

Glaucoma assessment





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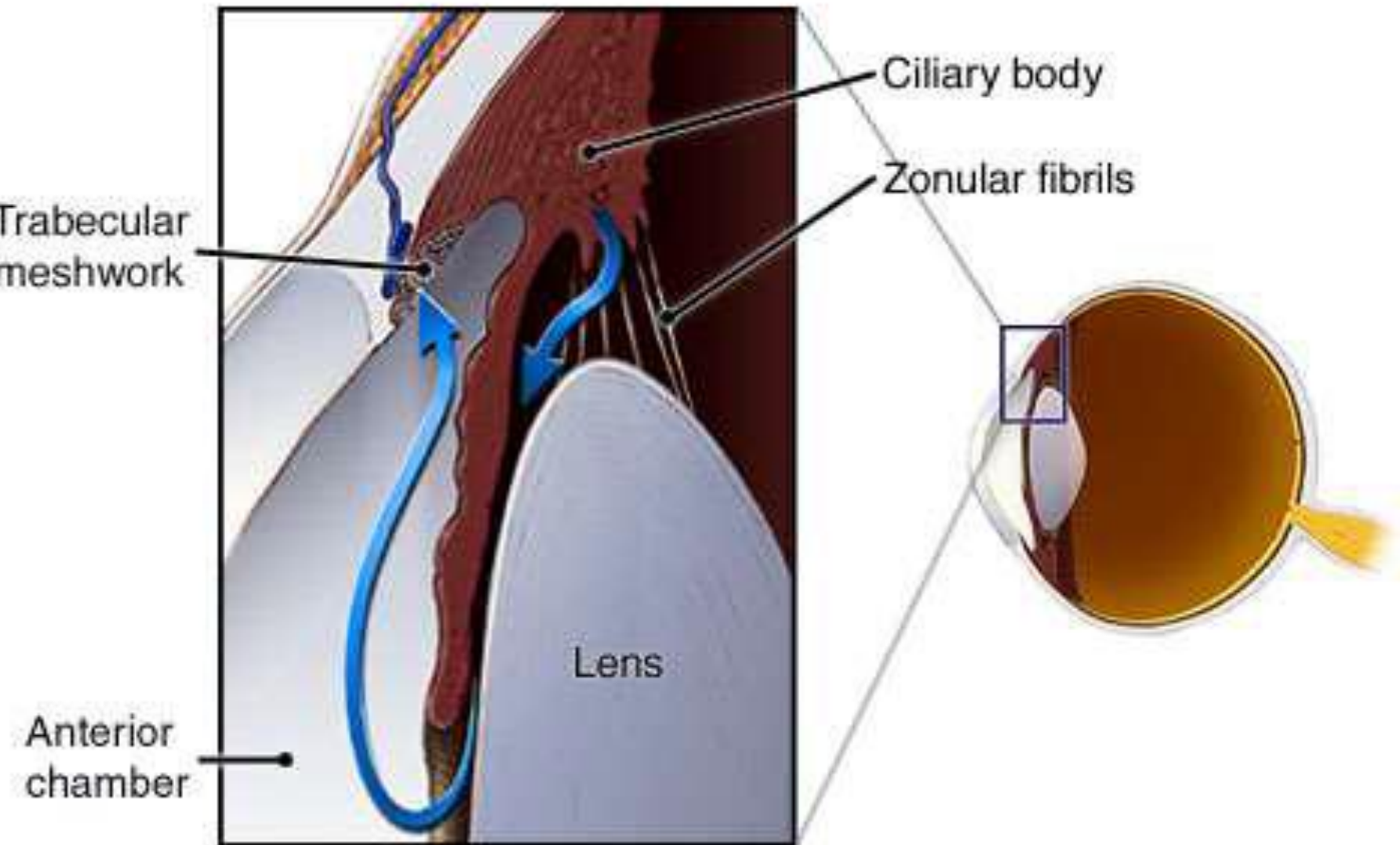
Glaucoma Definition:

- Glaucoma is a **progressive optic neuropathy** with
- characteristic changes in the **optic nerve head** and
- corresponding **loss of VF**.
- ☐ It represents a final common pathway for a number
- of conditions, for most of which raised IOP is the
- most important risk factor.

- Normal IOP: **10-22** mmHg.
- **Three risk factor determine the IOP:**
 - rate of aqueous humor **production** by ciliary body
 - **resistance** to aqueous outflow across the trabecular meshwork-Schlemm's canal system
 - The level of **episcleral** venous pressure

Flow of Aqueous Humor:

A Closer Look at the Trabecular Meshwork



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Appropriate management of glaucoma depends on the clinician's ability to diagnose the

- *specific form* of glaucoma in a given patient,
- *severity* of the condition,
- *progression* in that patient's disease status.

Proforma for examination

□ PRILIMINARY DATA

- Name:
- Age:
- Sex:
- Occupation:
- Address:

□ HISTORY TAKING

- Chief complaints:
- History of presenting complaints:
- Past history:
- Personal history:
- Family History:

□ EXAMINATION

- General Physical Examination:
- Systemic Examination:

□ OCULAR EXAMINTION

- VISUAL ACUITY
- ANTERIOR SEGMENT EXAMINATION:
 - EYE LIDS
 - CONJUNCTIVA
 - CORNEA
 - SCLERA
 - ANTERIOR CHAMBER

- IRIS
- PUPIL
- LENS
- FUNDUS
- IOP
- ANGLE OF ANTERIOR CHAMBER
- VISUAL FIELD TESTING
- NEWER TECHNOLOGIES

Chief Complaints

- Symptoms depend upon:
 - 1. Onset of disease—acute and chronic
 - 2. Age of patient- higher the age, greater is the risk of visual loss
 - 3. Rise of IOP
 - 4. Associated ocular diseases: cataract, uveitis, trauma, retinopathy and vascularisation

- 1. No symptoms
- 2. Visual
 - (a) Diminished distant vision
 - • Sudden—acute glaucoma, both primary or secondary
 - • Gradual—all chronic glaucomas with moderate rise of tension
 - (b) Diminished near vision: Early onset of presbyopia and frequent change of presbyopic glasses is seen in chronic simple glaucoma
 - (c) Loss of field—Unless there is extensive loss of field, it may go unnoticed; however patient with good central vision and constricted peripheral field may complain of tubular vision
 - (d) Photophobia is seen in congenital glaucoma due to rupture of Descemet's membrane
 - (e) Colored haloes.

- . Lacrimation is prominent feature of congenital glaucoma and acute glaucomas
- Pain is seen in acute rise of tension,
- Redness of eye

- Past history: diabetes, hypertension, asthma, seizures
- **NTG** associated systemic diseases migraine headache, raynauds disease, MI, nocturnal hypotension, autoimmune diseases, shock syndromes, anaemias, DM, sleep apnea syndrome
- Family history: glaucoma, diabetes, Hypertension
- Personal history: smoking, alcohol

General examination

- Systemic diseases associated with Glaucoma
- 1. autoimmune diseases-JRA, Ankylosing spondylitis
- 2. Infections- congenital Rubella, Leprosy, Syphilis
- 3. Vascular and hematologic disorders(NVG)- sickle cell anemia, vessel occlusions
- 4. Neoplasias- metastatic CA of breast and lung
- 5. when the glaucoma and systemic disorder are parts of a syndrome- Phakomatoses, Axenfeld Reiger Syndrome, Marfans syndrome, Weil Marchesaani syndrome
- 6. systemic hypertension, hypothyroidism, migraine headaches, nocturnal hypotension, sleep apnea, and silent myocardial infarction

. Visual acuity + refraction

(a) Without glasses—will give the extent of visual loss

(b) With pinhole—will indicate the limit to which vision can be salvaged with treatment

. Refraction :

Hyperopic eyes are at increased risk of **angle-closure glaucoma** and generally have smaller discs. **Myopia** is associated with disc morphologies that can be clinically confused with glaucoma, and myopic eyes are at increased risk of **pigment dispersion**. **have increased risk of open-angle glaucoma.**



In some patients, vision deteriorates with treatment of glaucoma:

- **Miotics will**
- (a) Reduce vision in cases associated with central nuclear cataract,
 - central corneal opacity and macular lesion
- (b) Cause diminished night vision
- (c) Reduce field of vision
- (d) Produce difficulty in near vision
- **[?] Carbonic anhydrase** inhibitors may produce transient myopia
- **[?] Anti-glaucoma surgery** may produce:
 - • Troublesome astigmatism
 - • Persistent hypotony

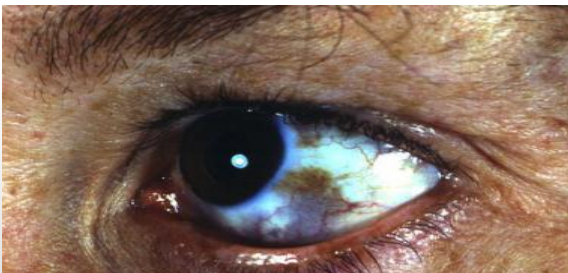
Slit lamp examination:

- Eye Lids: congested and edematous in an acute attack of angle closure glaucoma



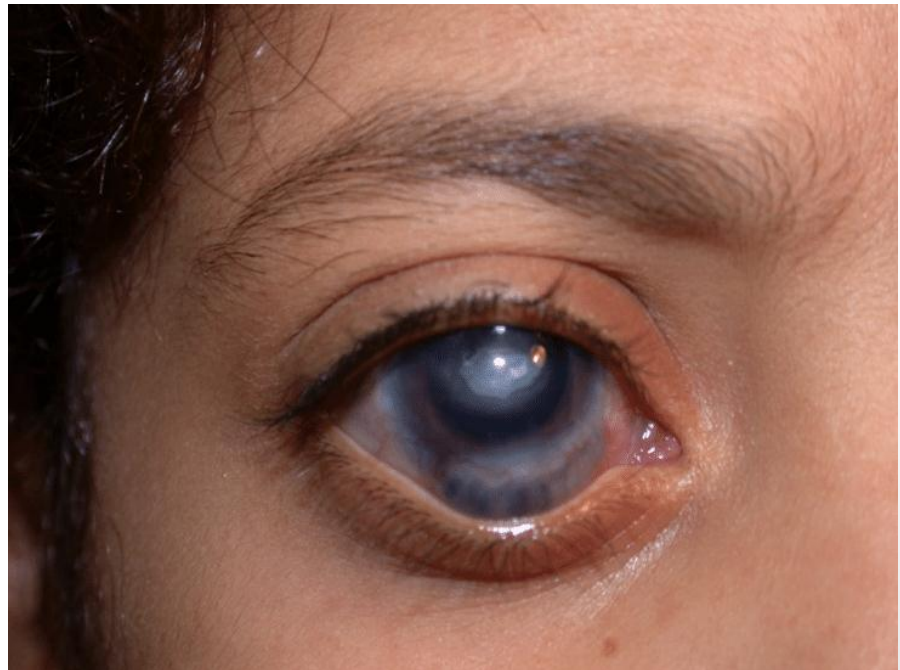
Conjunctiva

- Circumciliary congestion is seen in acute congestive glaucoma, chronic congestive glaucoma and absolute glaucoma
- **Episcleral congestion** is seen in raised episcleral pressure.
- Typical **corkscrewing** of vessels
- Long term use of sympathomimetics and prostaglandin analogues
 - Long term use of epinephrine derivatives(Staining,)
 - Filtering bleb +/-
- hyperemia, scar

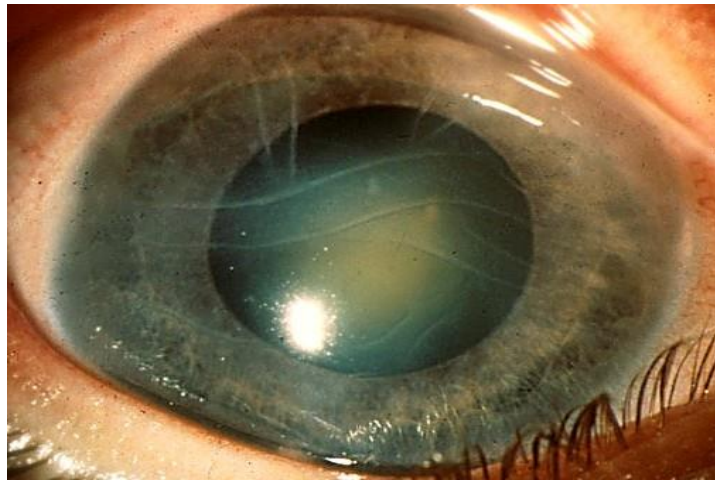


SCLERA

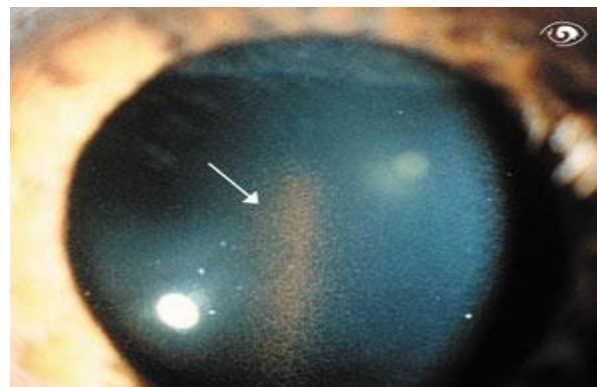
- Thinning and stretching of sclera is very common in congenital glaucoma
- Scleral ectasia is seen in congenital glaucoma and sometimes in absolute glaucoma



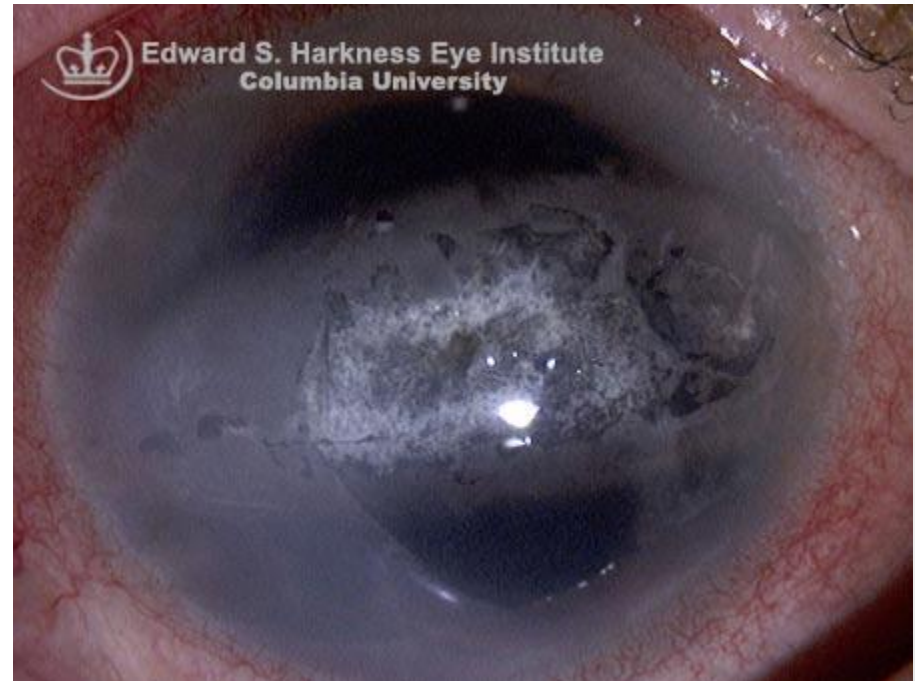
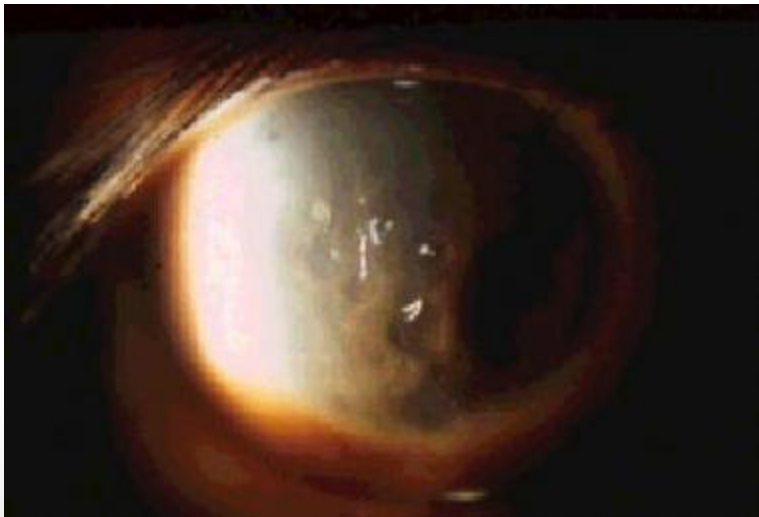
Cornea



