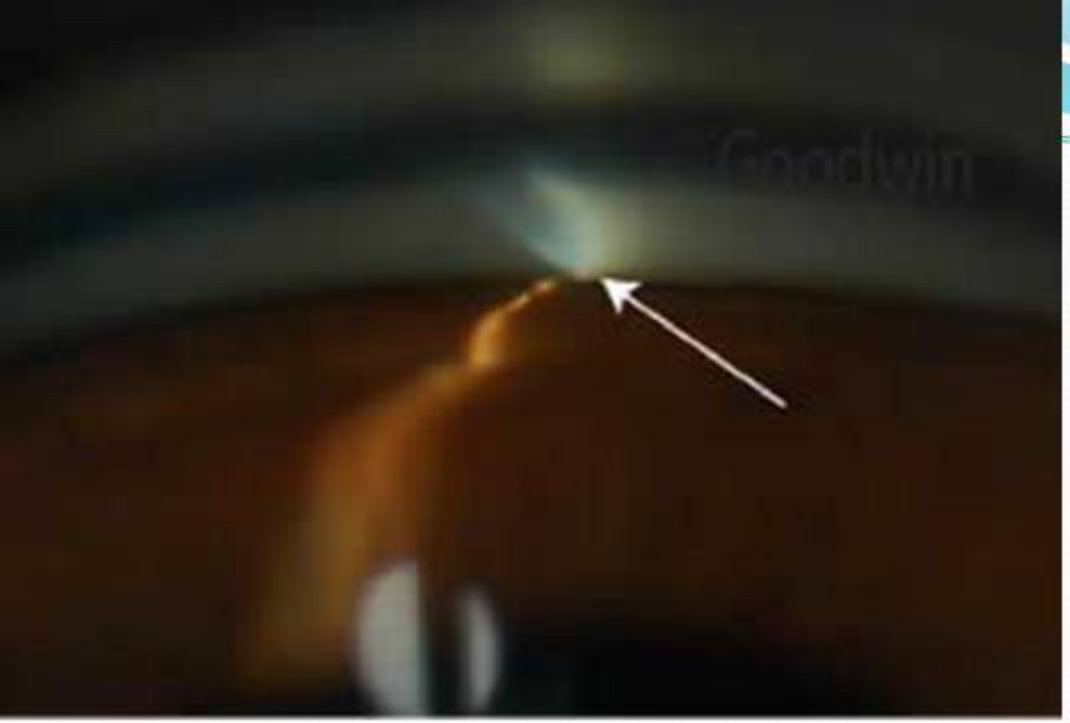
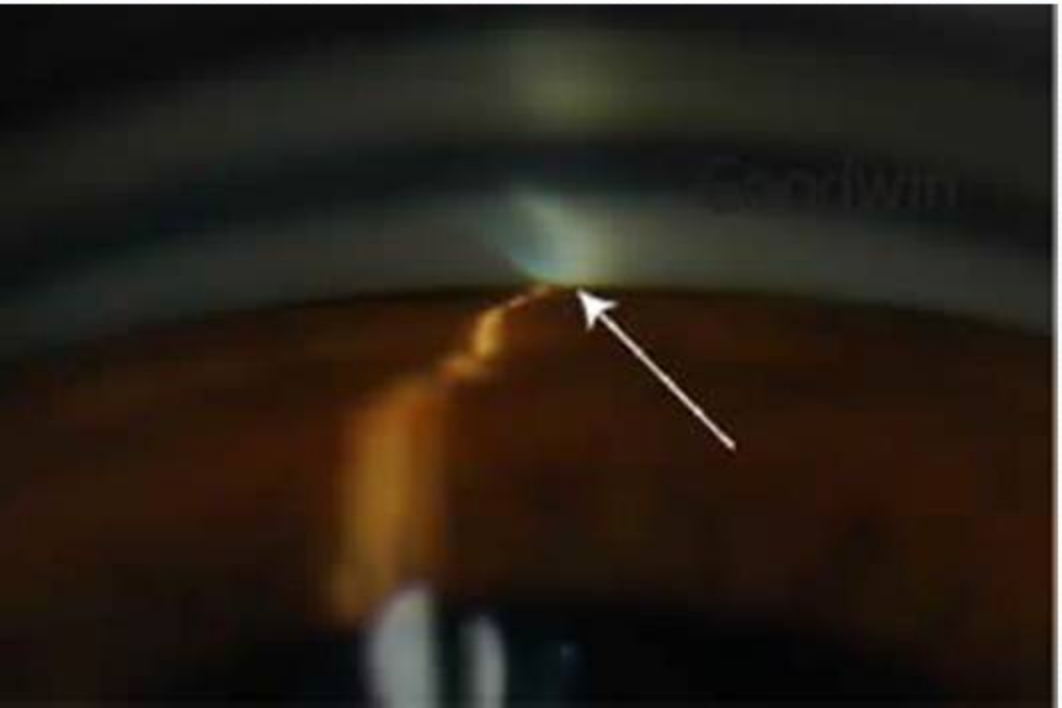
- Essential part of the ant. segment examination.
- Best performed during the *initial* evaluation of glaucoma suspects.
- *Periodic* gonioscopy is needed for any subsequent changes.

