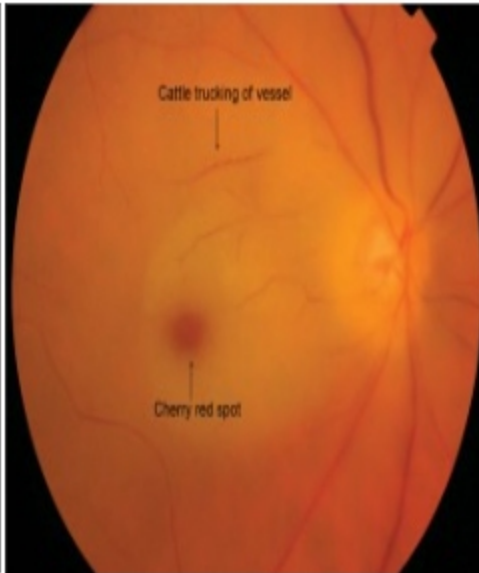
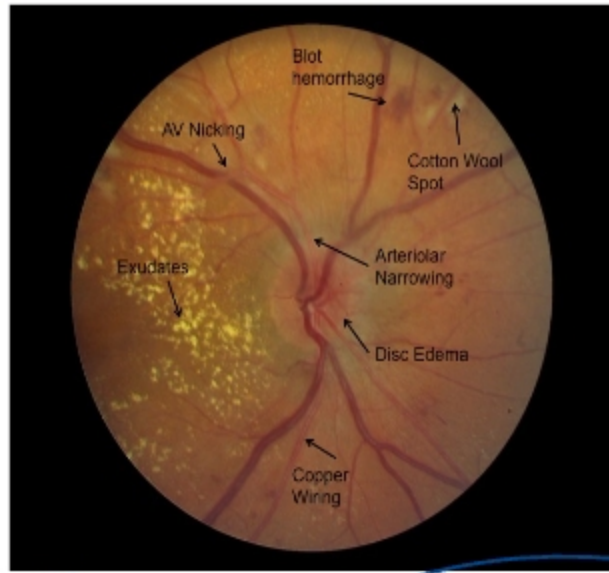
Screening-  
Type 1 - 5yrs  
Type 2 - immediately  
Most important R/F: duration > glycaemic control

Severe NPDR (4-2-1 rule): → VEGF ⊖  
• > 20 intraretinal hemorrhages in each of four quadrants  
• Definite venous beading in two or more quadrants  
• Prominent IRMA in one or more quadrants

Advanced Diabetic Eye Disease:  
Persistent vitreous hemorrhage  
Tractional retinal detachment  
Neovascular glaucoma · NVG - SOAG  
in 100d glaucoma

Intravitreal inj:  
Bevacizumab  
Ranibizumab  
Brolucizumab  
Ramuciruzumab  
Aflibercept  
Pegaptanib  
Holiday ♥ - panretinal AFB

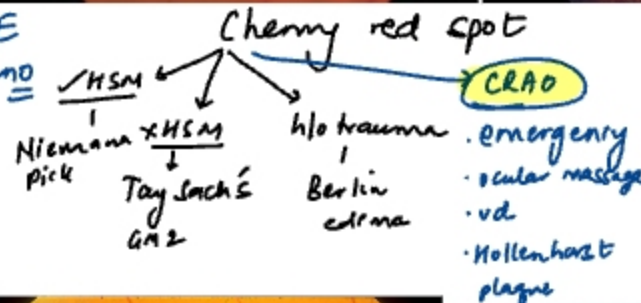
# Retina pathologies



(N) a:v - 2:3

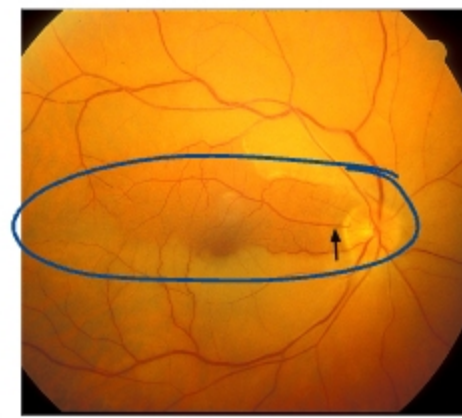
Hydr retinopathy  
a:v → 1:3

Rotn spots : IE  
= immuno  
Kern-Wagner



CRVO  
 "splashed tomato"  
 NVG = 100d glaucoma  
 "sea fan"  
 Sickle cell anemia

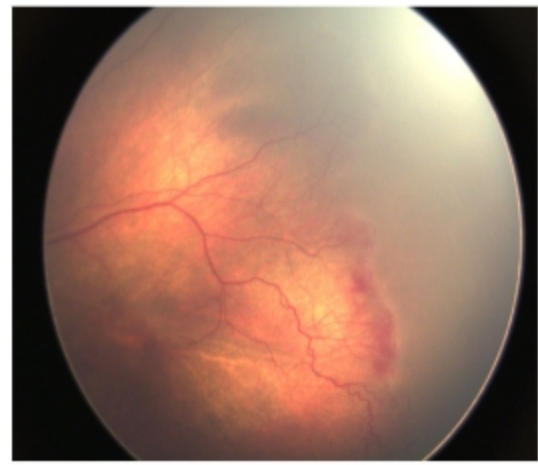
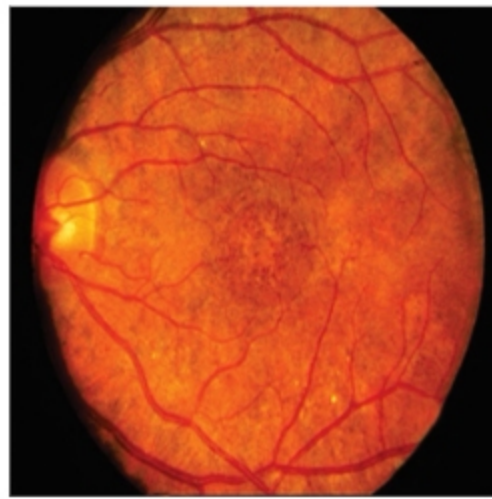
Grade 1	Arteriolar narrowing
Grade 2	Salu sign-S shaped deflection of veins
Grade 3	<ul style="list-style-type: none"> <li>GUNN: Tapering of vein at either end</li> <li>BONNET: Dilatation of vein at junction</li> <li>Flame shaped Hemorrhage</li> <li>Cotton Wool spots</li> <li>Copper wiring</li> </ul>
Grade 4	<ul style="list-style-type: none"> <li>Silver wiring</li> <li>Papilledema</li> </ul>



CRVO  
 14% - cilioretinal sparing  
 ↑  
 "Tunnel vision"  
 DID - RP  
 L Vigabatrin  
 L Chloroquine



retinopathy



h/o HIV/AIDS  
CD4 <50  
Pizza pie

↓  
**CMV Retinitis**

Headlight in fog



Macular scar

**TOXOPLASMOSIS**

salt & pepper  
retinopathy  
↓  
Congenital  
syphilis

"Plus"  
"Threshold"  
↓  
Argon laser

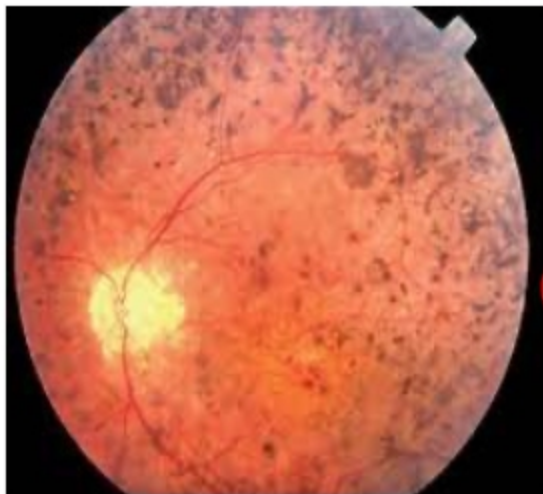
**ROP** Retinopathy of prematurity

- R/F: Birth weight <1750g (<2000g)
- Gestational age ≤ 34 weeks
- Sick infants (oxygen therapy, sepsis)
- Screening:
  - > 28wks: 4wks after birth
  - ≤ 28wks: r/o AP-ROP, 2wks after birth