- Rupture in Descemet's membrane and **Haab's striations** are seen in congenital glaucoma
- Corneal oedema
- **Krukenberg spindle (PDS)**
- KP may be present following acute rise of tension, or uveitis



- Band keratopathy is seen in long-standing glaucoma
 - Diminished corneal sensation is seen with acute rise IOP
 - Bullous keratopathy is seen in absolute glaucoma
 - Vascularisation may be present in the absolute stage
- stage



Cornea:

guttae Fuchs endothelial dystrophy
dendrites

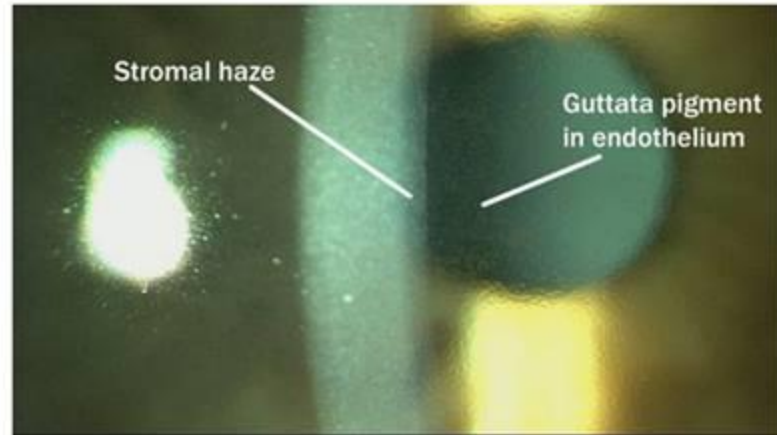
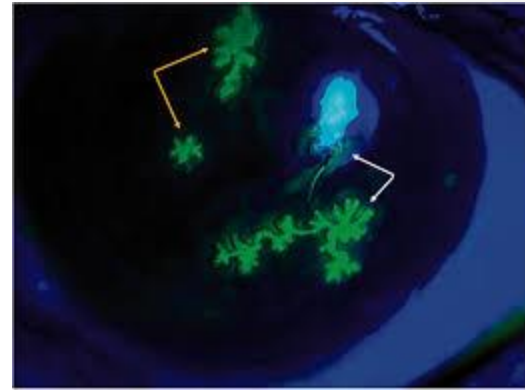


Figure 2

central corneal thickness (CCT):

- A **thinner cornea** may require less force to applanate it, leading to **underestimation** of true IOP while a **thicker cornea** would need more force to applanate it, giving an **artificially higher IOP**.
- However, corneal thickening due to edema causes a falsely lower reading.
- Patients with **less than 555 U had 3 times** greater risk of POAG
- IOP measurements are also modified after PRK and LASIK.

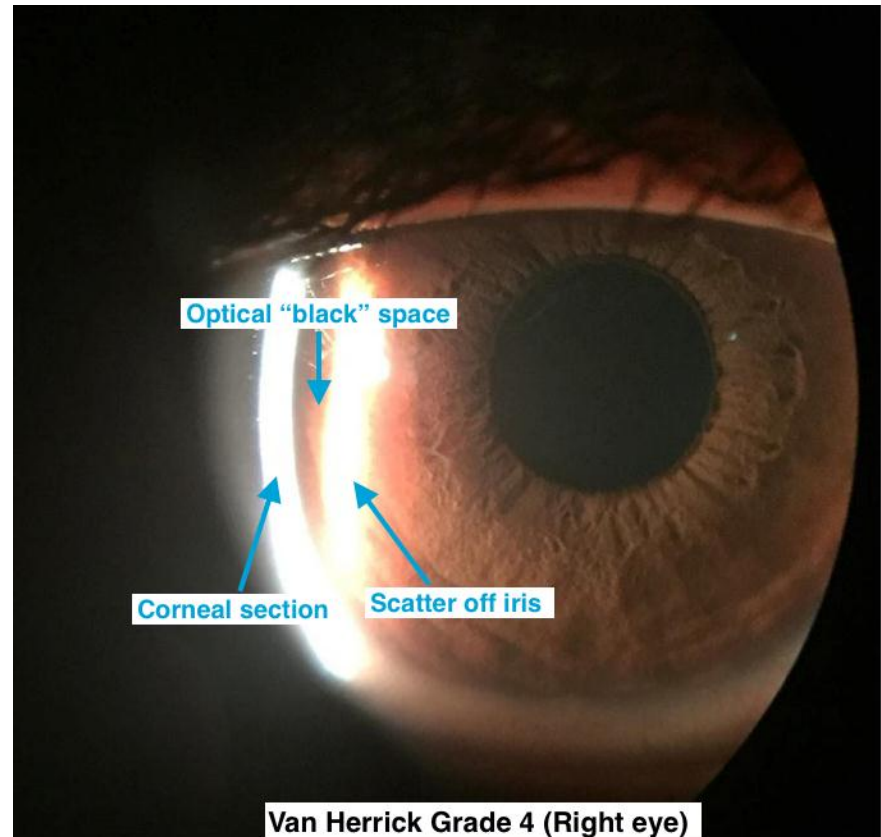
CCT

Corneal thickness (μm)	Correction value (mmHg)
475	+3.19
500	+2.13
525	+1.07
550	0.02
575	-1.04
600	-2.10
625	-3.16
650	-4.21
675	-5.27
700	-6.33

- The Goldmann applanation tonometer was designed to give accurate readings when the CCT was **520 μm** .
- The deviation of from **520 μm** yields a change in applanation readings of **0.7 mm Hg per 10 μm**

Measurement of anterior chamber depth

- (a) By oblique illumination
- (b) Comparing corneal thickness to anterior chamber depth - Van Herick's grading
- (c) Shadow of temporal iris
- (d) Pachymetry
- (e) A Scan
- (f) B Scan



GRADE I



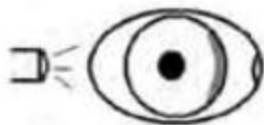
< 1/3
illuminated

GRADE II



1/3-2/3
illuminated

GRADE III



>2/3
illuminated

GRADE IV



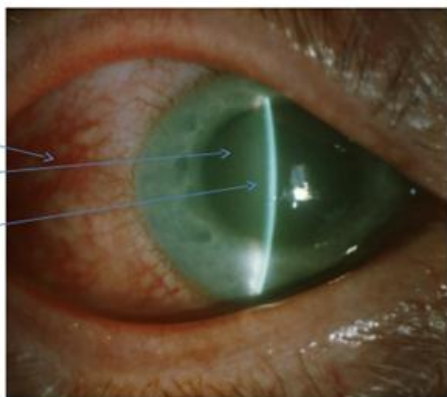
Fully
illuminated

te angle
ure glaucoma

Eye

edematous
cornea

-dilated



Anterior chamber depth

Normal – note light
illuminating both sides of iris

Shallow – nasal side of iris is
in darkness



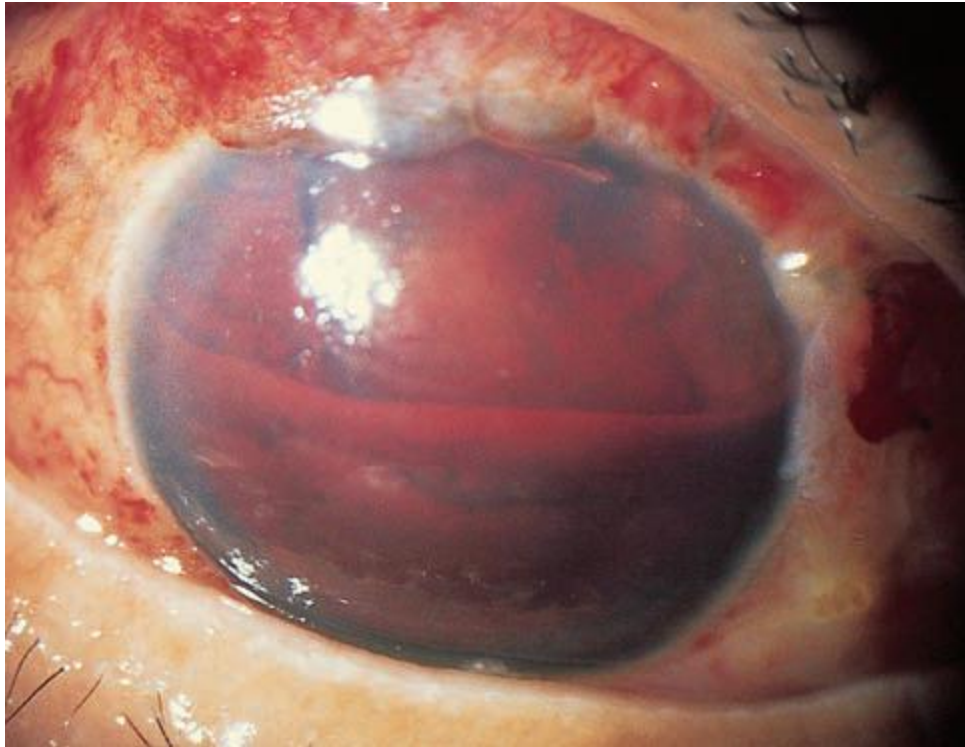
Anterior chamber:

- Uniformity of depth: bombe , masses



- Comparison between eyes
- Cells , blood , fibrin ...
- Narrow angle: Van herick method



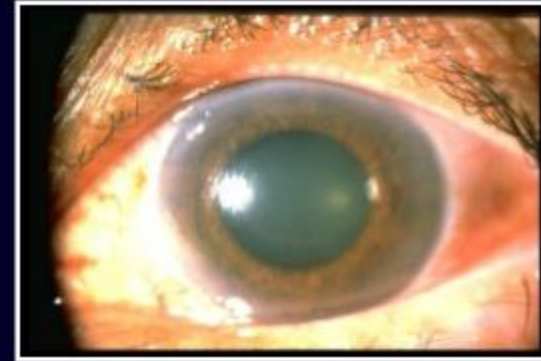


In this patient with hyphema, pupillary block caused by the obstruction to aqueous flow by the anterior segment clotted blood is part of the differential diagnosis of the elevated intraocular pressure

Pupil

- A large, sluggish pupil with fairly good vision, without a history of use of mydriatic, in a person past 40 years should raise the possibility of increased intraocular tension unless proved otherwise
- An afferent pupillary defect in glaucoma denotes unilateral advanced glaucomatous change in the optic disc
- A Mid-dilated, sluggish, vertically oval pupil in a congested eye
- means acute narrow-angle glaucoma
- A constricted pupil should invite enquiry about the instillation of a miotic, its strength and frequency. All small pupils should be examined to exclude iritis
- Distorted pupil is seen in trauma, uveitis, chronic congestive glaucoma and absolute glaucoma

Mid-dilated, fixed pupils and cloudy corneas during an angle closure attack.

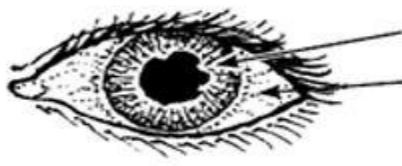


IRITIS (INFLAMMATION OF THE IRIS)

NORMAL EYE



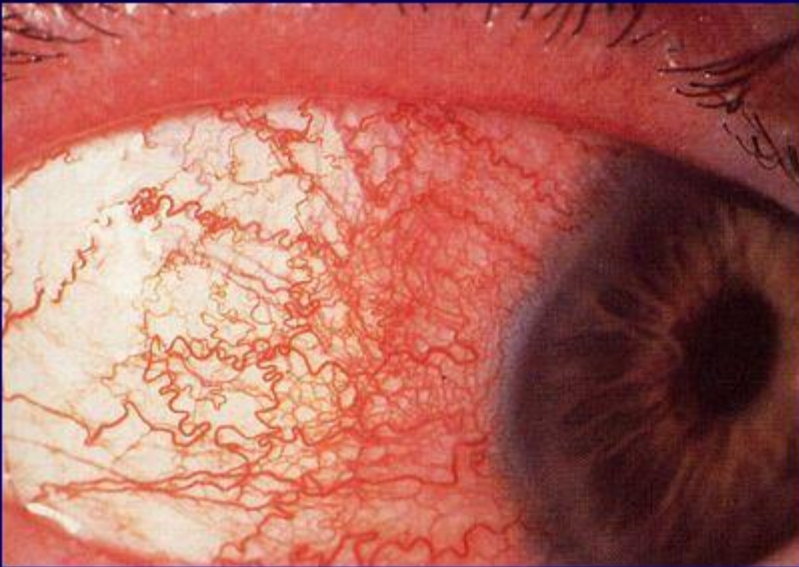
EYE WITH IRITIS



Signs :

- pupil small
- often irregular
- redness around iris
- severe pain

Iritis (anterior uveitis)



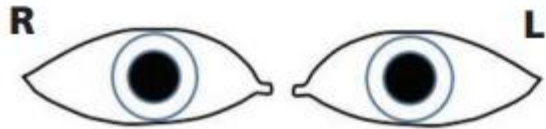
Ciliary injection



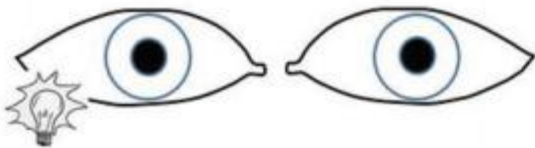
Miosed (small pupil)

Swinging light test

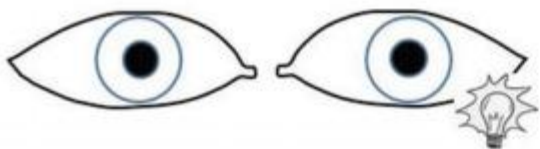
In a dark room, bright pen light and patient fixated on distant object (to avoid a near pupil response).



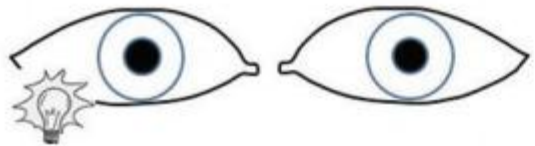
1. **Shine light into right (R) eye.** Both pupils should constrict.



2. **Shine light to left (L) eye.** Both pupils remain constricted.



3. **Shine light back to right eye.** Both pupils remain constricted.



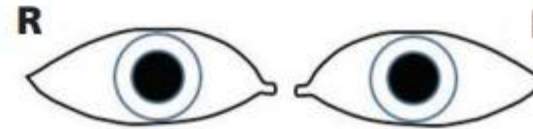
4. **Swing light back to right (normal) eye.** Both pupils remain constricted.

Abnormal swinging light test indicates unilateral or asymmetric optic nerve pathology (e.g., asymmetric glaucoma) or retinal disease and should always be performed by a neurologist or an ophthalmologist.

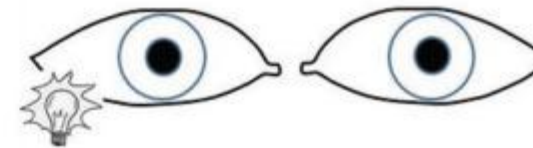
In APD, both pupils dilate when light is shone in the right eye during the swinging light test.