- Screening of the angle depth can be done by shining a *penlight* from the temporal side of the eye across the anterior segment.
- The examiner observes the beam of light as it shines through the anterior segment onto the nasal side.

Normal angle

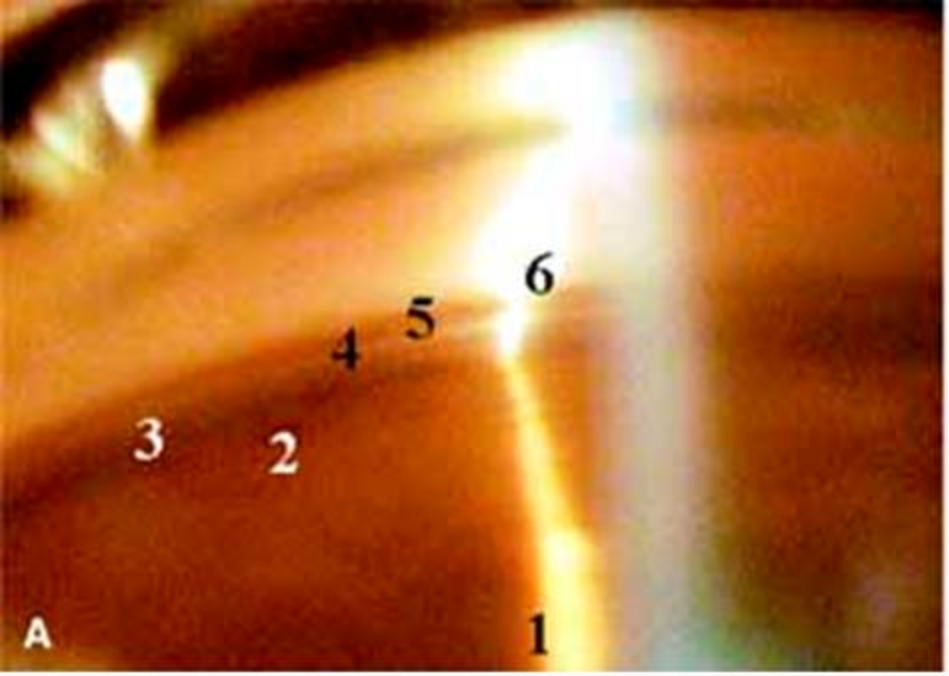
- *Schwalbe's line* is an important landmark in identifying the gonioscopic anatomy in confusing angles.
- can be best identified by locating the *corneal wedge*.
- the appearance can vary from eye to eye.
- *Tilting the lens* may be needed in order to make the wedge more prominent.