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

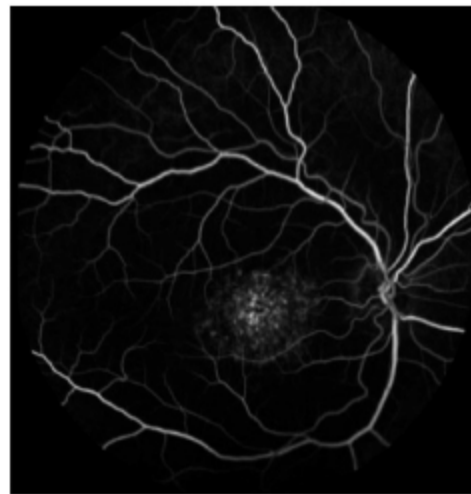
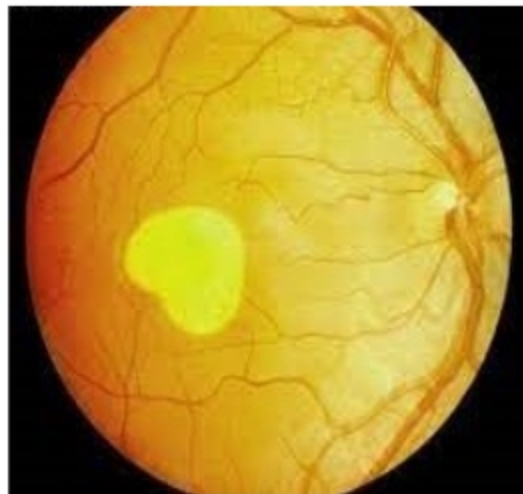
## ROD dystrophy

Q2



RP

## CONE dystrophy



Egg yolk

BEST Disease

loc: EOG

AD

STARBUCK'S

"silent chorioid"

Bull's eye macula

↳ DID - Chloroquine

"Fish flecks" /

Copper beaten

ABCA4 gene <sup>ee</sup>

Fundus flavimaculatus

chr 1

RPE

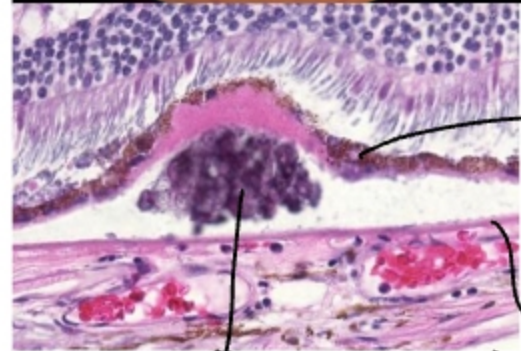
ERG abN

ARMD

Dry  
Wet → neoangiog  
NVI ↓  
glaucoma



(Dry)  
Lipofuscin



DRUSEN

Brunsch

RPE

AREDS2-

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

- MC Inheritance: AR <sup>a</sup> > XLD / XLR
- TRIAD:**
  - waxy / pale OD
  - arteriolar attenuation
  - brony spicules
- C/F: Early: night vision ↓
- IOC: ERG <sup>ee</sup>
- Docosahexanoic acid ↓
- Usher, Refsum, Kearns-Sayre, Bardet-Biedl
- Late → Tunnel vision <sup>ee</sup>

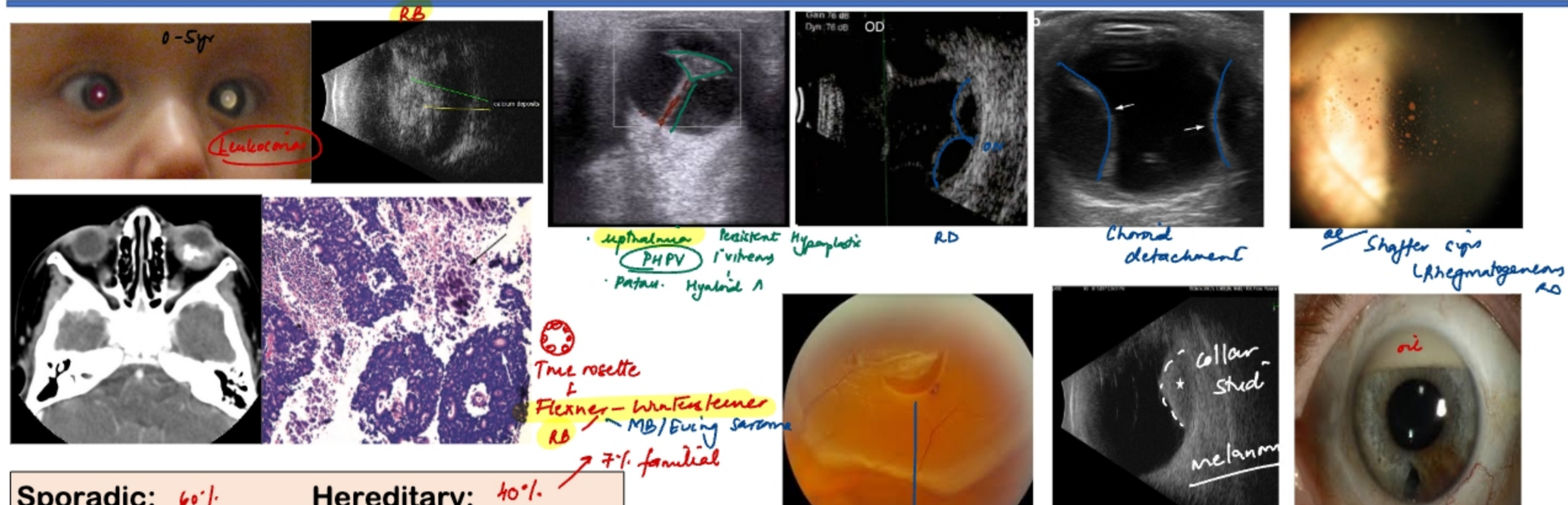
Oguchi's disease/ congenital stationary night blindness:

Mizuo-nakamura phenomenon

Contact admin  
@your group

# Retinoblastoma

# Retinal detachment



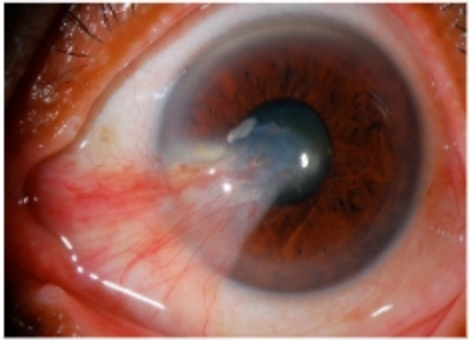
• upthralma PHPV Patau. Hyaloid A  
 • Resistant Hyalo  
 • Flexner-Waterhouse  
 • MB/Ewing sarcoma  
 • 7% familial

**Sporadic:** 60%  
**Hereditary:** 40%  
**Gene/inheritance:** RB → chr 13 (AD)  
**Trilateral RB:** B/L RB + Pinealoblastoma  
**MC association:** osteosarcoma  
**C/F-** Leukocoria > Squint - esotropia  
**IOC-** CT - Ca<sup>2+</sup>  
**IOC for spread-** CE-MRI (optic nerve)  
**TOC-** (unresectable - NACT)

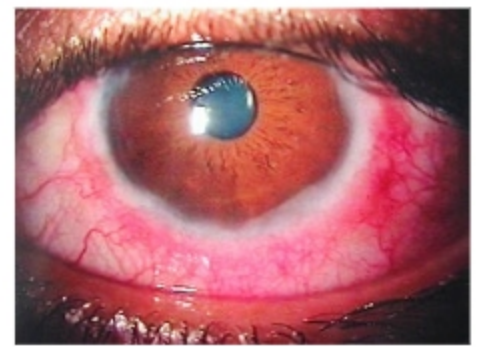
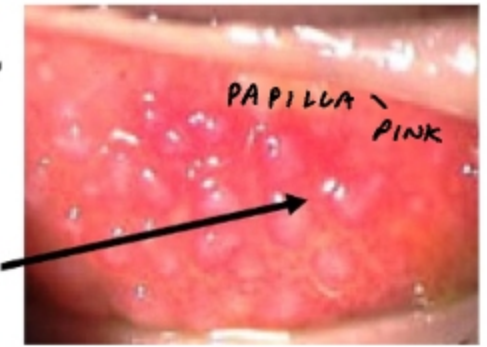
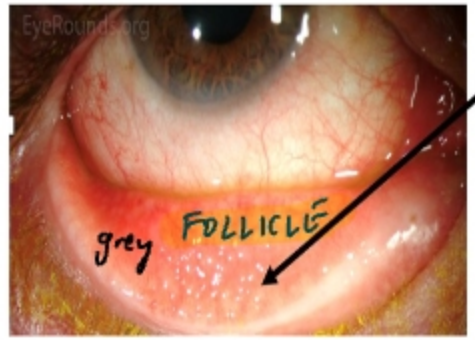
**Rhegmatogenous- Trauma/myopia/surgery**  
**"Curtain falling in front of eye"**  
**Exudative-** uveitis / tumor "fluid shift" "convex"  
**Young boys + U/L lipid exudation:** Coat's D  
**Tractional-** "Diabetic retinopathy" "concave"  
**Rx:** Scleral buckle + retinopexy → silicone oil / SF6

# Conjunctiva

Bulbar ← Fornix → Palpebral



**Diagnosis: Pterygium**  
 C/F: astigmatism  
 Limbus Stem cells  
**ABCG2, CD34** Precur  
 Rx: PERFECT Sx Mitomycin C  
 Pterygium excision → conjunctiva