Left relative afferent pupillary defect* (LRAPD)

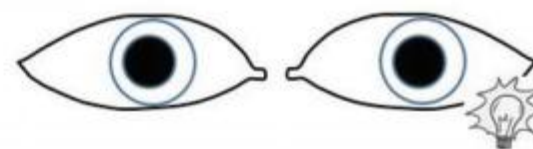
1. Begin with dark room, bright pen light and patient fixated on distant object.



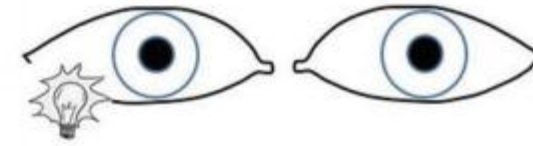
2. **Shine light into right (R) eye.** Both pupils should constrict.



3. **Swing light to left (L) affected eye.** Instead of constricting, both pupils will dilate.

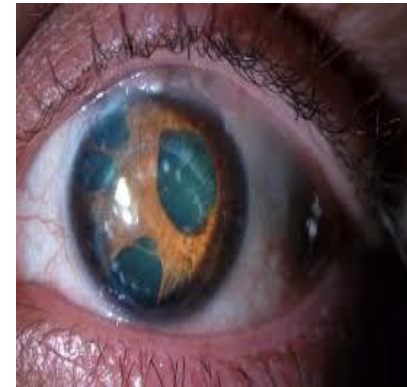
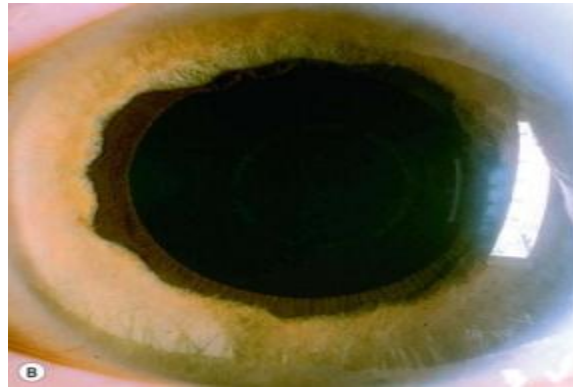


4. **Swing light back to right (normal) eye.** Both pupils remain constricted.



□ Iris:

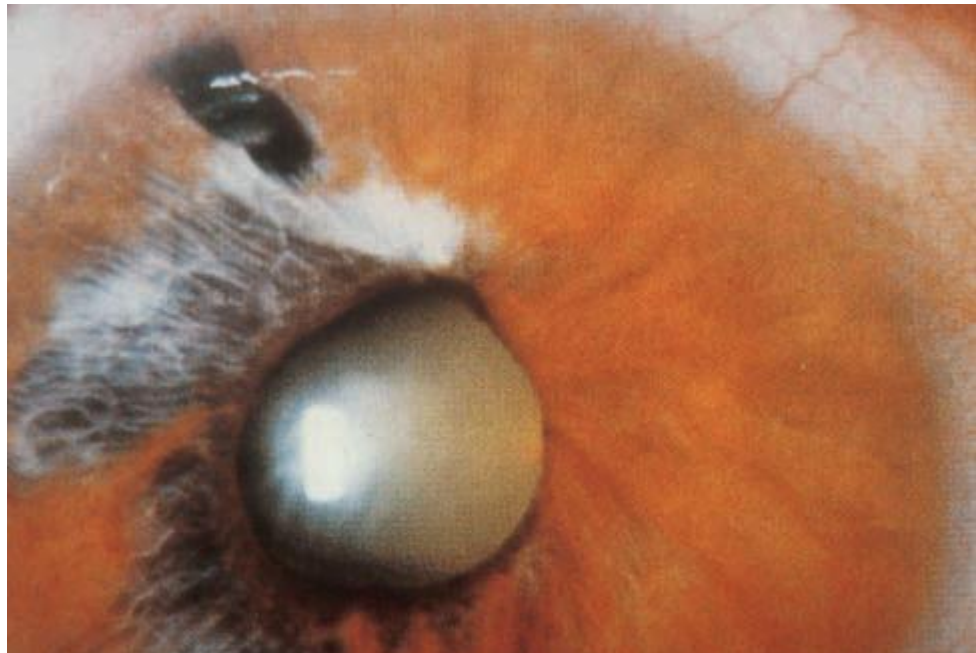
- Before dilation
- Heterochromia (Fuchs) , ectropion , corectopia , exfoliation ,neovascularisation



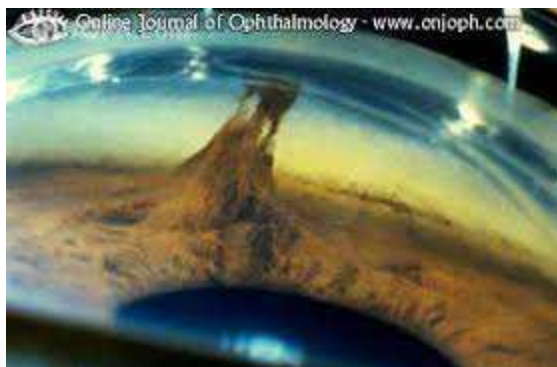
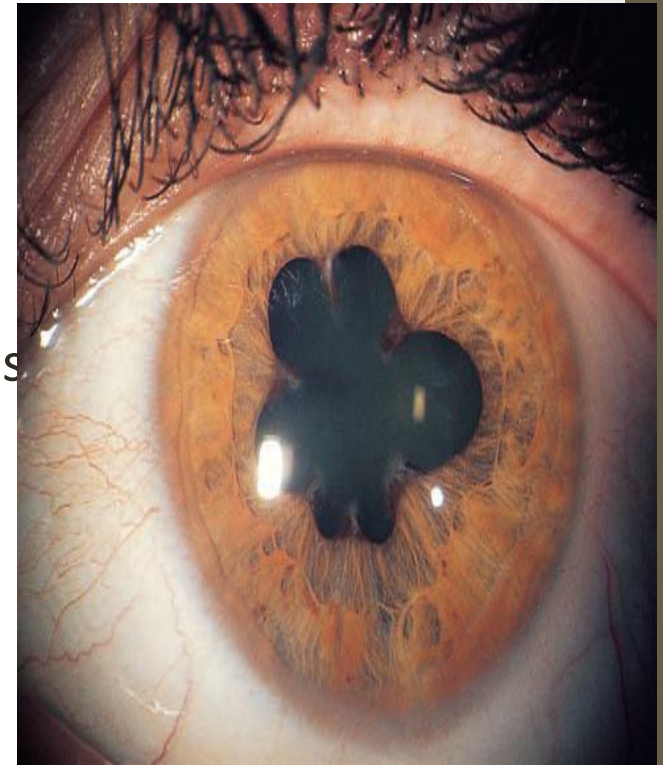
Iris



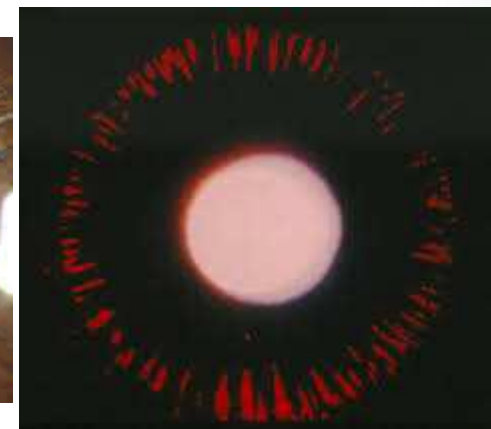
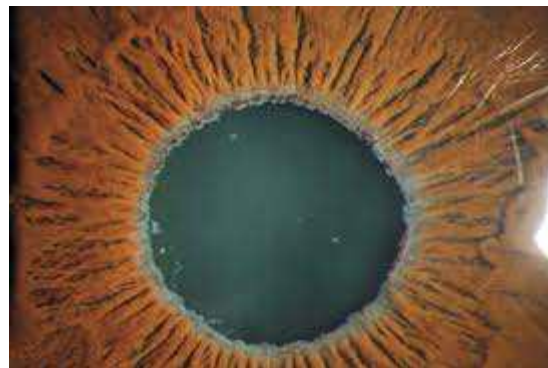
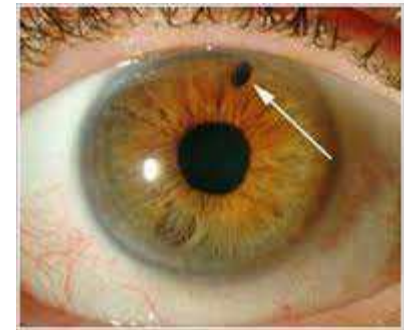
- Loss of pattern is due to oedema
- Atrophic patches (iritis glaucomatosa, chronic congestive glaucoma and absolute glaucoma_)-
- segmental iris atrophy in(ACG and herpes simplex uveitis)
- diffuse in OAG, Senility,Chronic uveitis.



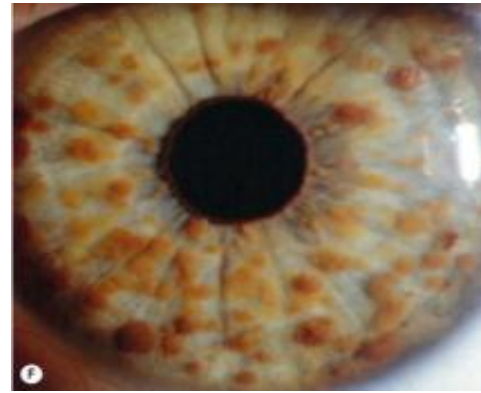
- Posterior synechiae—sudden high rise of intraocular tension, anterior uveitis, iritis and glaucomatosa result in pos
-) Peripheral anterior synechiae are seen following unrelieved tension in acute congestive glaucoma, chronic uveitis and neo-vascular glaucoma



- **Neovascularisation**—thrombotic glaucoma
- (**Coloboma**—surgical, laser and trauma
- **Holes**—(positive transillumination) are seen in essential iris atrophy, mesodermal dys-genesis of anterior chamber, glaucomatocyclitic uveitis, heterochromic uveitis,
- pigment dispersion syndrome
- and herpes zoster
- **Flakes** are seen in PXF

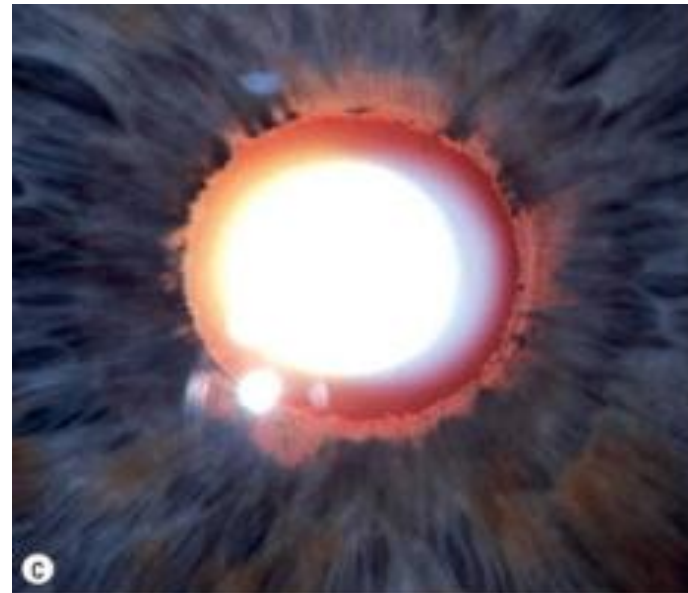
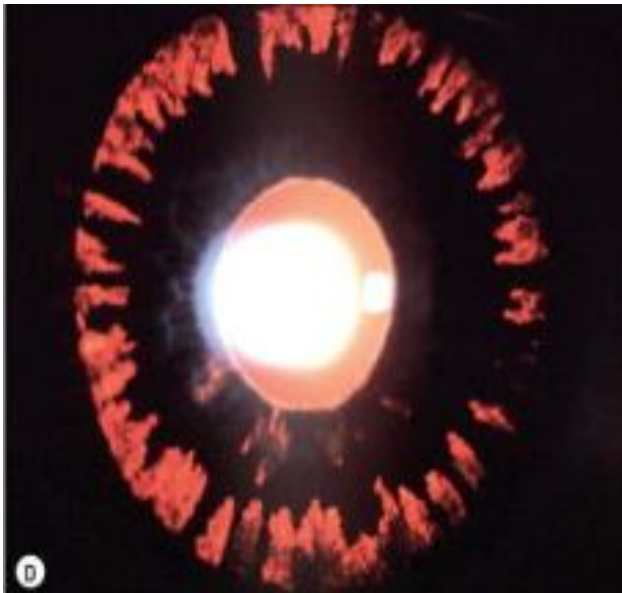


- Surface of iris: nodules , masses , inflammatory membrane

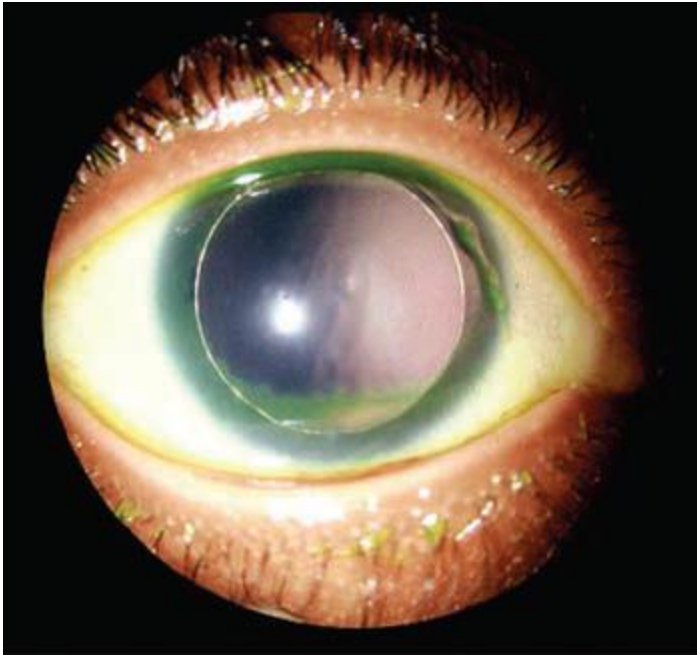


- Retro illumination: PDS , PXF
radial slit-like defects

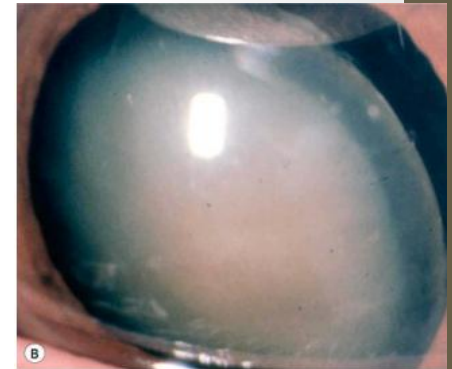
moth-eaten defect



Aniridia



Lens:



- Cataract: Mature /Hypermature (Lens Induced Glaucoma)
- Pseudoexfoliation material
Glaucomflecken (with patchy iris atrophy and mid dilated non reacting pupil forms the vogy's triad of ACG)
- Pigments on lens
- Posterior synechiae



Glaucomflecken

- (Glaucomflecken are gray-white epithelial and anterior cortical lens opacities that occur following an episode of markedly elevated IOP, as in acute angle-closure glaucoma.

Histopathologically, glaucomflecken are composed of necrotic lens epithelial cells and degenerated subepithelial cortex.)



After acute angle closure glaucoma due to pupil block, milky opacities occur underneath the lens capsule.