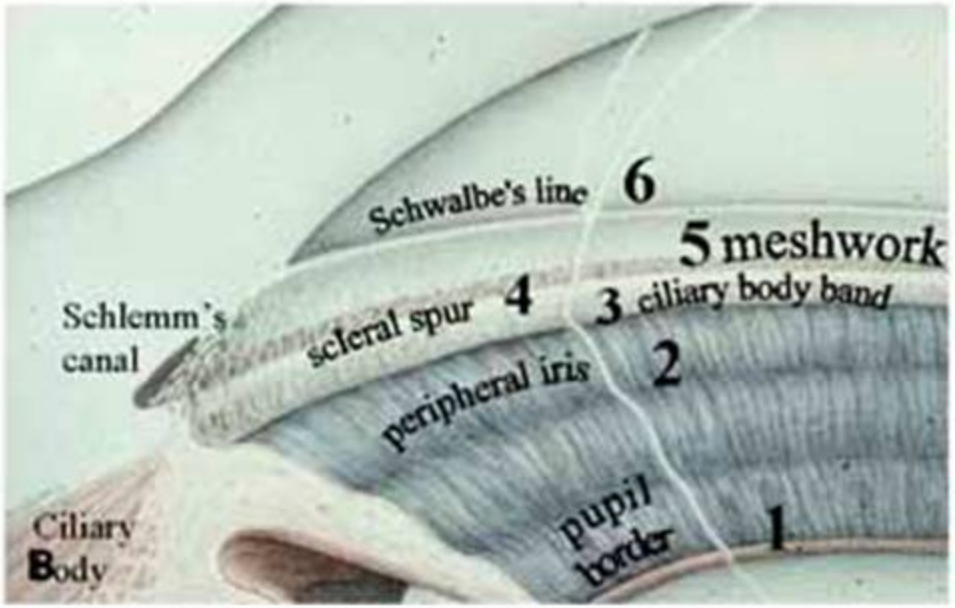




Demonstrates the corneal wedge that can be used to determine the position of Schwalbe's line.

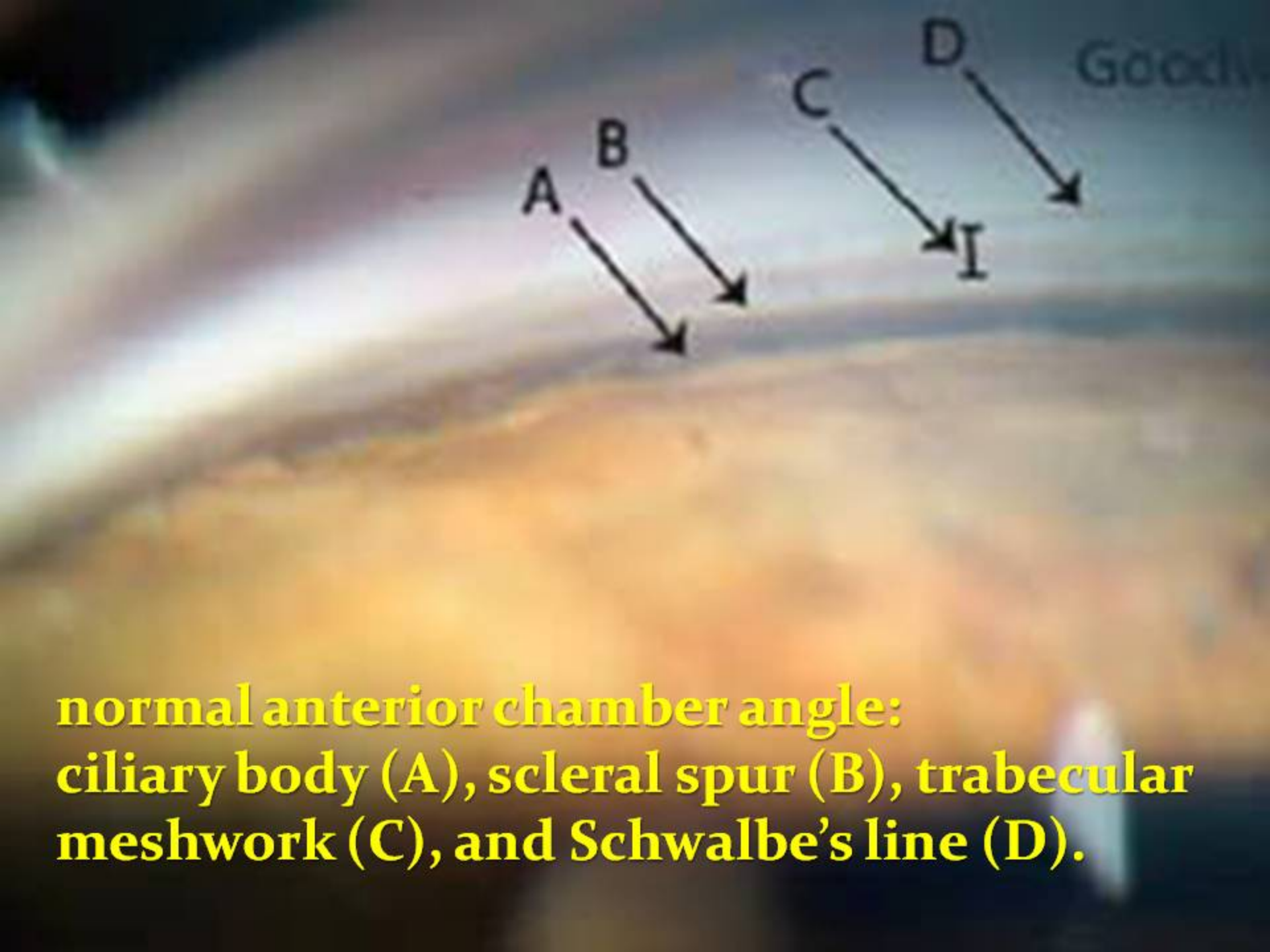
- It is easy to make a *mistake* while doing gonioscopy in eyes with *closed angles, hazy corneas and pigmentation anterior to Schwalbe's line.*
- Such a false angle can be mistaken for an open angle. We would therefore stress on identifying the Schwalbe's line first and then identifying the structures from anterior to posterior.