Pingecula

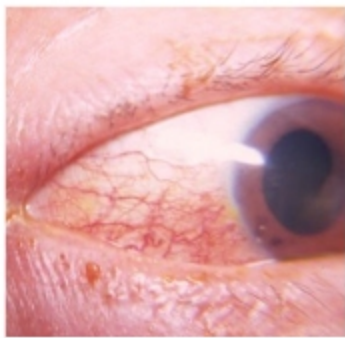


Limbal dermoid

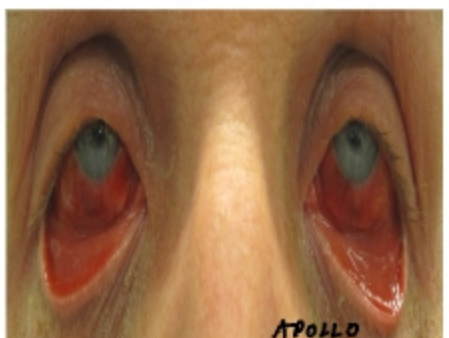
- Toxins (e.g., Apraclonidine)
- Viruses (e.g. COVID-19)
- Chlamydia

- Bacterial
- Allergic (AKC, VKC)
- Foreign Body
- GPC<sup>ag</sup> - CL VKC  
'Giant'

- VKC = Spring catarrh
- 5-14yr boys - Maxwell-Lyon sign
  - Ropy discharge
  - Hysn: type I
  - Shield ulcer
  - Cobblestone papilla
  - Horner-Tranta dots
  - Pseudogerontoxon
  - DOC: Olapatadine → steroids



Moaxella  
 Contact admin  
 Join our group  
 Angular conjunctivitis



APOLLO  
 Hemorrhagic conjunctivae  
 Coxsackie A24 Enter 70 Adenovirus



Phlyctenular conj  
 ↳ hysn II  
 LTB

Neonatal conjunctivitis	Onset age	Treatment
Chemical Crede method (AgNO <sub>3</sub> )	<24 hr	Eye lubricant
Gonococcal	24-48hrs	Ceftriaxone
Chlamydial (D-K) <sup>ag</sup>	5-14 days	Erythromycin

# Trachoma (A-C)



Trachomatous inflammation-follicular (TF)

*Sago grain*

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



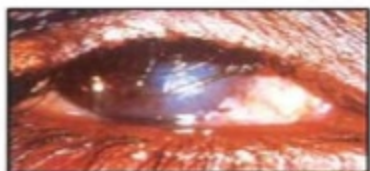
Trachomatous inflammation-follicular and intense (TI)

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



Trachomatous scarring (TS)

*Art's line*



Trachomatous trichiasis (TT)



Corneal Opacity (CO)

*→ cause of blindness ca*

Contact admin  
Join our group



Surgery



Antibiotics

*Azithromal 1g  
stat*

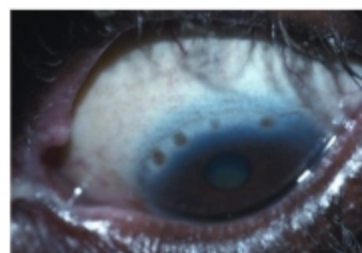


Facial cleaning

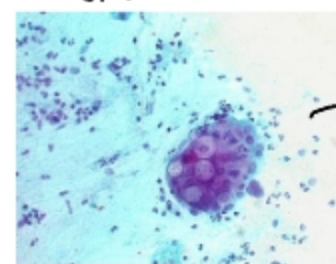


Environmental change

*'water washed'*



Herbert pit



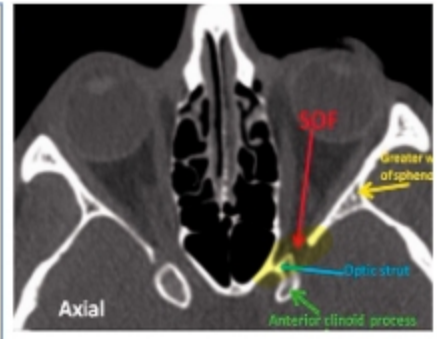
*HP bodies*

*Halberstaeder - Provaždyek*

ELIMINATION CRITERIA: *8 Oct 2024*  
TF of  $<5\%$  in children aged 1 to 9 years  
TT  $<0.2\%$  /  $<1/1000$  in adults  $>15$  yrs

# Orbit

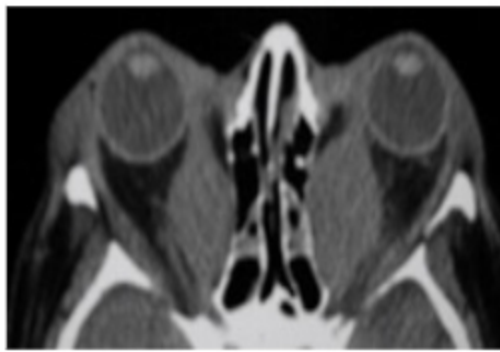
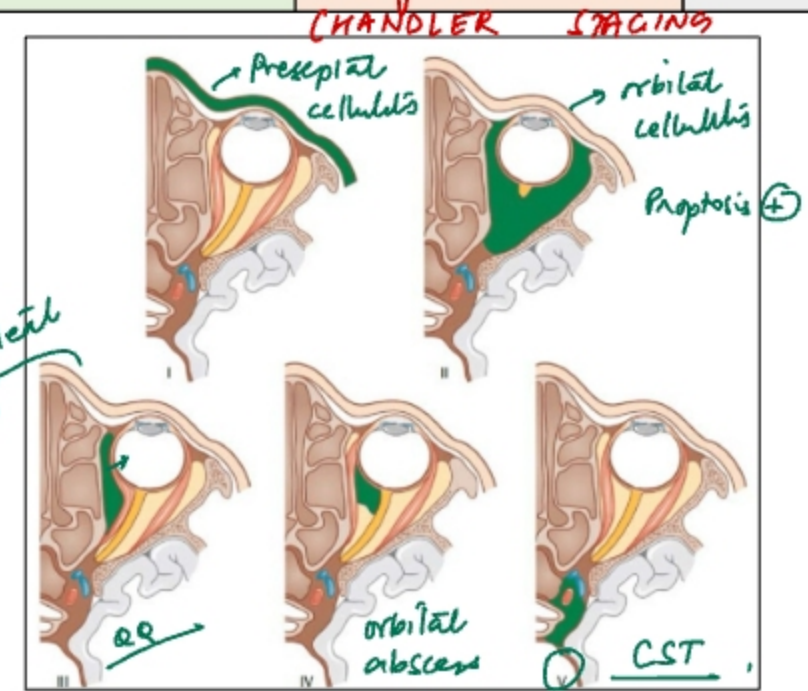
**Proptosis:**  $\geq 21$  mm protrusion - lat orbital rim  
**MCC:** Thyroid eye disease -  $\text{reverse}$  - steroids  $\rightarrow$  orbital decompression  
**Pulsatile:** CCF - carotico-cavernous fistula h/o trauma  
**Increases on bending/ Valsalva:** varix - orbital  
**Increases on crying:** Hemangioma  
**Increases with URTI:** Lymphangioma  
**MCC of orbital mets:**  
 Child- NB  
 Adult- ca breast  
**MC primary orbital tumor in child**  
 Benign- Dermoid cyst Malignant- RMS  
**MC orbital tumor in adult**  
 Benign- Hemangioma Malignant- Leukemia (chloroma)  
**MC lacrimal gland neoplasm:** Pleomorphic adenoma



III/IV/V/VI, II, VII/III/IV/V,

SOF + optic canal

	ORBITAL APEX SX	CST
NERVES	②) 3/4/6/V <sub>1</sub>	6 $\rightarrow$ 3/4/V <sub>1</sub>
OPHTHALMOPLEGIA	++	++
VISION LOSS	⊕⊕	⊖
U/L OR B/L	u/l	B/L
CHEMOSIS, PROPTOSIS	+	++ PT
ONSET	gradual	sudden