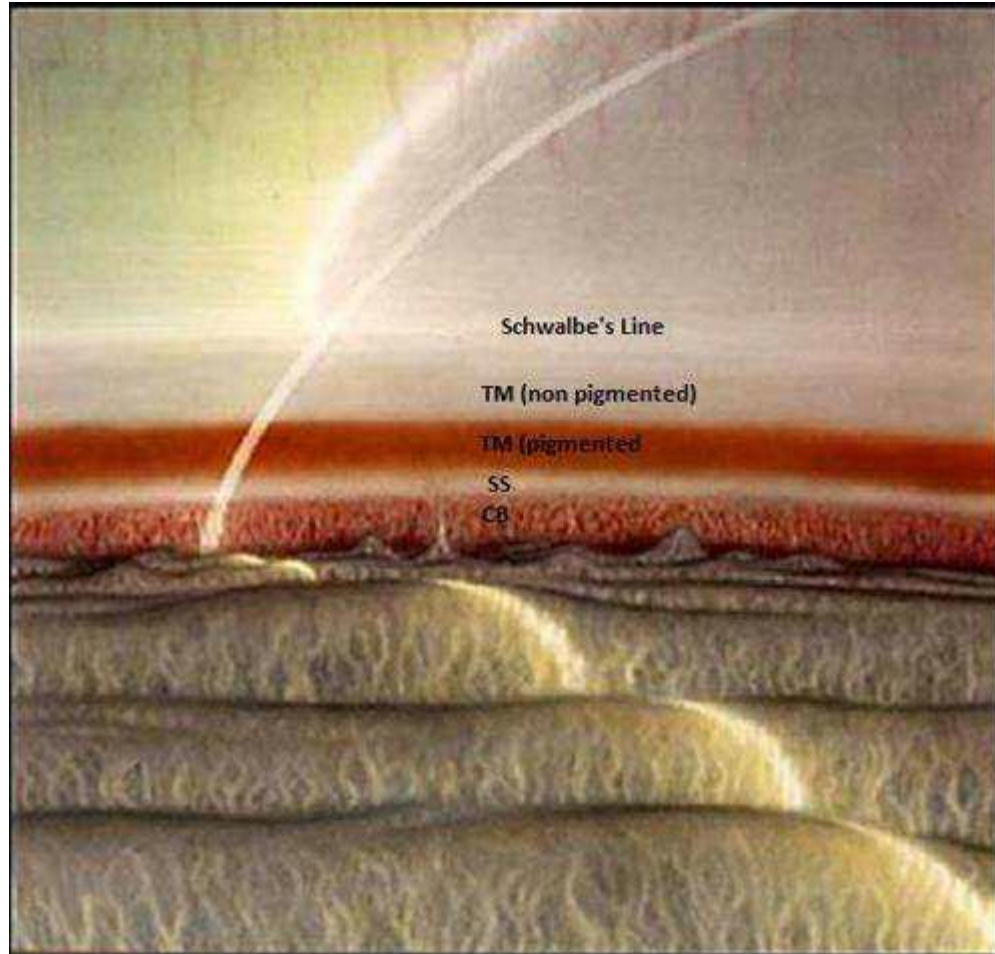
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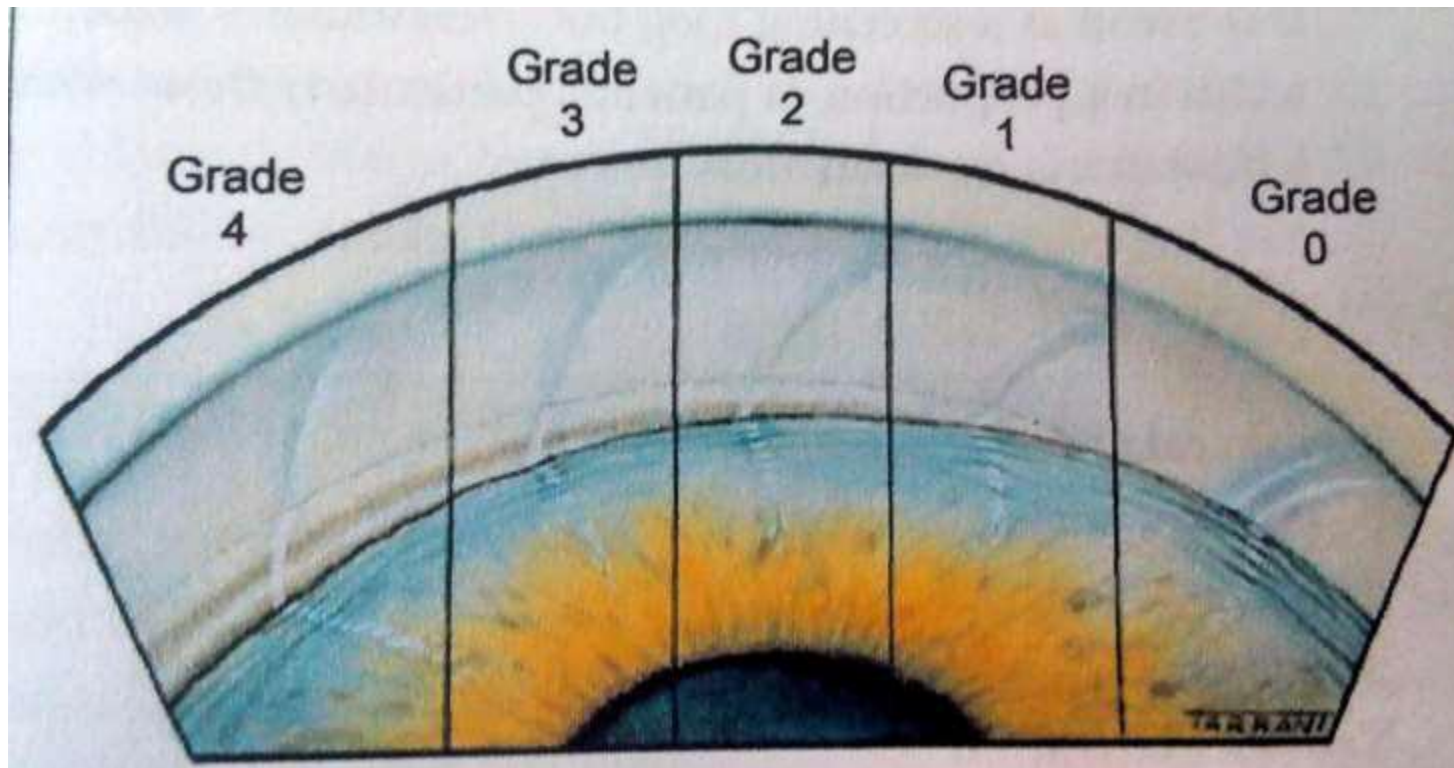
Textogram

Gonioscopy indication

- Classification : Open or Closed angle glaucoma
- To assess AC angle recess & risk of angle closure.
- To identify plateau iris.
- To look for Abnormal angle pigmentation
- PEX ,
- cyclodialysis,
- foreign body,
- Neoplasm,
- copper deposition ,
- blood in Schlemm's canal.





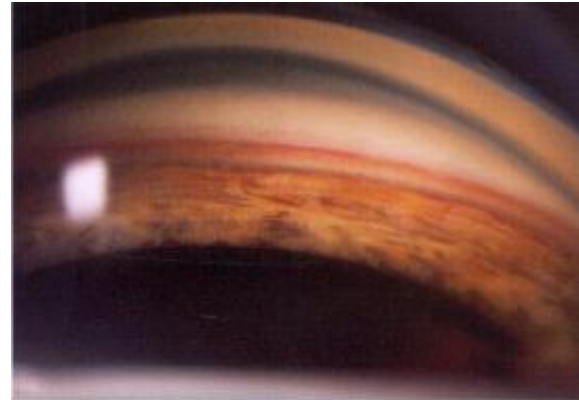
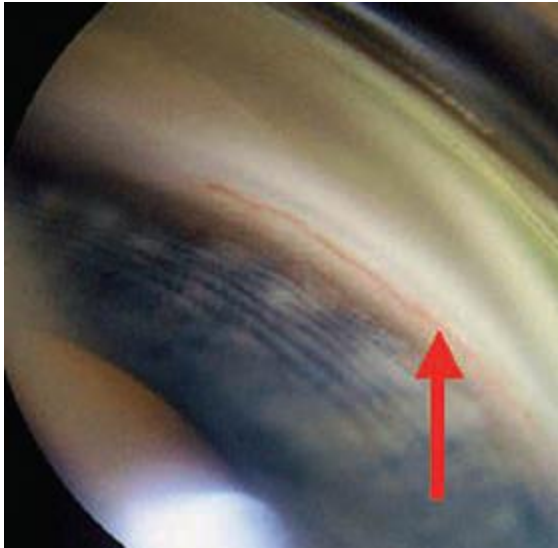


Shaffer grading

GRADE	ANGLE WIDTH	CONFIGURATION	CHANCE OF CLOSURE	STRUCTURES VISIBLE ON GONIOSCOPY
IV	30-40	WIDE OPEN	NIL	SCHWALBE'S LINE TO CILIARY BODY
III	20-30	OPEN	NIL	SCHWALBE'S LINE TO SCLERAL SPUR
II	20	MODERATELY NARROW	POSSIBLE	SCHWALBE'S LINE TO TRABECULAR MESHWORK
I	10	VERY NARROW	HIGH	SCHWALBE'S LINE ONLY
0	0	CLOSED	CLOSED	NONE

Gonioscopy:

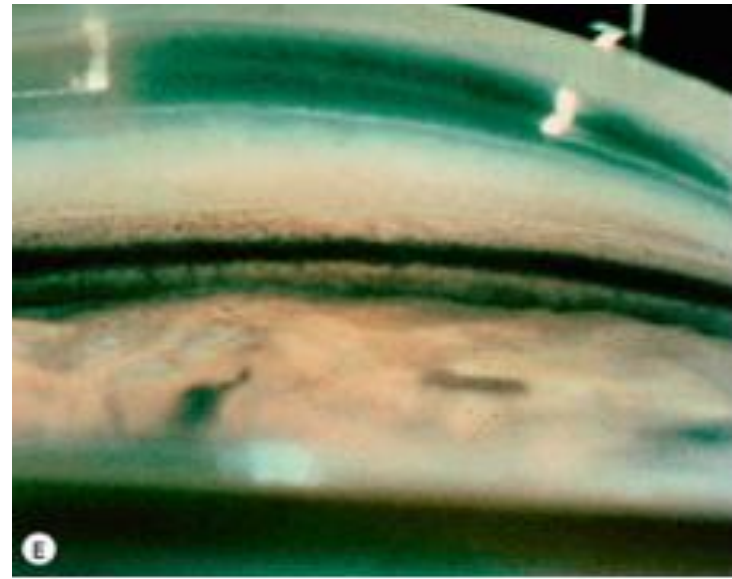
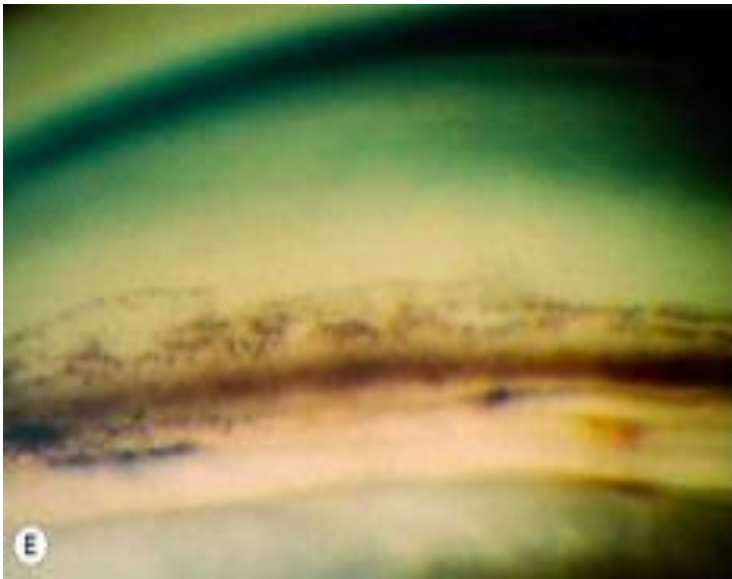
- Dim light room + thin beam
- Blood in schlemm canal



Gonioscopy Findings and Associated Conditions

Finding	Associated Condition(s)
Pigment	Pigmentary dispersion syndrome, exfoliation syndrome, trauma and surgery
Peripheral anterior synechiae	Intermittent or chronic angle closure attacks, trauma and chronic inflammation
Hyphema	Neovascularization of the angle, trauma
Exfoliative material	Exfoliation syndrome
Wide ciliary band	Angle recession
Blood vessels	Neovascularization, normal iris vessels
Iris processes	Normal finding, Axenfeld-Reiger syndrome

- - Patchy + sampaolsi line - dandruff-like' appearance PXF
 - Uniform pigment PDS
 - Trauma , melanoma , surgery , inflammation

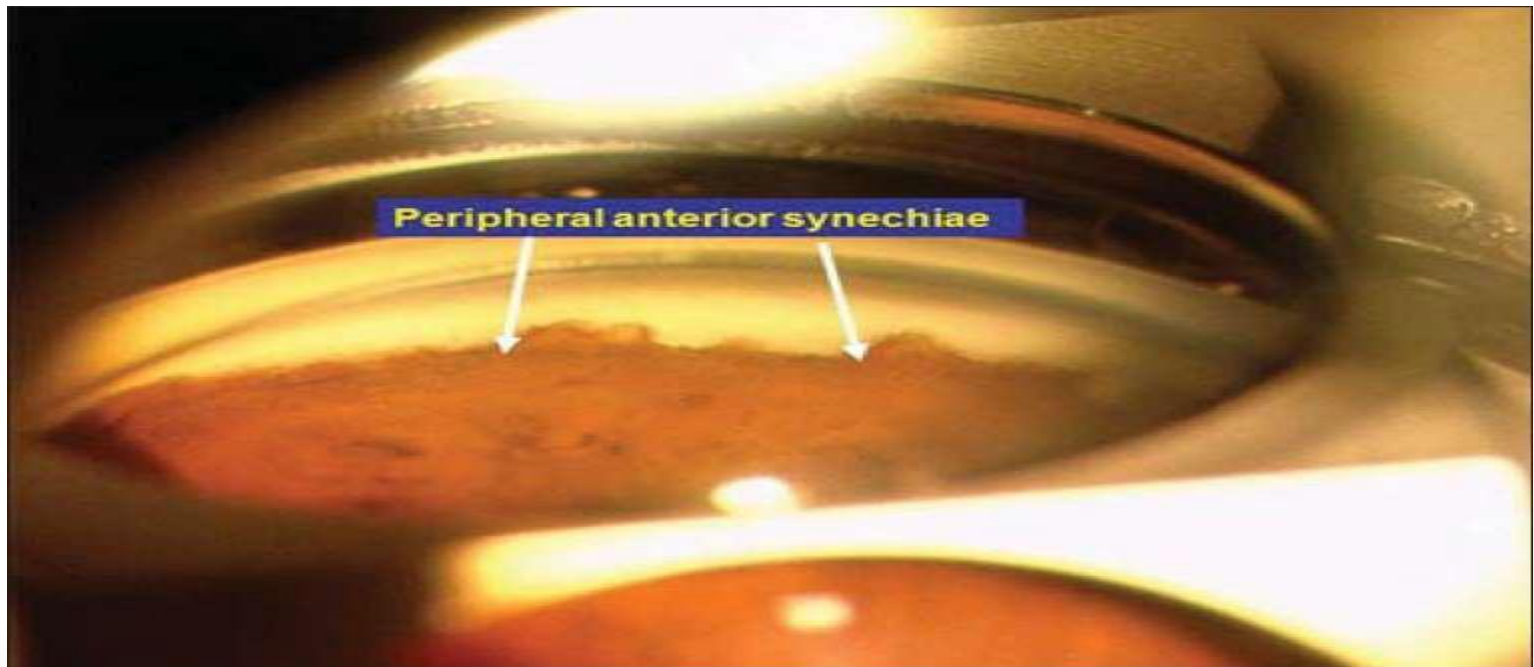


IRIS PROCESS

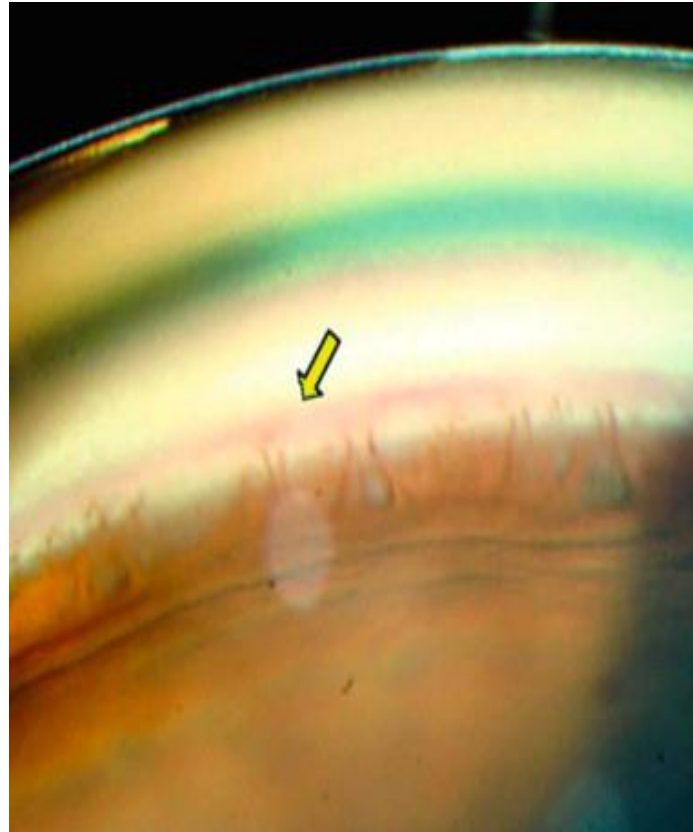
- Fine
- ▶ Extend into scleral Spur
- ▶ Follow concavity of Recess
- ▶ Underlying Structures are seen
- ▶ Iris moves with indentation
- ▶ Broken with angle
- Recession