A
1
2
3
4
5
6


Schwalbe's line
6
5 meshwork
Schlemm's canal
scleral spur
4
3 ciliary body band
peripheral iris
2
Ciliary Body
pupil border
1


Schlemm's canal
6
5
4
3
2
Ciliary body
C


variable width
of ciliary body band
D



normal anterior chamber angle: ciliary body (A), scleral spur (B), trabecular meshwork (C), and Schwalbe's line (D).

Recording and Coding for Gonioscopy

- There are several methods of recording gonioscopy findings.
- clinically useful .
- Descriptive.
- other practitioners can read your chart notes .

Recording and Coding for Gonioscopy

- Several grading systems have been described.
- Use *minimum possible illumination, & short slit beam.*

Van Herick System

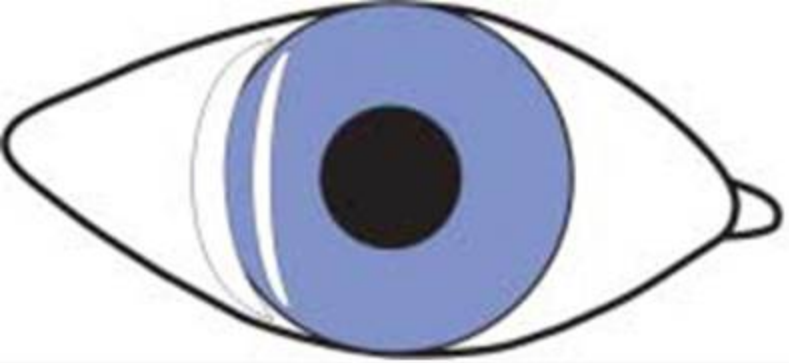
- narrowed slit beam at a 60º angle.
- At the most peripheral part of the cornea.
- Compares AC depth to the peripheral corneal thickness.

Van Herick System

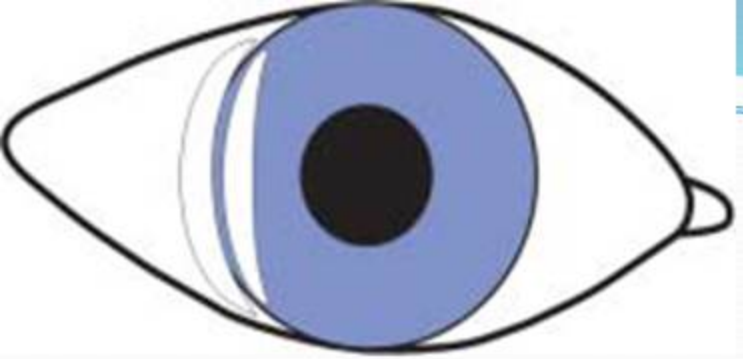
- quick, reproducible part of a routine slit-lamp examination.
- it merely estimates the peripheral depth of the anterior chamber and does not recognize valuable details of the anterior chamber angle's anatomy or configuration.