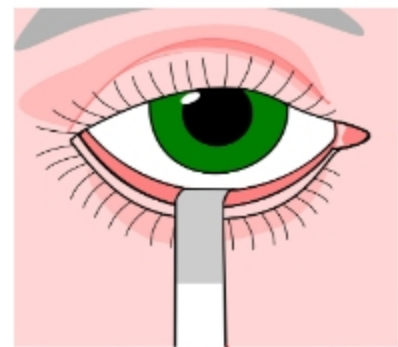
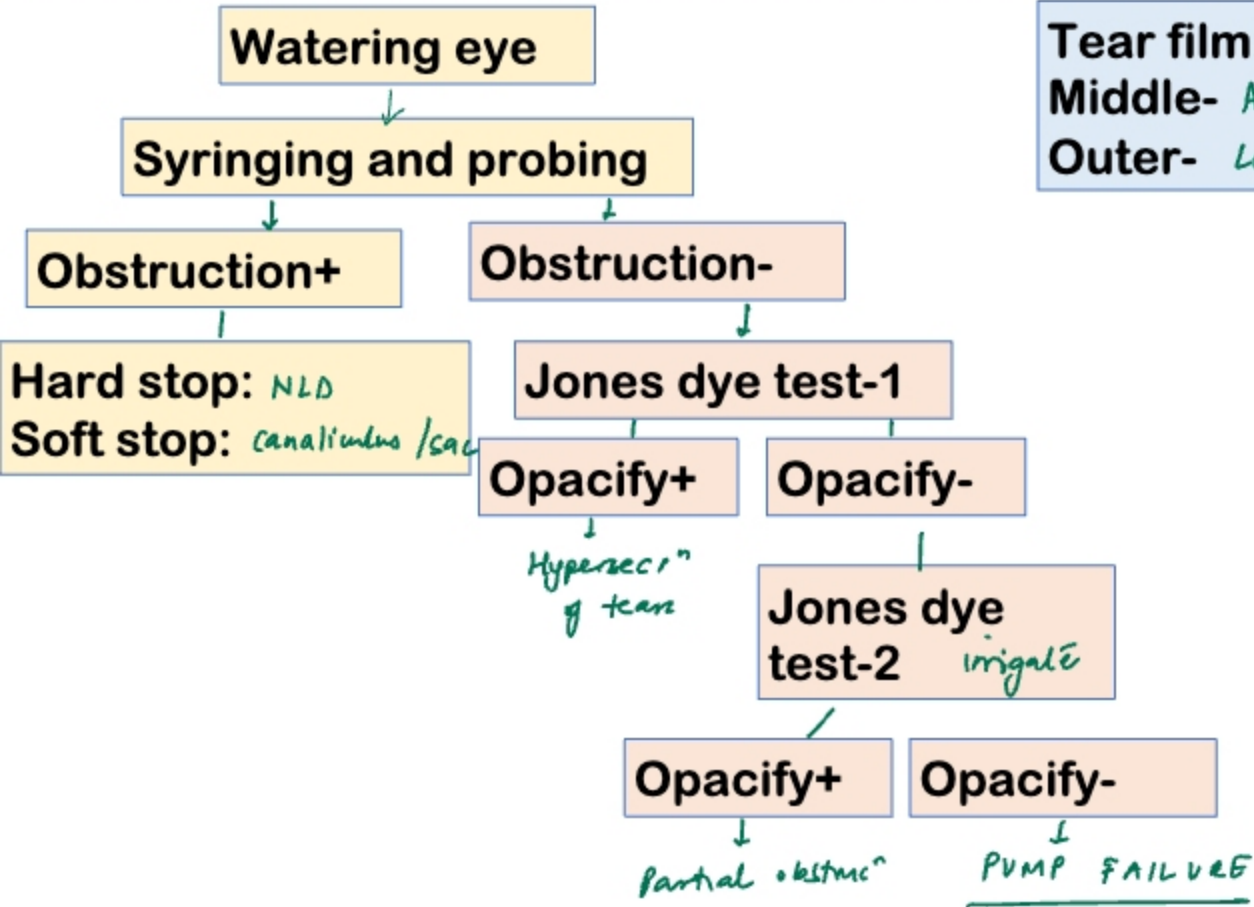


Subperiosteal abscess

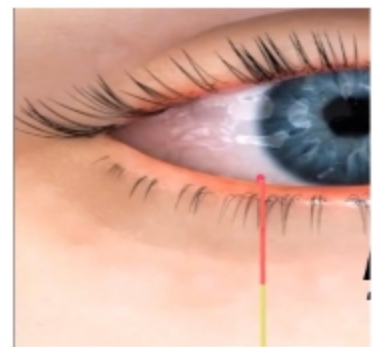
# Lacrimal Apparatus

**Tear film:** Inner- Mucin - Goblet cells - vit A def  
 Middle- Aqueous - Lacrimal - KCS  
 Outer- Lipid - Meibomian gl - CL uses

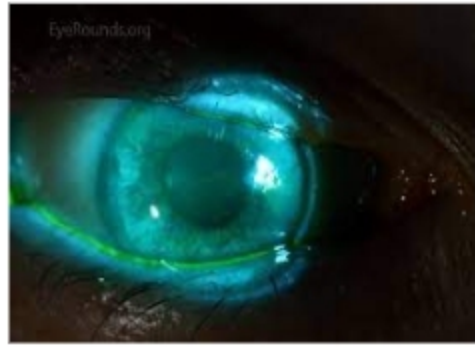
**Dry eye**



Schirmer test  
5min - 15mm

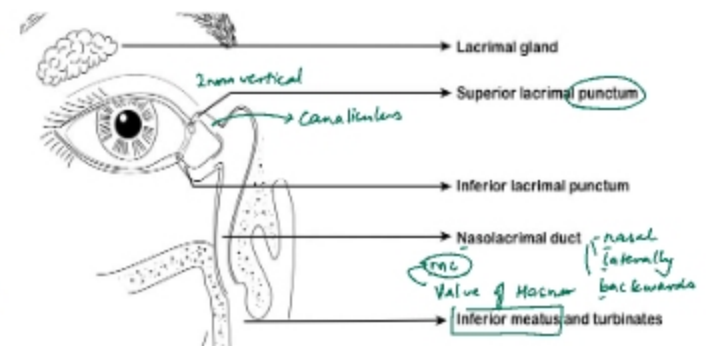


Phenol red  
- 15s



Tear break-up time  
< 10s abn

**Congenital dacryocystitis: MCC:** obstructive at Hasner  
**Mx:** Crigler's massage → Probing & Syringing (6mm-18mm) → DCR (mm) < 18mm earliest > 4ya ideal  
**Chronic dacryocystitis:** DC



# Eyelids

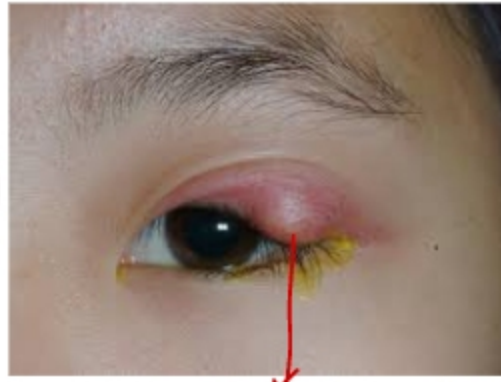


CHALAZION

- recurrent
- painless
- granulomatous

Mebomian gland

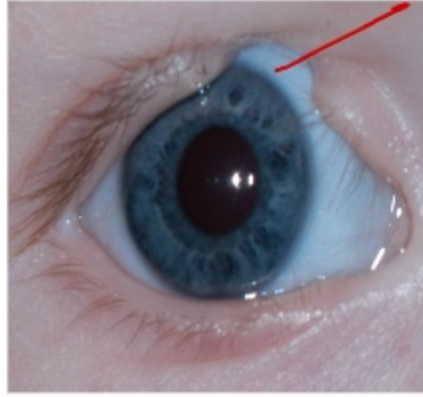
- r/o sebaceous cell carcinoma



Zeis → painful

STYE (External)

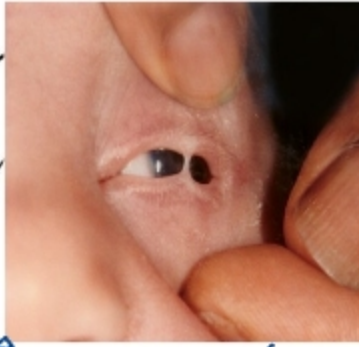
acute painful  
↓ internal  
HORDEOLUM



Coloboma - Eyelid



Distichiasis



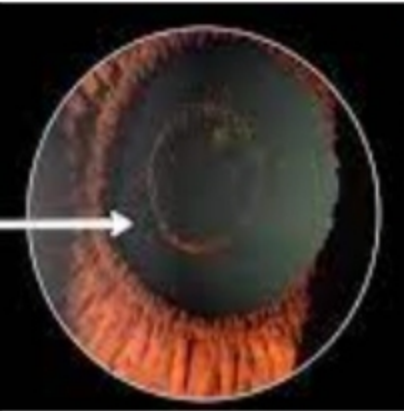
upper-lower  
↓  
ankyloblepharon



bulbar-palpebral  
↓  
Symblepharon

**Madarosis:** absent eyelash  
**Ectropion:** outward-eyelids  
**Tylosis:** thickening eyelids

# Eye Trauma



Vossius RING

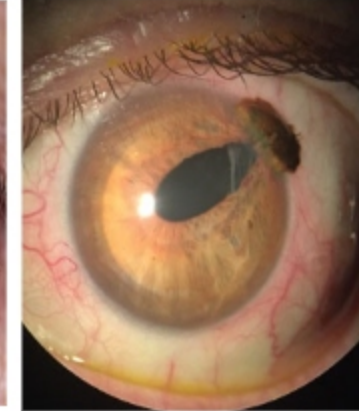


Stellate / rosette cataract



Iridodialysis vs Iridodonesis

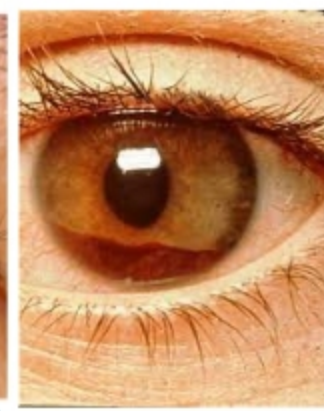
Iridodonesis  
↳ trembling  
sympathetic ophthalmia