PAS

- ▶ Broad
- ▶ Extend Beyond Scleral Spur
- ▶ Bridge concavity of Recess
- ▶ Obscures the View
- ▶ Resists Movement
- ▶ Intact in Recession

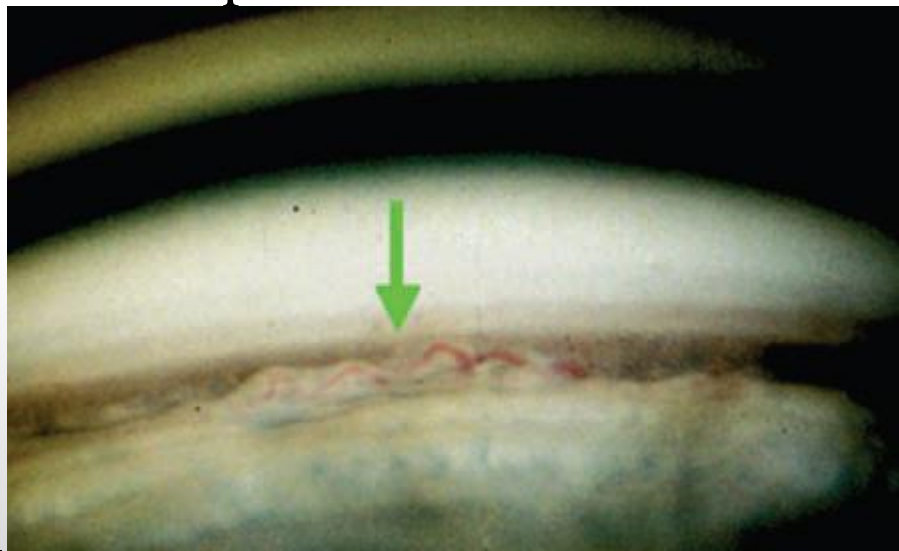


- PAS \ iris processes



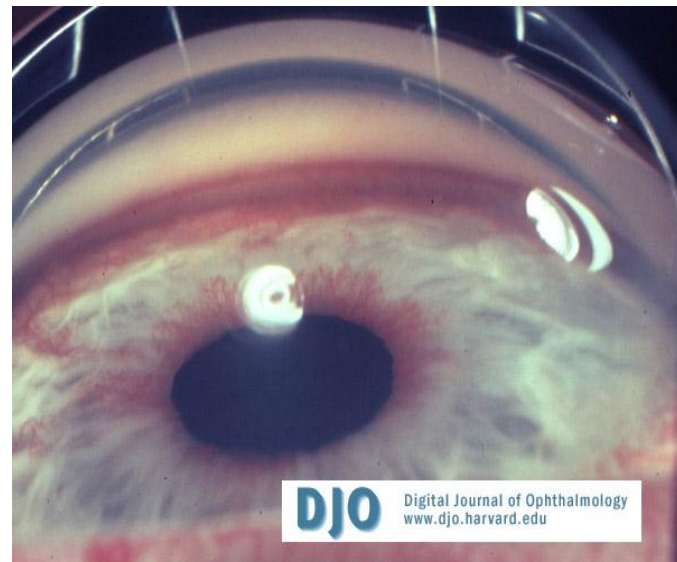
NORMAL

- ▶ Radial Orientation
- ▶ Thick
- ▶ Non Branching
- ▶ Do not cross Scleral Spur



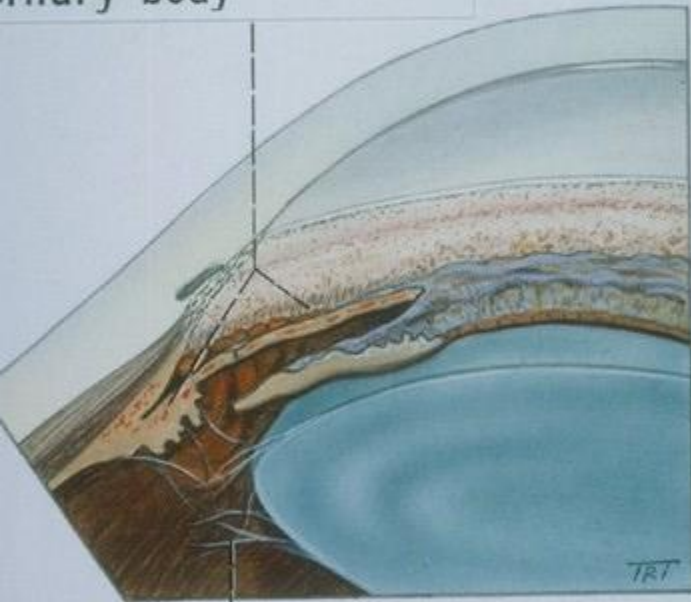
NEOVASCULARIZATION

- ▶ Fine
- ▶ Arborising
- ▶ Crosses Scleral Spur



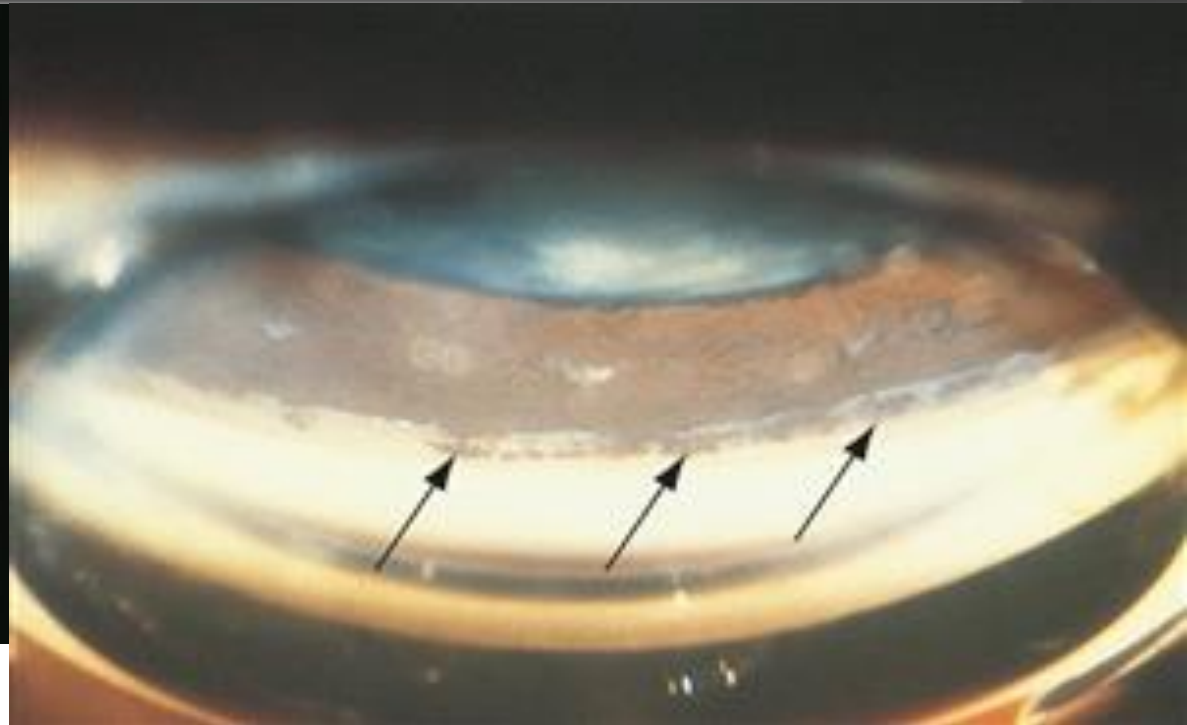
ANGLE RECESSION

Disruption of trabecular network and laceration of ciliary body



Torn zonules

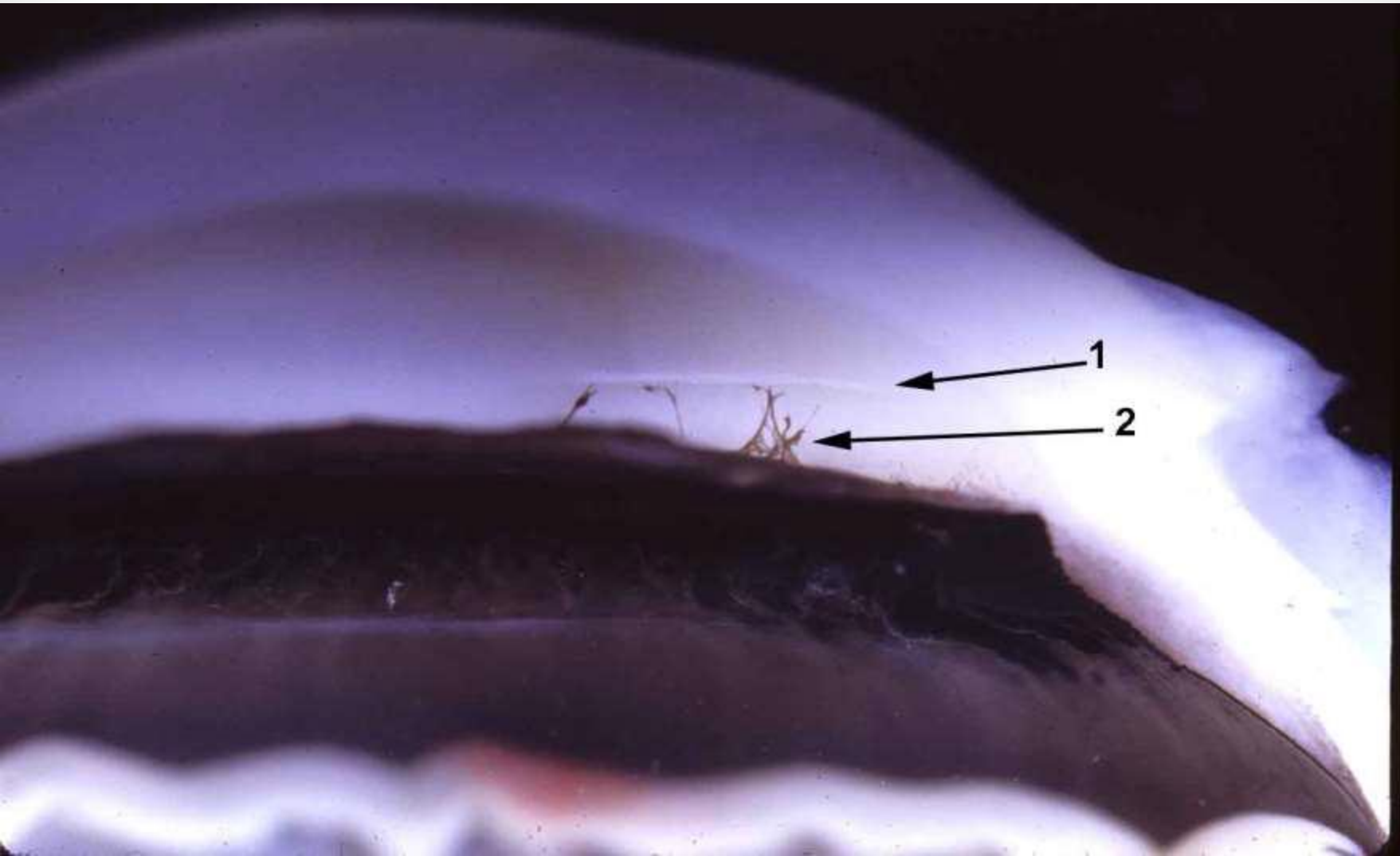
following trauma to the eye. It occurs due to tear between longitudinal and circular muscles of ciliary body.





Neovascular Secondary Angle-Closure
Glaucoma, Rubeosis Iridis, Gonioscopy

Vessels cover the chamber angle (ciliary
body band, scleral spur, trabecular
meshwork) thus preventing outflow.



POSTERIOR EMBRYOTOXON

IOL



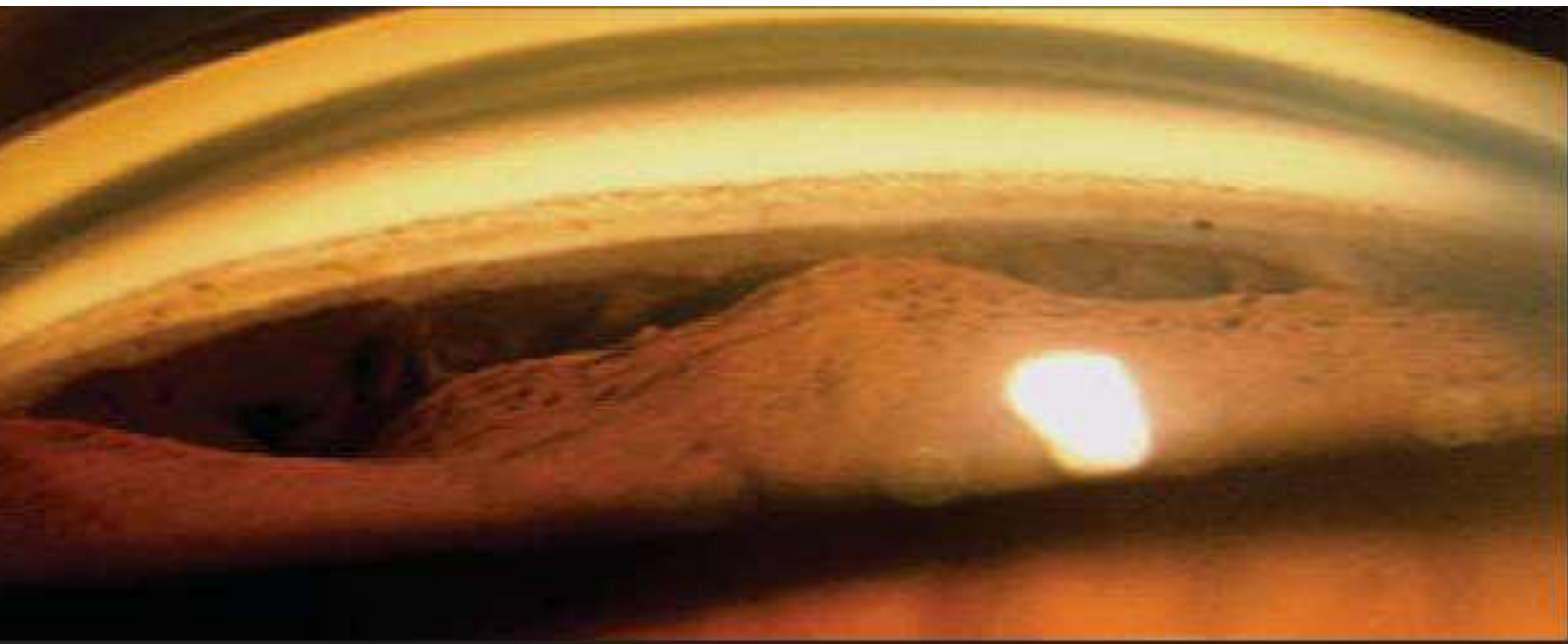
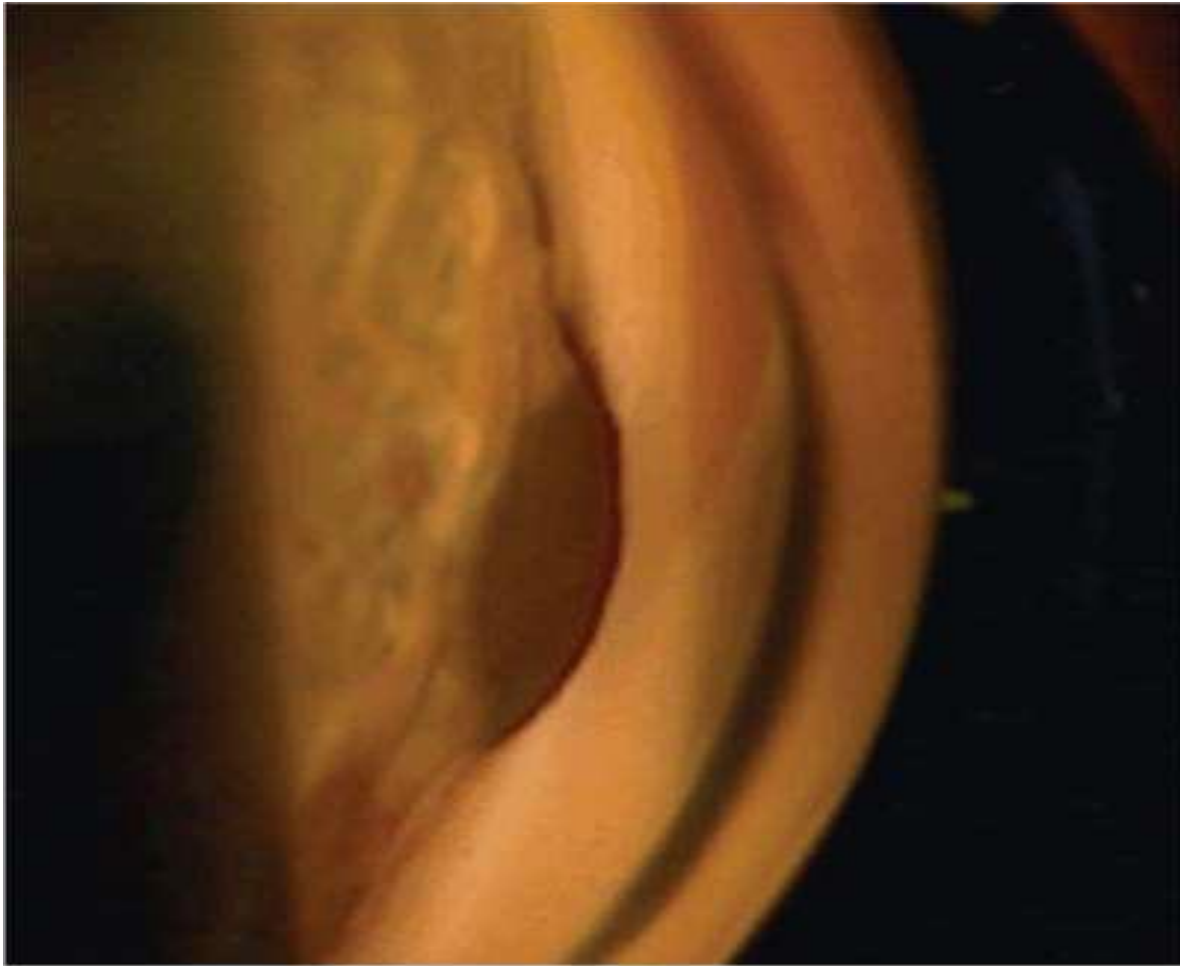


Fig 1.30 Iridodialysis



4. A gonioscopic image of iris melanoma. Notice how the melanoma obscures the angle.

IRIS NEVUS

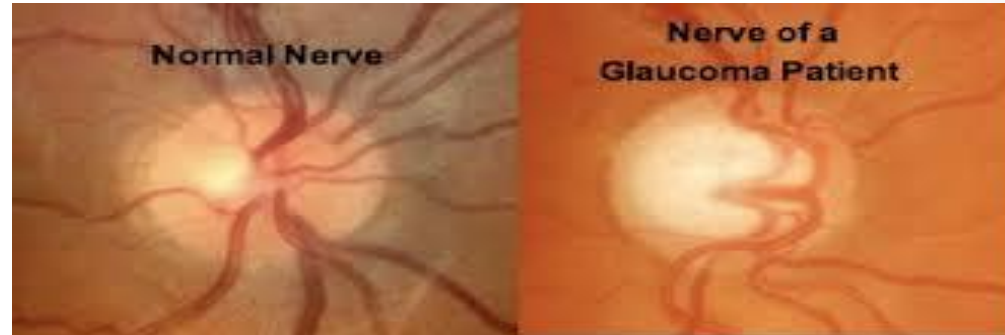




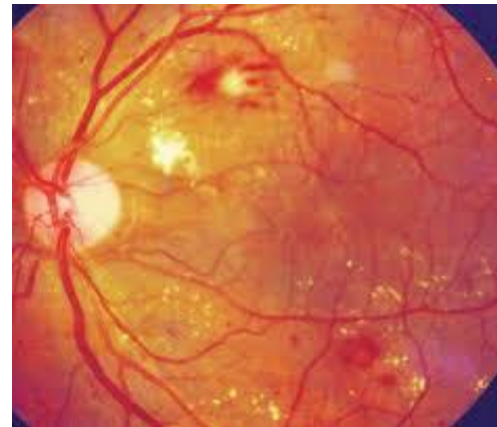
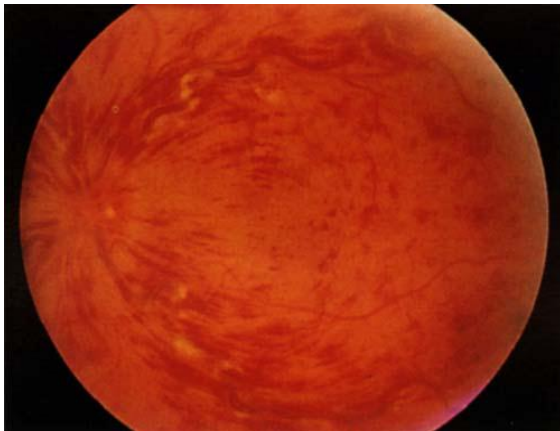
“We’re hopeful the built up pressure will subside, but right now he’s still in a glaucoma.”

□ Fundus:

- Optic nerve :

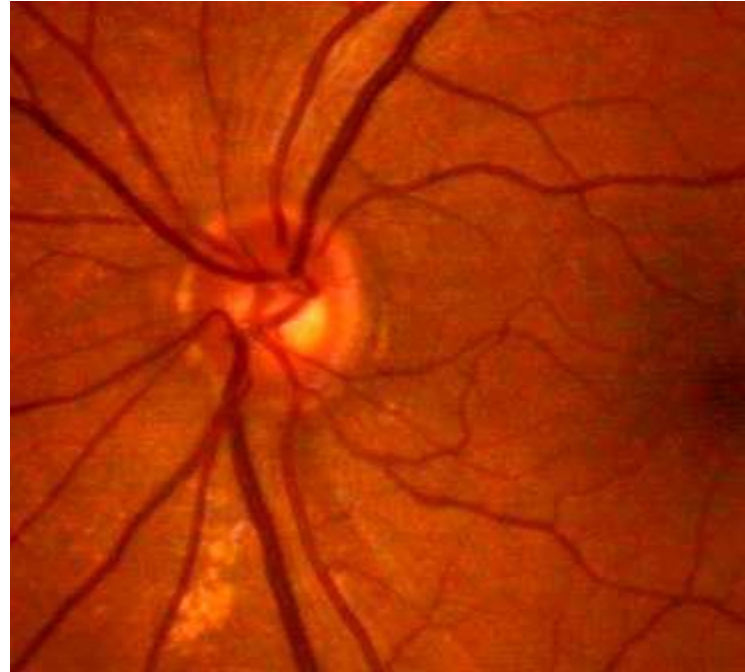


- Hemorrhages , masses , CRVO , DR , RD , silicon oil

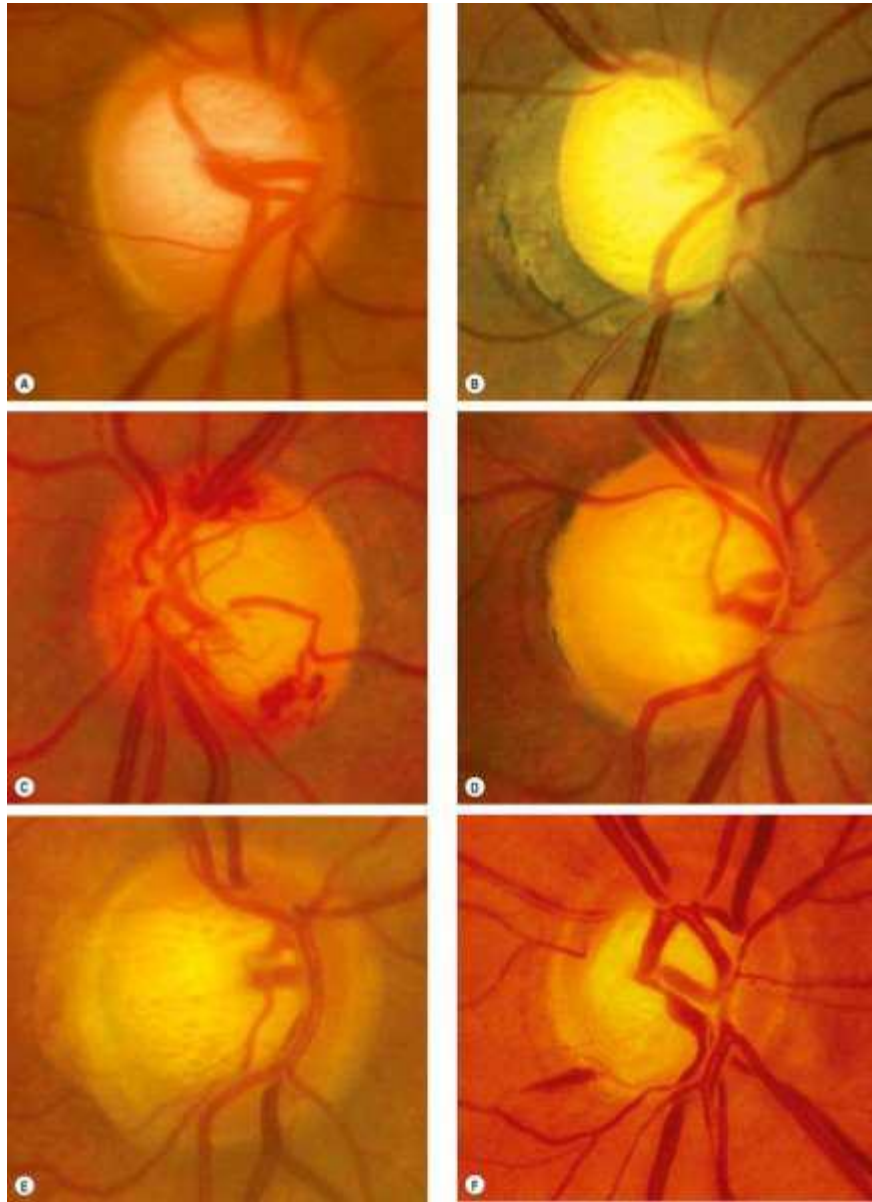


The 7 parameters to look for...

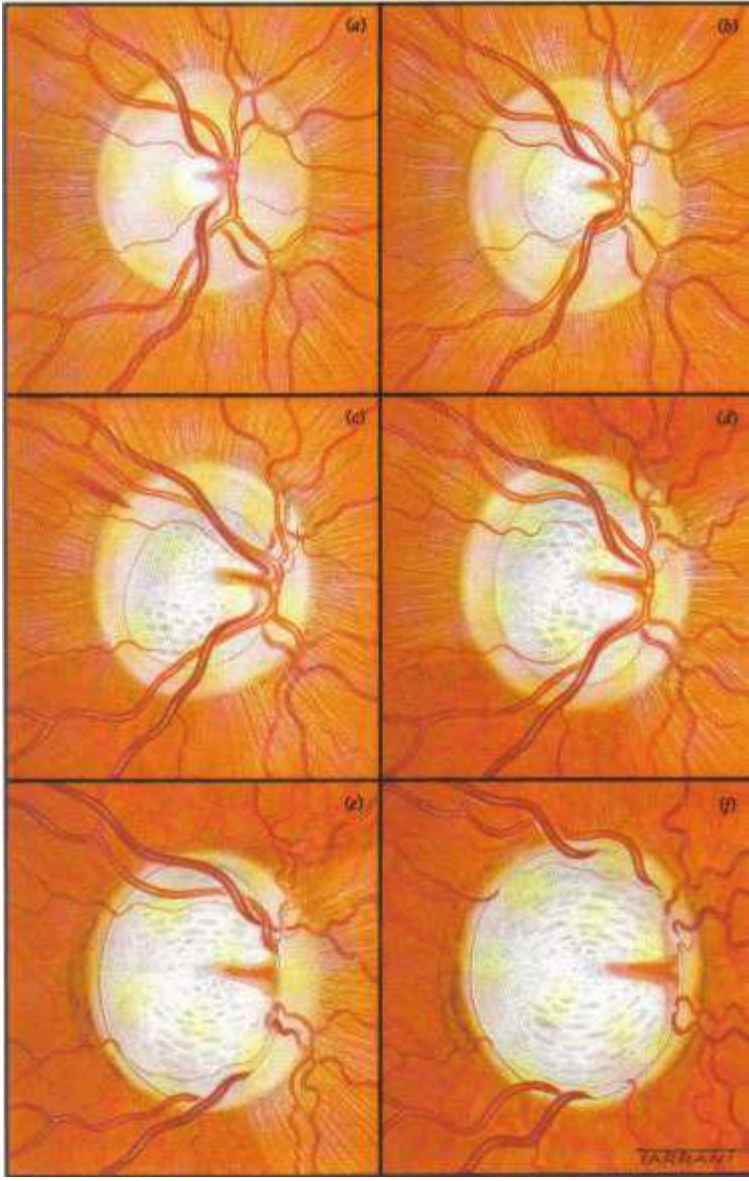
- 1) Disc size
- 2) Neuroretinal Rim (NRR):
 - - ISNT rule
- 3) Cup: Disc ratio
 - - Vertical C/ D Ratio.
- 4) Optic Disc Hemorrhage
- 5) Nerve Fiber Layer Defect:
 - - focal & diffuse
- 6) Para Papillary Atrophy:
 - - Size, location & Configuration
- 7) Retinal Arterial Attenuation:
 - - focal & diffuse