Iris prolapse



Subconjunctival hge



Hyphema



IOFB

- MRI CT
- Ict - Xray
- IOC - NCCT

siderosis bulbi

Globe rupture



Penetrating trauma  
Ciliary body  
Granulomatous panuveitis in C/L eye in 2 weeks  
Dalen Fuch nodules - type IV hyon.  
• Immune privilege  
• PREVENT - Enucleation  
• Ap - steroids

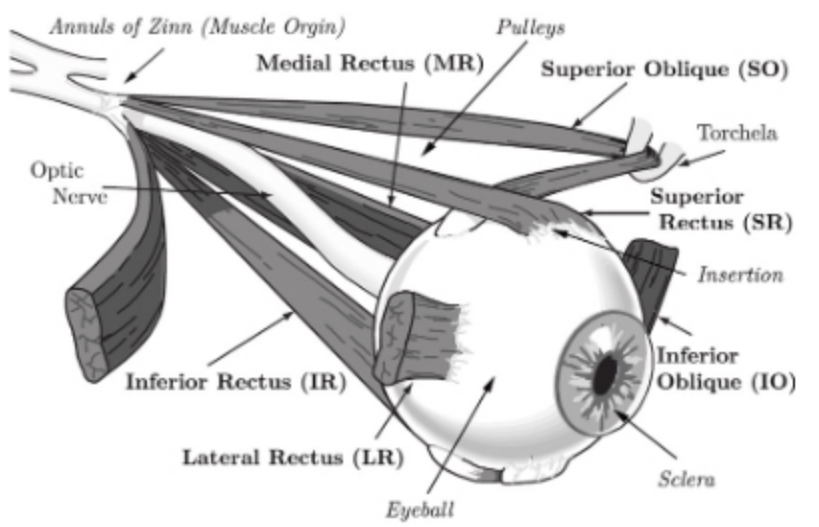
Hudson-Stahli line Fe - elderly  
Iron deposition around pterygium: Stocker's line  
Iron deposition around filtering bleb: Ferry's line

ON  
Enucleation → RB / trauma → SO.  
Evisceration - endophthalmitis  
leave sclera  
Exenteration orbital contents - Mucor / meli

# SQUINT - EOM

SIN RAD

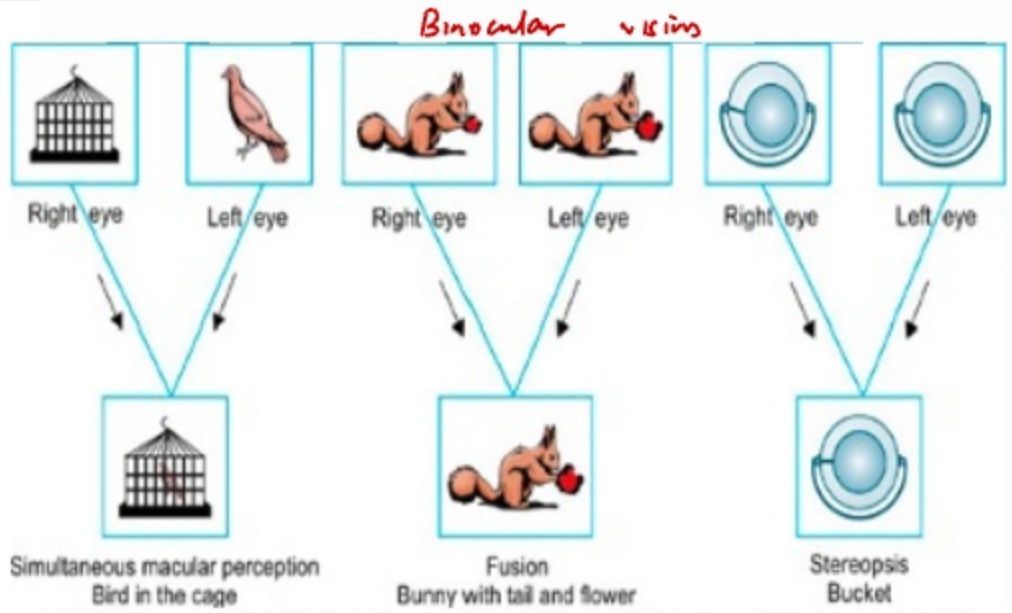
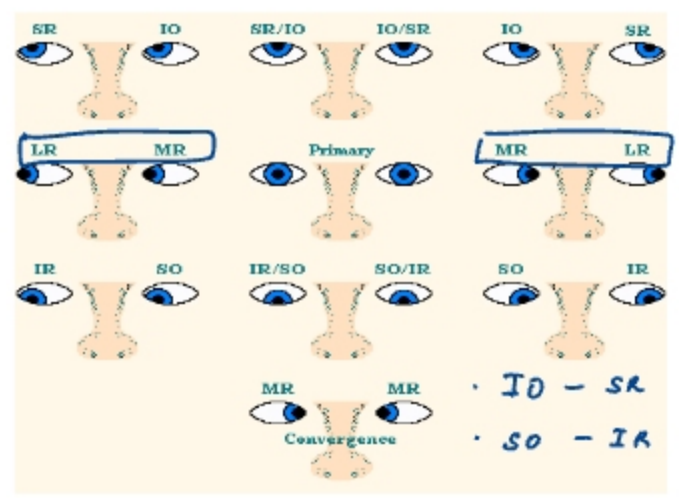
Misalignment of visual axis  
 Muscle not arising from Annulus: IO <sup>maxilla</sup>  
 Longest muscle: SO (c12)



Muscle	Nerve Supply	Primary Action	Secondary Action	Tertiary Action
MR	3	Adduction	-	-
LR	6	Abduction	-	-
SR	3	Elev <sup>n</sup>	Intorsion	Adduction
IR	3	Depression	Extorsion	"
SO	4	Intorsion	Depression	Abduction
IO	3	Extorsion	Elevation	"

HERRING: equal innervation - YOE  
 SHERRINGTON: reciprocal inhibition

antagonistic



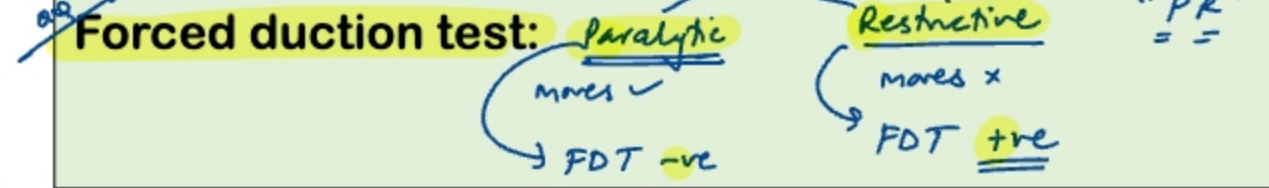
# SQUINT – Types



**Apparent/Pseudo:** Epicanthal folds / ↑ IPD - Hyperkonia  
**Tropia:** Manifest  
**Phoria:** Latent  
**Eso-** Inward  
**Causes:** RB / Hypermetropia  
**Exo-** Outward - Myopia  
**Hyper-** Upper  
**Hypo-** Lower

**Crossed Diplopia:** Exotropia  
**Uncrossed Diplopia:** Esotropia

**1 = 2 deviation:** Non-paralytic = Comitant  
**2 > 1 deviation:** Incomitant



Ptosis + down & out - IIIrd



SO - IV



LR - 6



**Ptosis + dilated pupil:** IIIrd CN  
**Ptosis + constricted pupil:** Muller's / Horner's Sx  
**Ptosis + normal light reflex:** Myasthenia

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[Join our group](#)

# Park 3 step test

## “IGI and ITO”

ill gaze - inf    ill tilt - oblique

**Left hypertropia** - Increases on right tilt and right gaze

ITO  
rectus

IGI  
sup

SR (R)

**Right hypotropia** - Increases on left tilt and right gaze

Lt hypertropia

ITO  
oblique

IGI  
sup

LT SO

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

IGI

ITO

sup

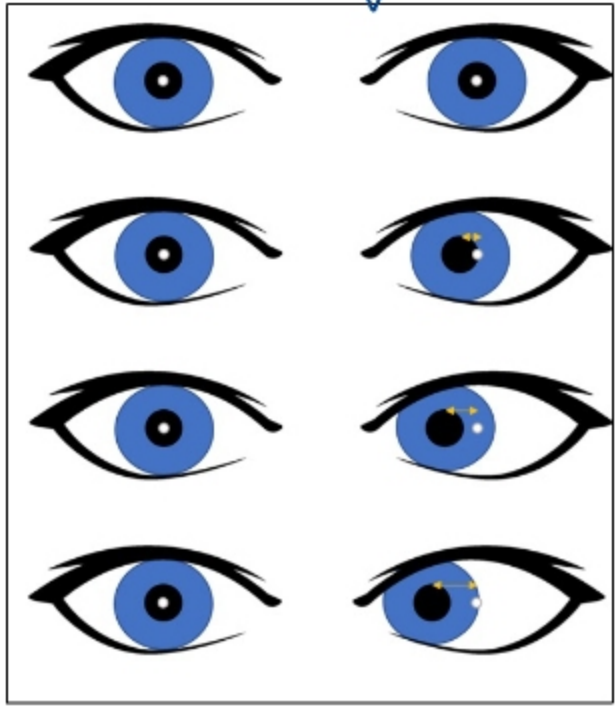
rectus

Lt hypertropia

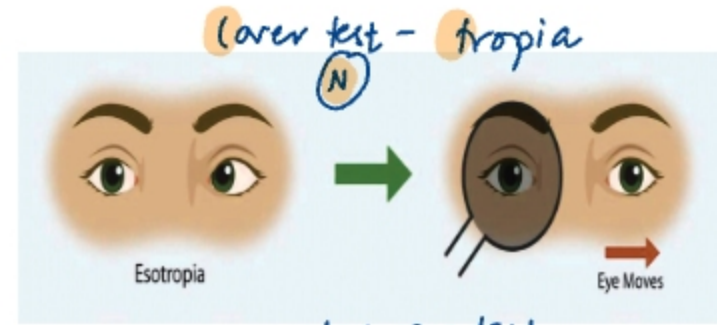
# SQUINT - TESTS

Maddox rod test

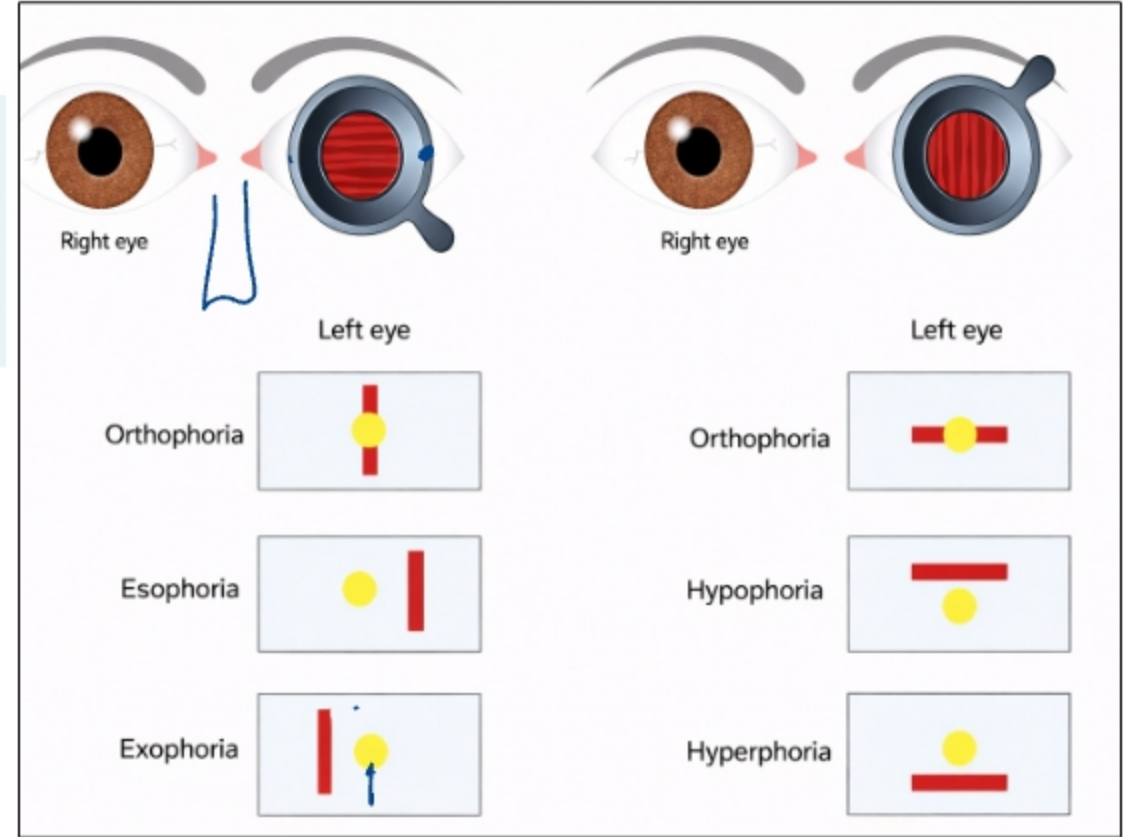
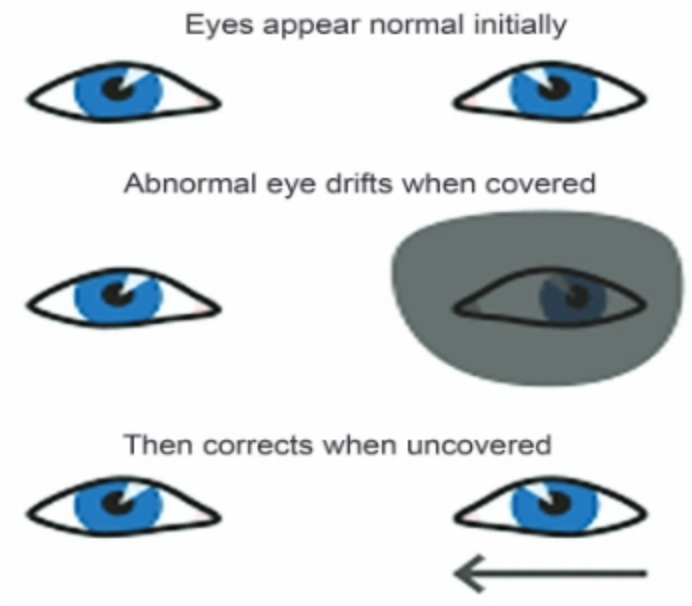
Hirschberg



**Hirschberg test:**  
Amount of squint  
1mm - 15° D of squint



Uncover test



**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

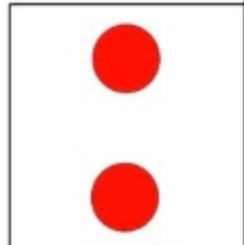
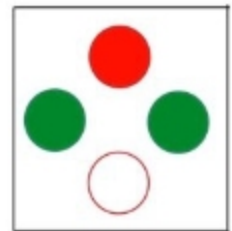


# SQUINT – TESTS

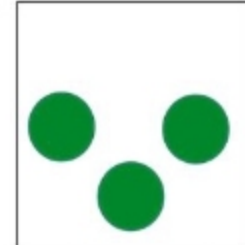
North 4 spot / dot test



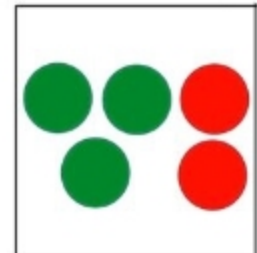
RE red  
LE green



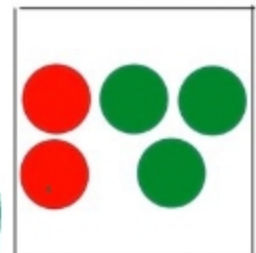
LE SUPPRESSION



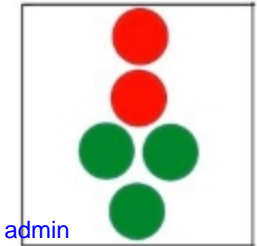
RE SUPPRESSION



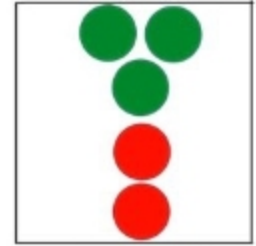
UNCROSSED DIPLOPIA



CROSSED DIPLOPIA



LEFT HYPER DEVIATION

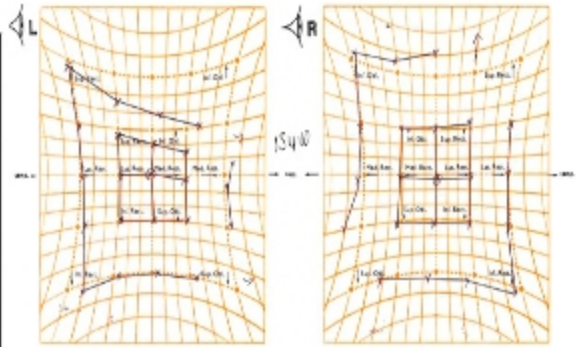


RIGHT HYPER DEVIATION

Prism bar



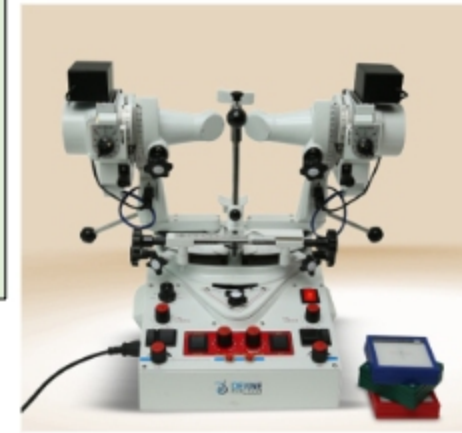
Most accurate for degree of tropia  
 Eso: Base out  
 Exo: Base in  
 Hypo: Base up  
 Hyper: Base down