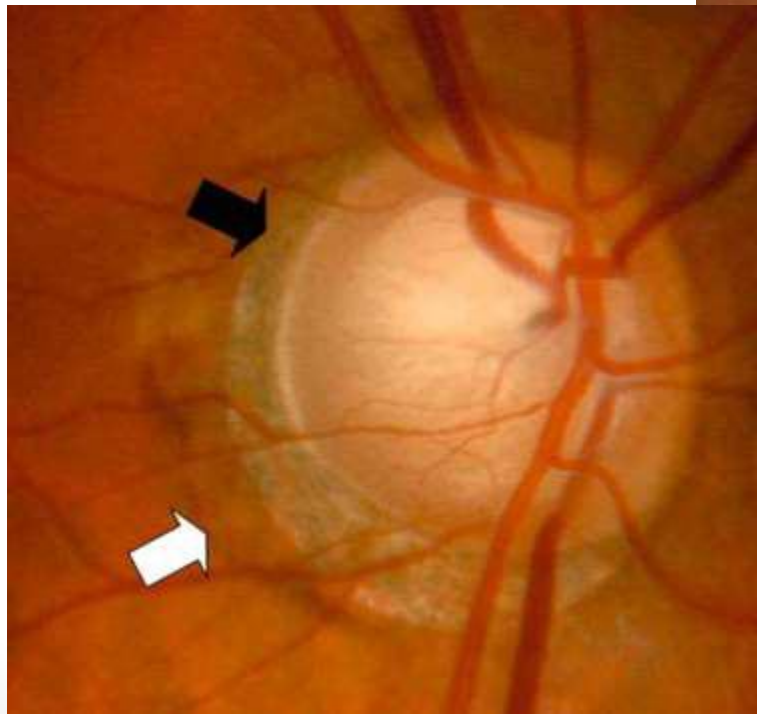
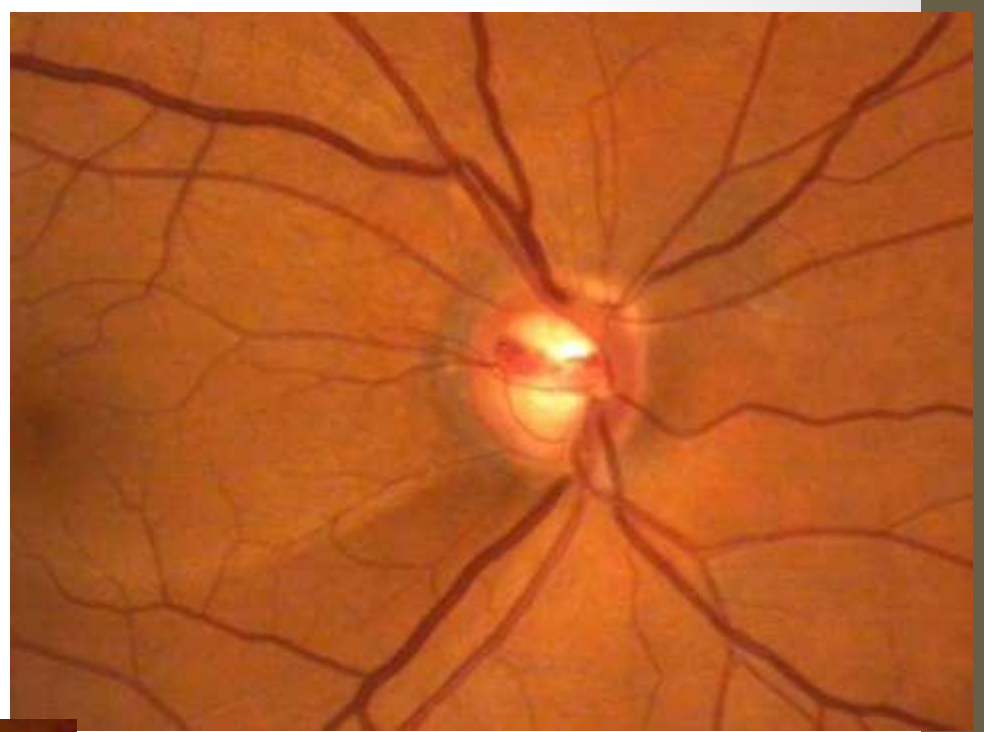
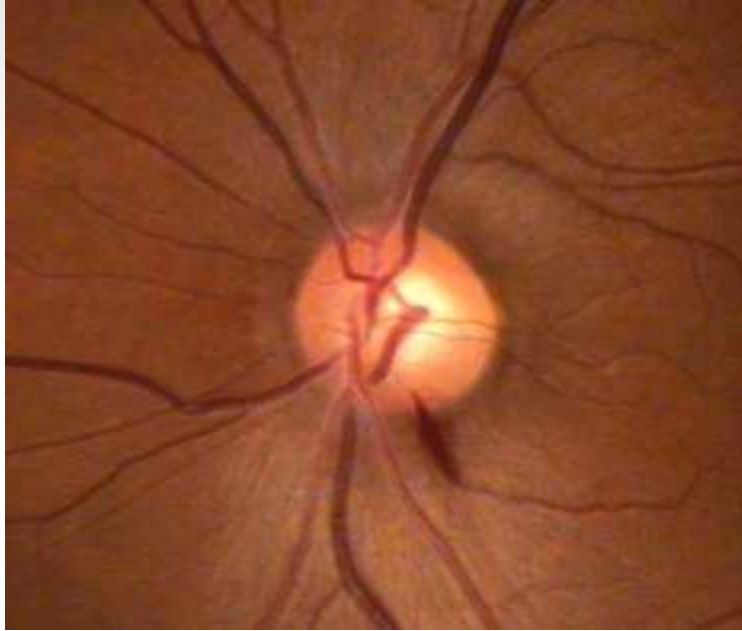


Generalized	Focal	Less specific
<ul style="list-style-type: none"> ○ Large optic cup ○ Asymmetrical of the cup ○ Progressive enlargement of cup 	<ul style="list-style-type: none"> ○ Notching of the rim ○ Vertical elongation of the cup ○ Region pallor ○ Splinter hemorrhage ○ Nerve fiber layer loss 	<ul style="list-style-type: none"> ○ Exposed lamina cribrosa ○ Nasal displacement of the vessels ○ Baring of circumlinear vessels ○ Peripapillary crescent

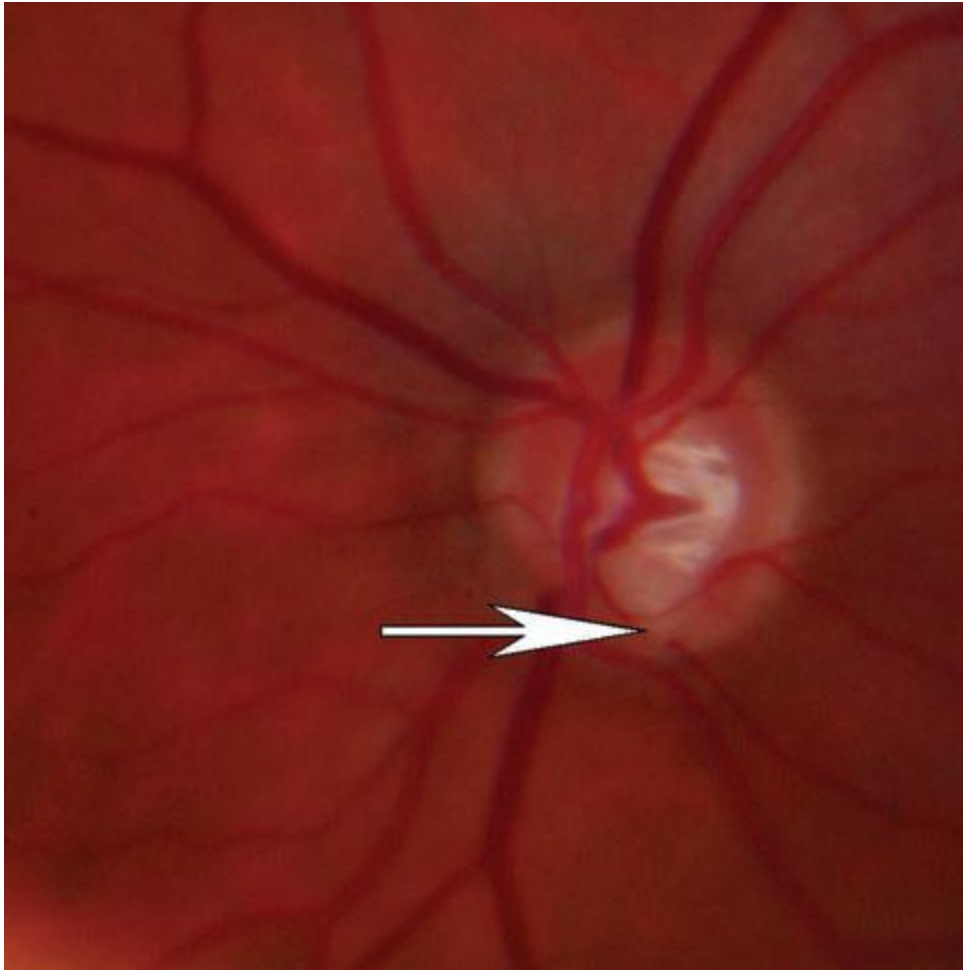


(A) Inferior barring of circumlinear blood vessels; **(B)** inferior bayoneting; **(C)** collaterals; **(D)** loss of nasal neuroretinal rim; **(E)** lamellar dots; **(F)** disc haemorrhage





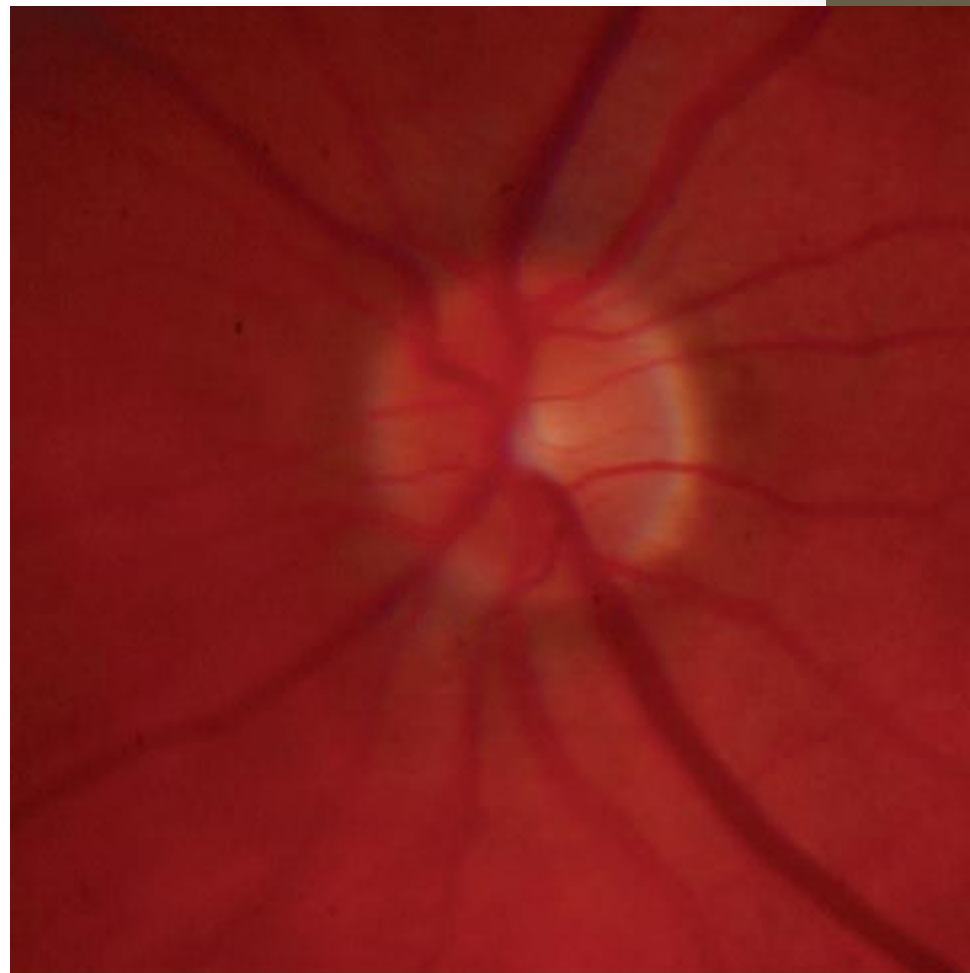
(‘notch’) in the inferior region of the ONH (arrow).

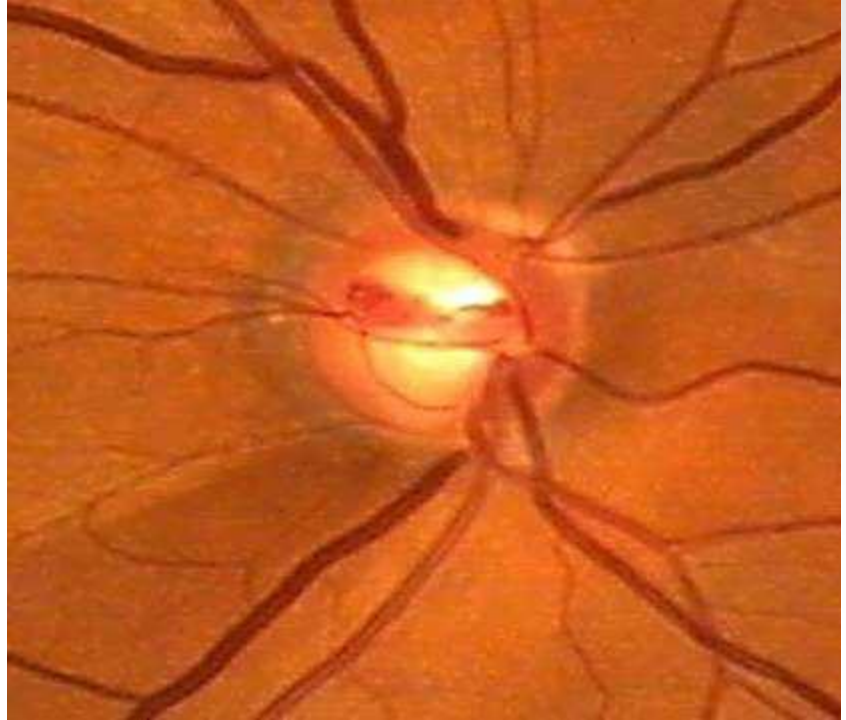
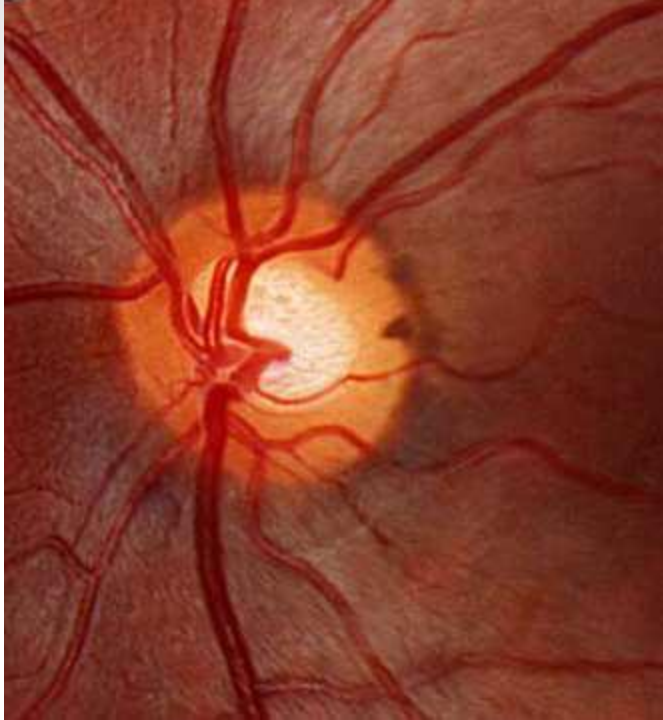


Asymmetric cups in slightly asymmetric discs. The right cup measures 0.4 and the left cup measures 0.2.