Hess chart  
diplopia



RAF Euler  
(Royal air force)  
binocular



Synaptophore  
binocular vision



Titmus fly test  
stereopsis

# Miscellaneous

Duane's retrac<sup>n</sup> Sx

Globe on adduc<sup>n</sup>

Type 1:  
Abd<sup>n</sup>

Type 2:  
Add<sup>n</sup>

Type 3:  
Abd<sup>n</sup> + add<sup>n</sup>

**Amblyopia (Lazy eye)** strabismus/refractory error/stimulus deprivation

**Loss of vision without organic cause**

**Prevention:** Patching abN eye / refr error correct / video games

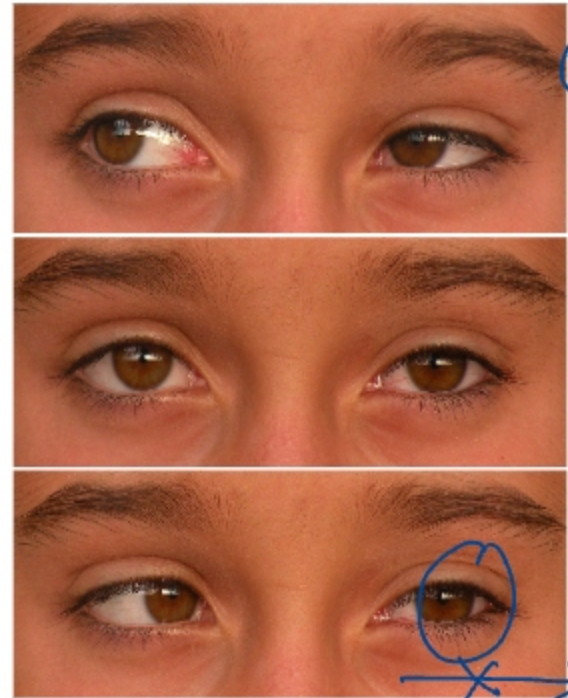
**Rx of strabismus: Recession** weakening of overactive M

**Resection** strengthening weak M

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

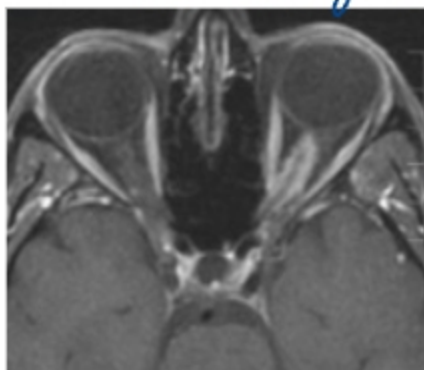
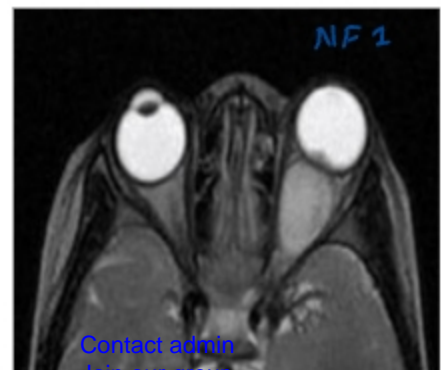
**Synkinetic phenomenon b/w V<sup>3</sup> and III CN:** <sup>pterygoid</sup> Marcus Gunn jaw winking phenomenon

**Defective elevation in adduction, normal elevation in abduction**  
S0 Brown Sx



ON Glioma

ON Meningioma



"tram track"

NF 2

# Refractory Errors

Snellen chart

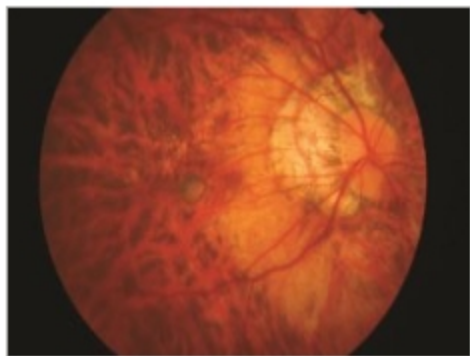
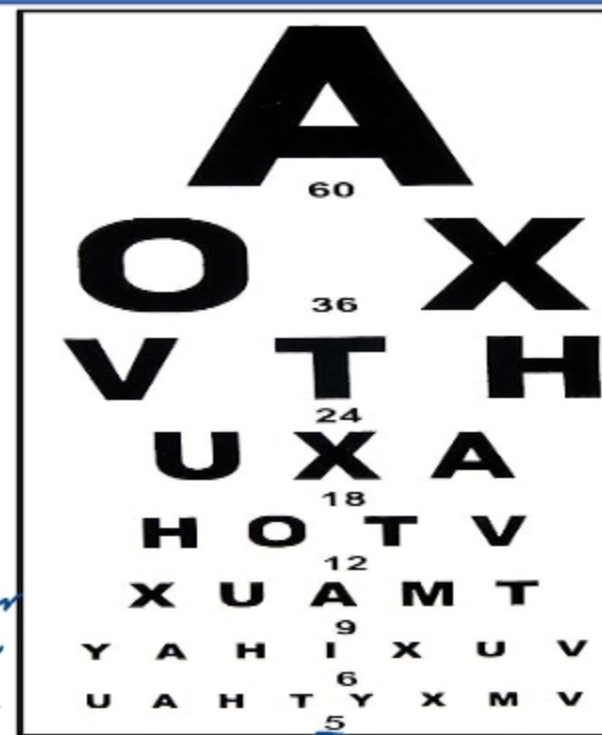
## MYOPIA

Axial length: ↑  
AC: deep  
Squint: exo

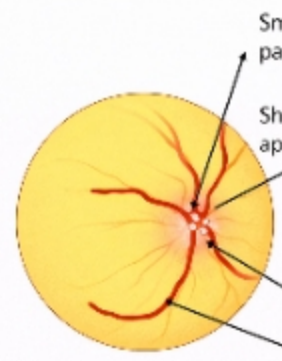
Axial myopia: Axial length ↑  
Curvature myopia: keratometric ↑  
Index myopia: Nuclear cataract  
Positional myopia: West Mardherani

## HYPERMETROPIA

Axial length: ↓  
AC: shallow  
Squint: esotropic  
Aphakia



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



$$VA = \frac{\text{dist}}{\text{No. letter Min}}$$

$$\frac{\text{Best } 6}{5} = \frac{1}{60}$$

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

Angle subtended by topmost letter when viewed from 6m:

$$\frac{\text{Dist of letter}}{\text{Dist of test}} \times 5 = \frac{60}{6} \times 5$$

Landolt C chart - illiterate  
ETDRS - most accurate, crowding phenomenon  
Tellers chart, Optokinetic drum - children

## Treatment of myopia :

Radial keratotomy xx boxer  
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) >8D





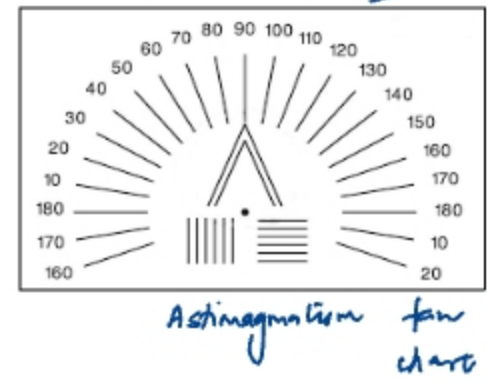
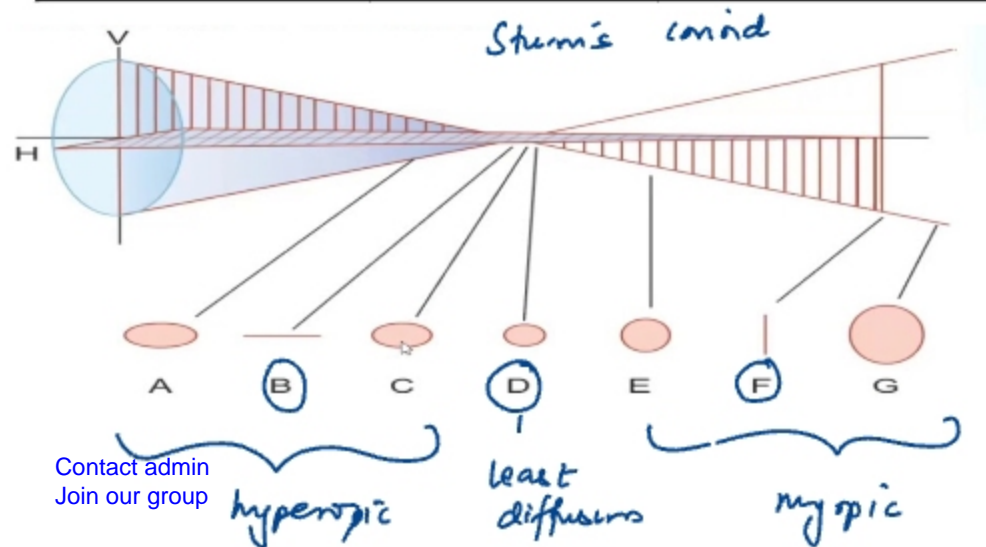
Pinhole  
refr errors improve

# ASTIGMATISM

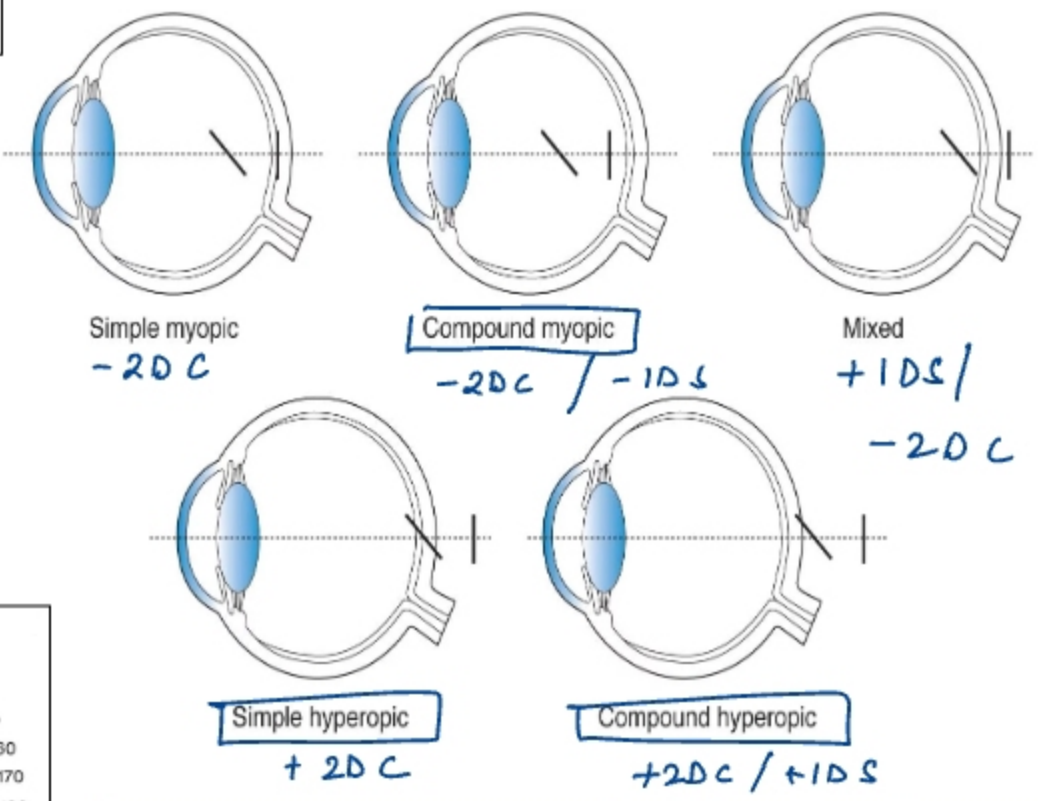
Unequal curvature of eye in different meridians of the eye

Regular: 2 principal meridians perpendicular to each other

Regular astigmatism		180	90
<b>WTR</b> Vertical more curved		Concave (-ve)	Convex
<b>ATR</b> Horizontal more curved		Convex	Concave

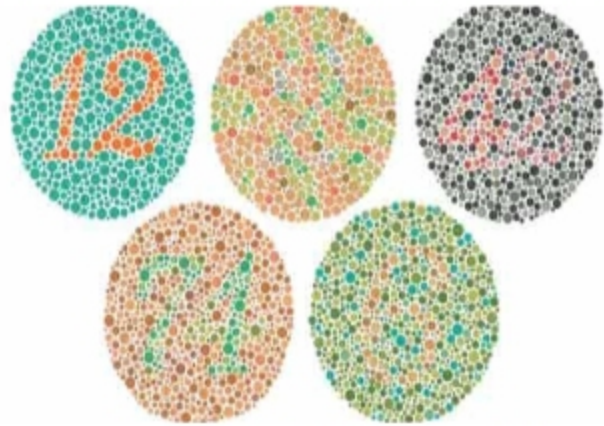


Simple: One meridian emmetropic



-2cyl @180: WTR - Simple myopic  
 -1DS / -2DC @180 WTR - comp "  
 -3DS / -4DC @90: ATR - " "

# Miscellaneous



Snellen chart

**Prota Deutra Trita**

Inheritance: XLR

MC: Red-green CB



Farnsworth - Munsell  
100' hues'



Pelli - Robson  
contrast sn  
chart

Retinoscopy

Examination distance: 1m

No mvt: 1D myopia

Against: >1D myopia

With: <1D myopia / hypermetropia

**Photocoagulation**

Double freq Nd-Yag (532nm)

Argon laser

PRP

LT

**Photoablation**

Argon fluoride Excimer

(193nm)

LASIK

**Photodisruption**

Nd-Yag (1064nm)

PCO

PI

**Nd Glass (1053nm)**

- SMILE

- FLACS ( $10^{-15}$  m)

## Clinical presentations-Localisation:

Gradual progressive painless DOV: *Cataract / OAG.*

Sudden painful red eye + DOV: *ant uveitis / (AIG) trauma*

Sudden painless DOV: *CRAO / CRVO / RD*

Floater: *VH*

Metamorphopsia: *macular*

GTCS

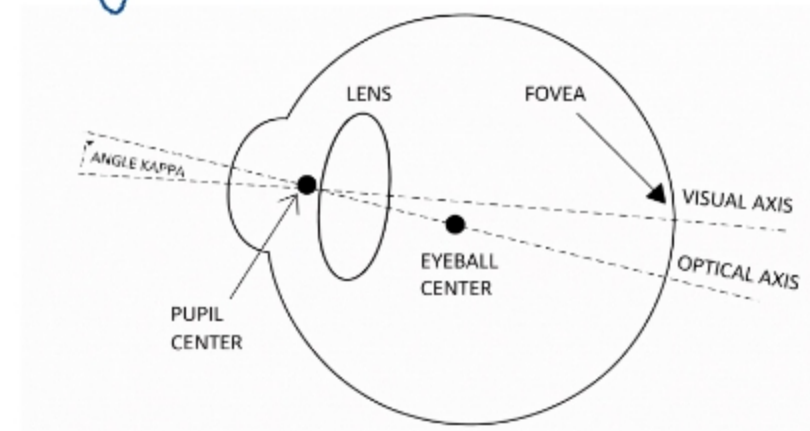
Steroids  $\left\{ \begin{array}{l} \text{topical} - \text{glaucoma} \\ \text{systemic} - \text{cataract} \end{array} \right.$

Eye drop  $\rightarrow$  ointment

Asteroid hyalosis  $\rightarrow$  elderly  $\rightarrow$  hydroxyapatite  $\rightarrow$  settle

Synchysis scintillans  $\rightarrow$  VH lipid  $\rightarrow$  cholesterol  $\rightarrow$  settle  $\checkmark$

Chemical injury to eye: copious irrigation



WHO:

$\geq 6/18$	- (N)	
$< 6/18 - 6/60$		Low vision
$< 6/60 - 3/60$		Economic / work
$< 3/60 - 1/60$		social / walk
$< 1/60 - LP+$		Manifest
NLP		Absolute

NPCBYI



Blindness:  $< 3/60$  presenting vision  
 better eye  
 & available correct (new)

Contact Admin  
 Join our group

Alpha - between visual axis and optical axis  $VA \cap$   
 Gamma - between fixation axis and optical axis  
 Kappa - between visual axis and pupillary plane