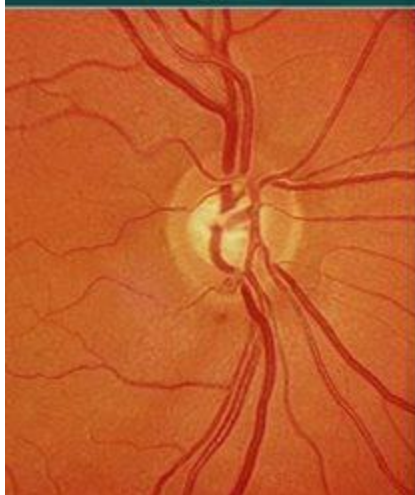
Neither eye had detectable evidence of glaucomatous damage but long-term follow-up is

indicated ■



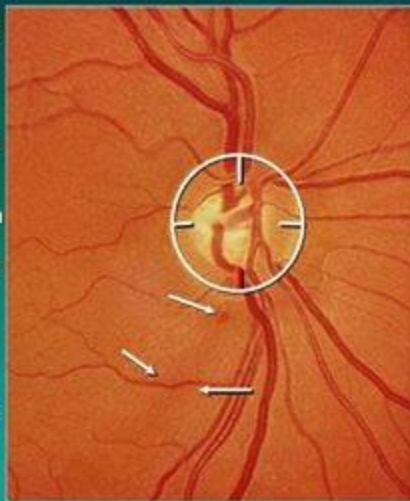


Example 1



Glaucoma or Normal? Use the 5 Rules

- 1 Observe the scleral **R**ing to identify the limits of the optic disc and its size
- 2 Identify the size of the **R**im
- 3 Examine the **R**etinal nerve fiber layer
- 4 Examine the **R**egion of parapapillary atrophy
- 5 Look for **R**etinal and optic disc hemorrhages



- 1 Small disc size
- 2 Rim thinning (inferiorly)
ISNT rule: ⊖
- 3 Localized RNFL defect (inferiorly)
- 4 No significant PPA
- 5 Hemorrhage

GLAUCOMA

Early signs of glaucomatous damage

- **■ Retinal nerve fibre layer**
- Nerve fiber layer dropout
- **■ Optic nerve head**
- 1. Focal notching of neuroretinal rim - Thinning of infero-temporal Rim (ISNT rule is not preserved)
- 2. Vertical elongation of cup
- 3. Asymmetry of cupping between 2 eyes
- **■ Non specific signs of glaucomatous damage**
- 1. Baring of circumlinear blood vessels
- 2. Splinter haemorrhages

The various provocative tests include:

- i. Mydriatic test
- ii. Dark room test
- iii. Prone test
- iv. Prone dark room test
- v. Phenylephrine-pilocarpine test
- vi. Triple test.

Humphry's Visual fields in glaucoma

- ■ Glaucomatous visual field loss commonly occurs
- in the arcuate area in the sup and inf hemifields
- ■ These areas arch around the fovea, starting from optic disc and extending nasally to end at the horizontal raphe.
- ■ A relative decrease in retinal sensitivity (relative scotoma) in this area is usually the first evidence of glaucoma. These scotomas tend to occur nasally and there is significant asymmetry bet sup and inf visual fields.



step



(b) temporal wedge



(c) established superior arcuate defect



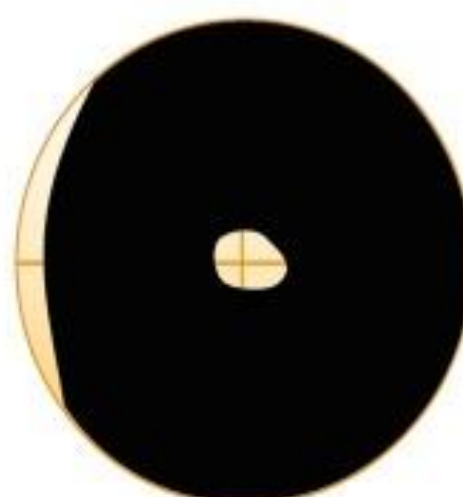
(d) early superior paracentral defect at 10°



or, fixation-sparing paracentral



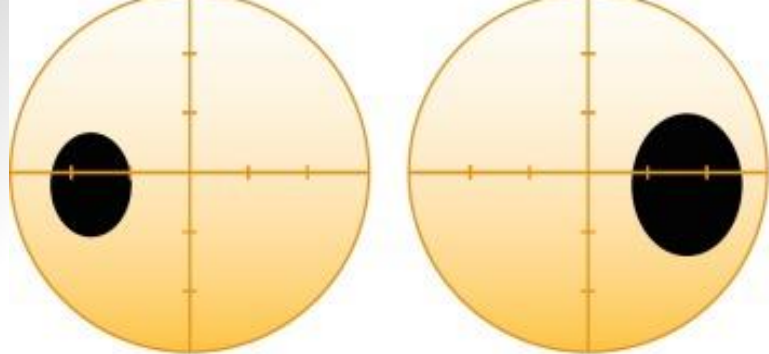
(f) superior arcuate with peripheral breakthrough and early inferior defect



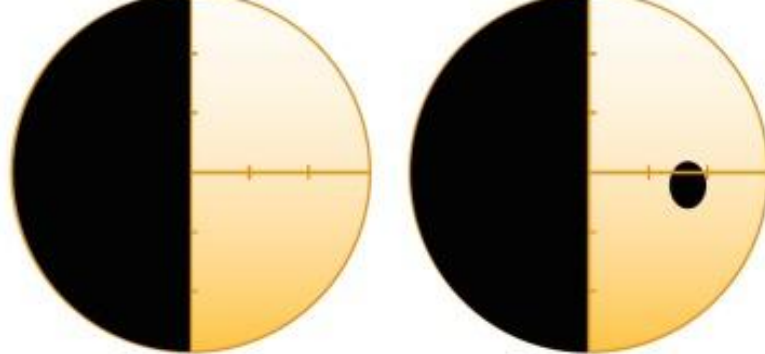
(g) tunnel vision defect with temporal crescent sparing



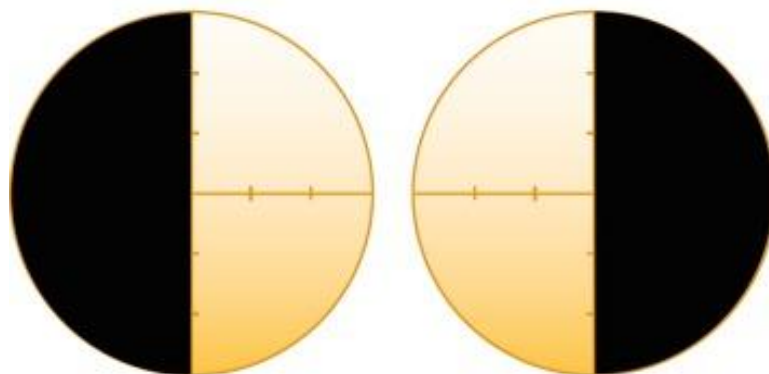
(h) end stage, complete field loss



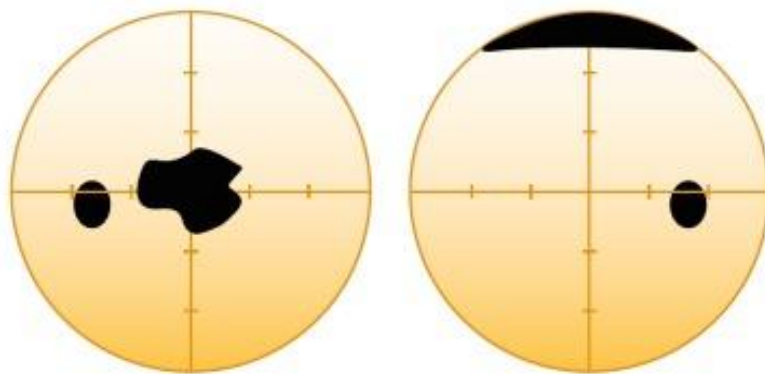
(a) Enlarged blind spots (e.g. papilloedema)



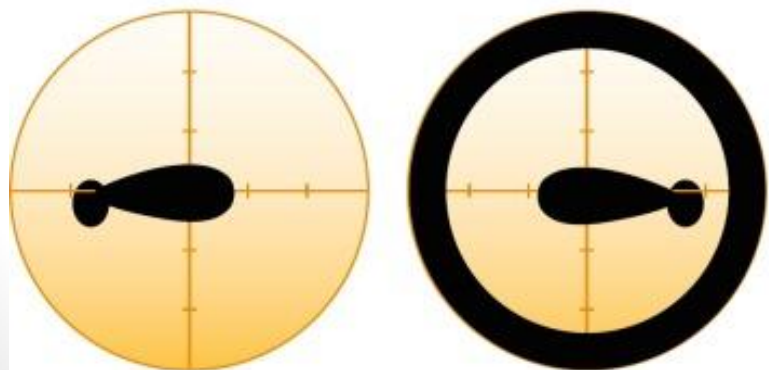
(b) Left homonymous hemianopia (e.g. stroke)



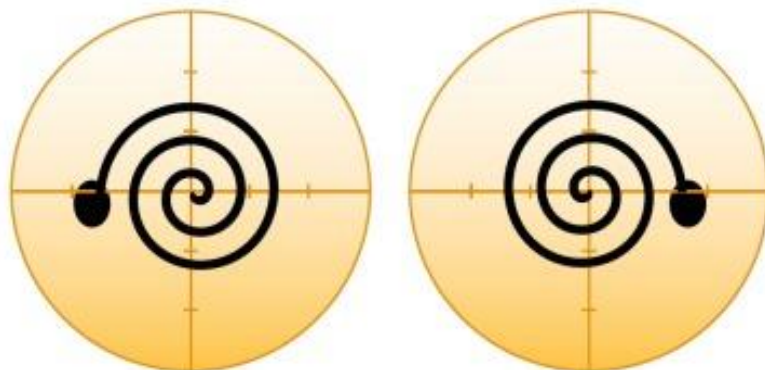
(c) Bitemporal hemianopia (e.g. pituitary tumour)



(d) Left central scotoma (e.g. central macular disease) and right upper eyelid artefact



(e) Centrocaecal scotomata (e.g. toxic optic neuropathy) and right lens rim artefact

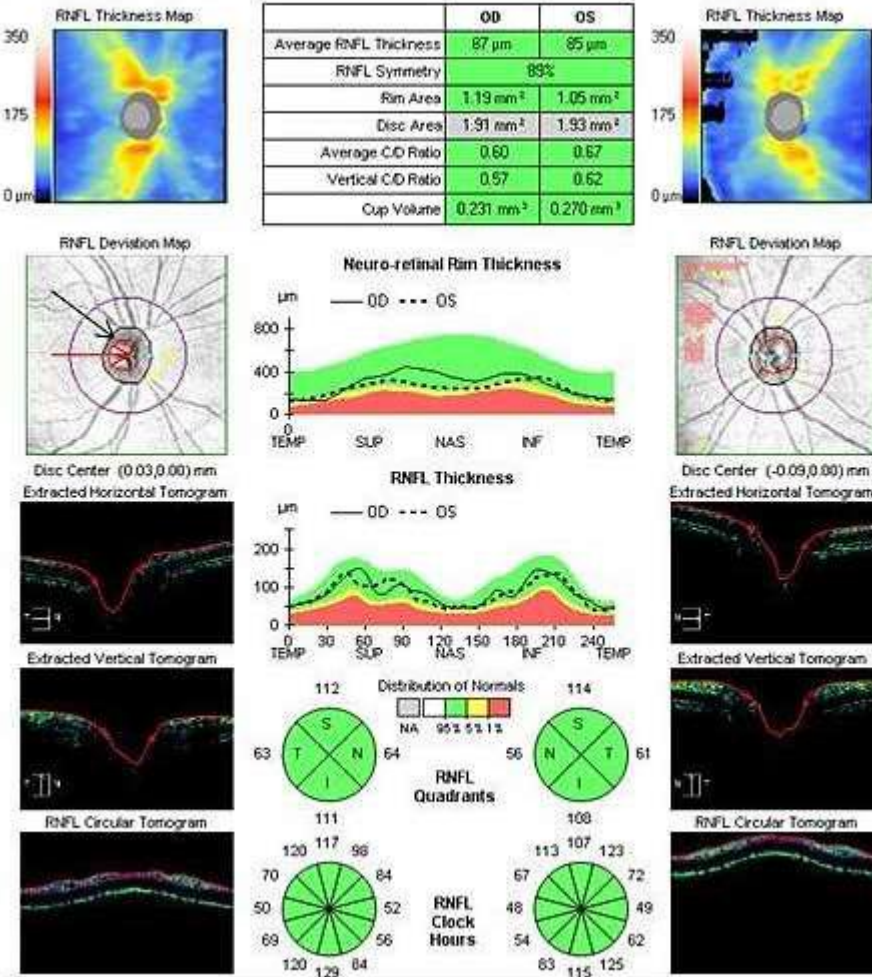


(f) Spiral visual fields (the functional or hysterical visual loss associated with malingering)

OCT

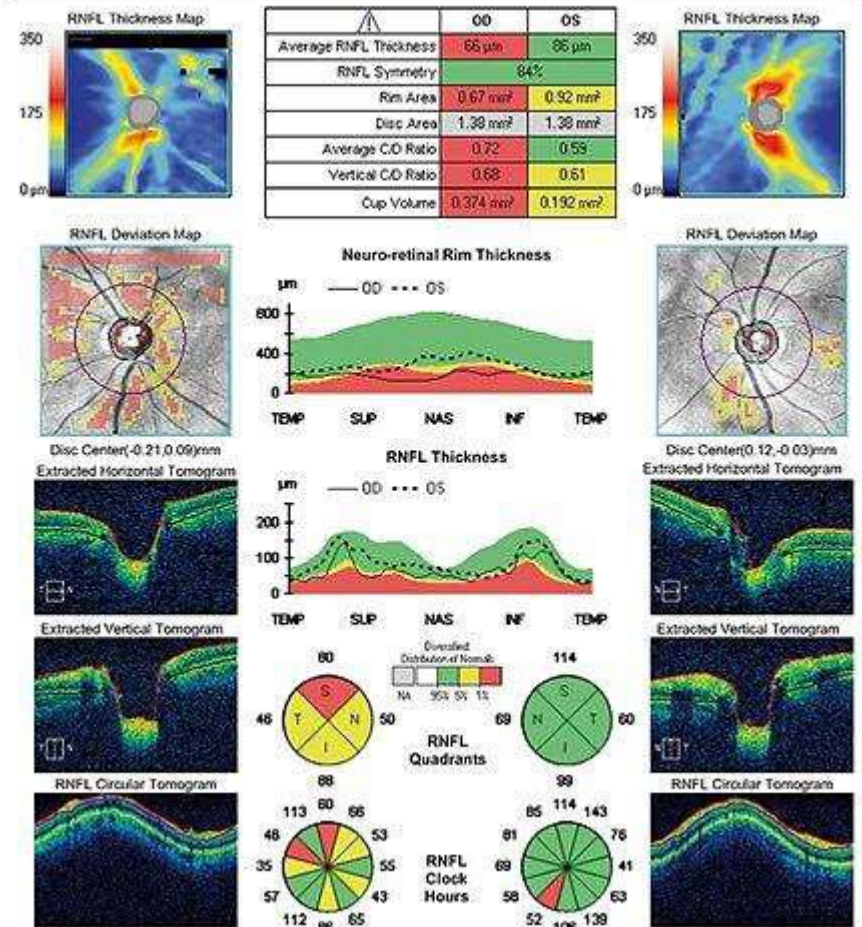
RNFL and ONH: Optic Disc Cube 200x200

OD ● ● OS




ONH and RNFL OU Analysis: Optic Disc Cube 200x200

OD ● ● OS







Thank
you!