Van Herick System

Grade 4	Angle is wide open	PAC > ½ CT
Grade 3	Angle is narrow	PAC = ¼ - ½ CT
Grade 2	Angle is dangerously narrow	PAC = ¼ CT
Grade 1	Nearly closed	PAC < ¼ CT
Grade 0	closed	zero



Grade 4

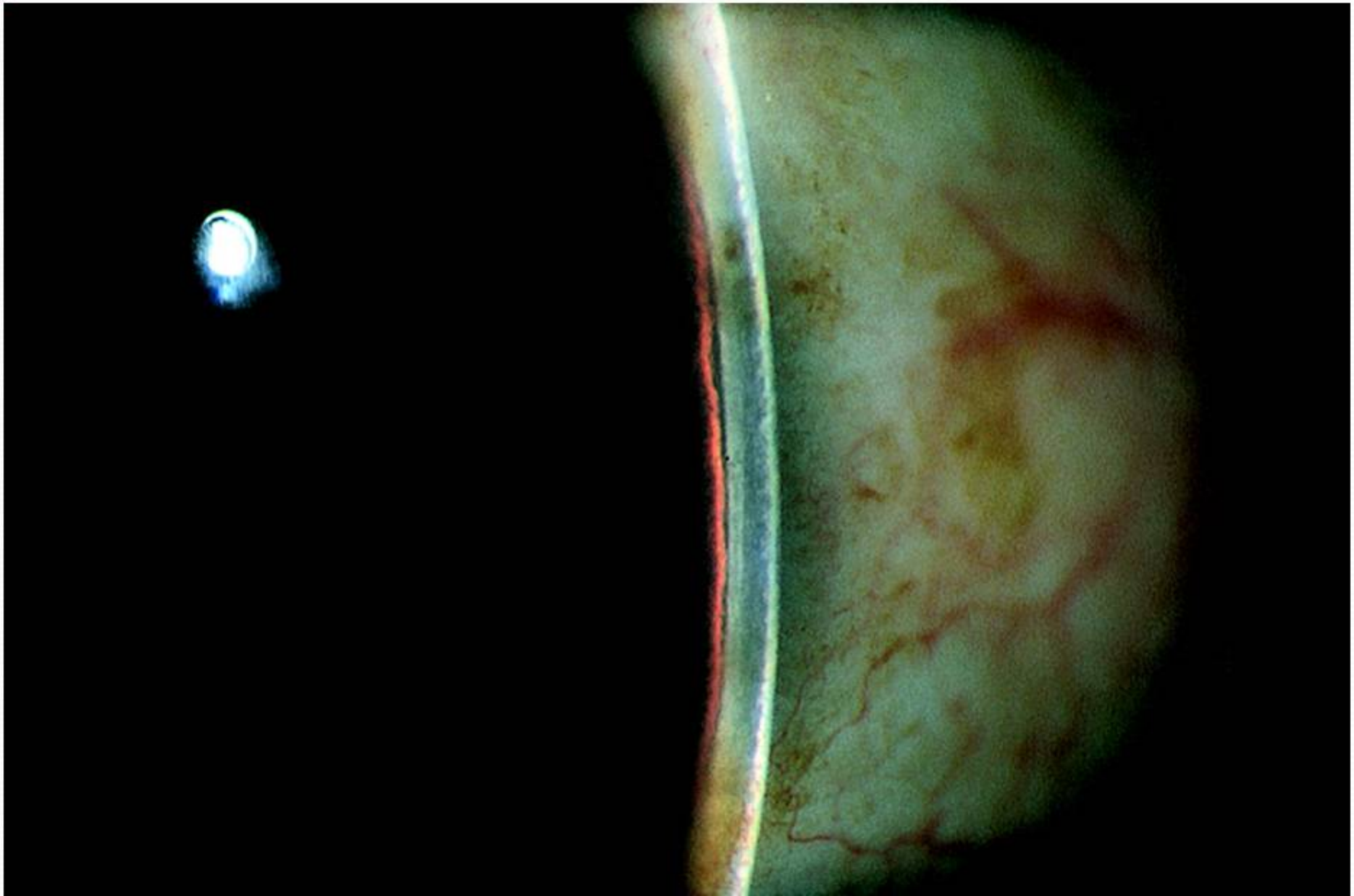


Grade 2

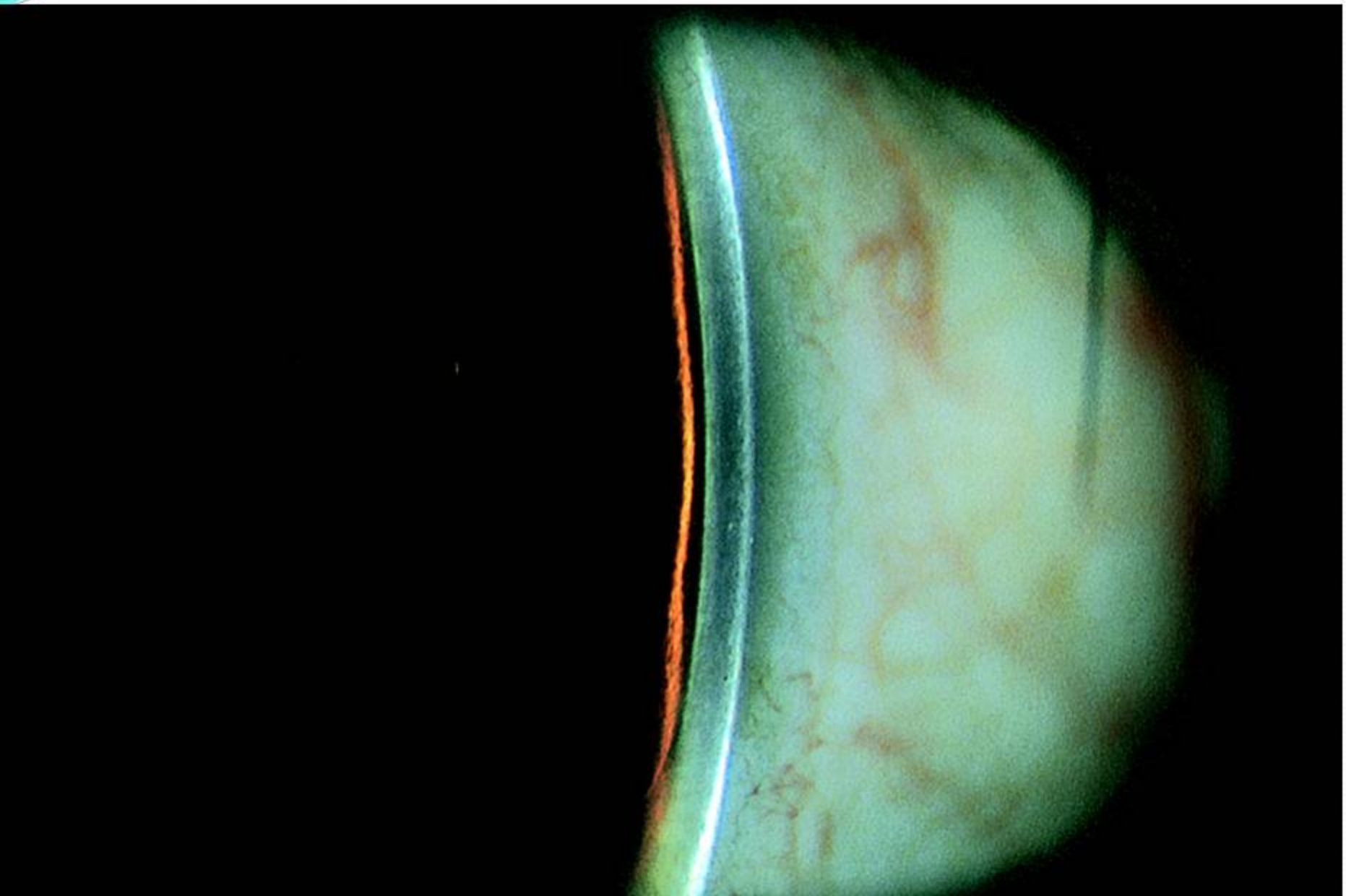
Modified grading scheme

- illumination column 60° .
- Bright, narrow vertical beam of light was directed at the temporal limbus at the most peripheral point of the cornea.
- objective magnification was set to ×1.6.
- The LCD graded as a percentage in the following seven categories: 0%, 5%, 15%, 25%, 40%, 75%, and ⩾100%.

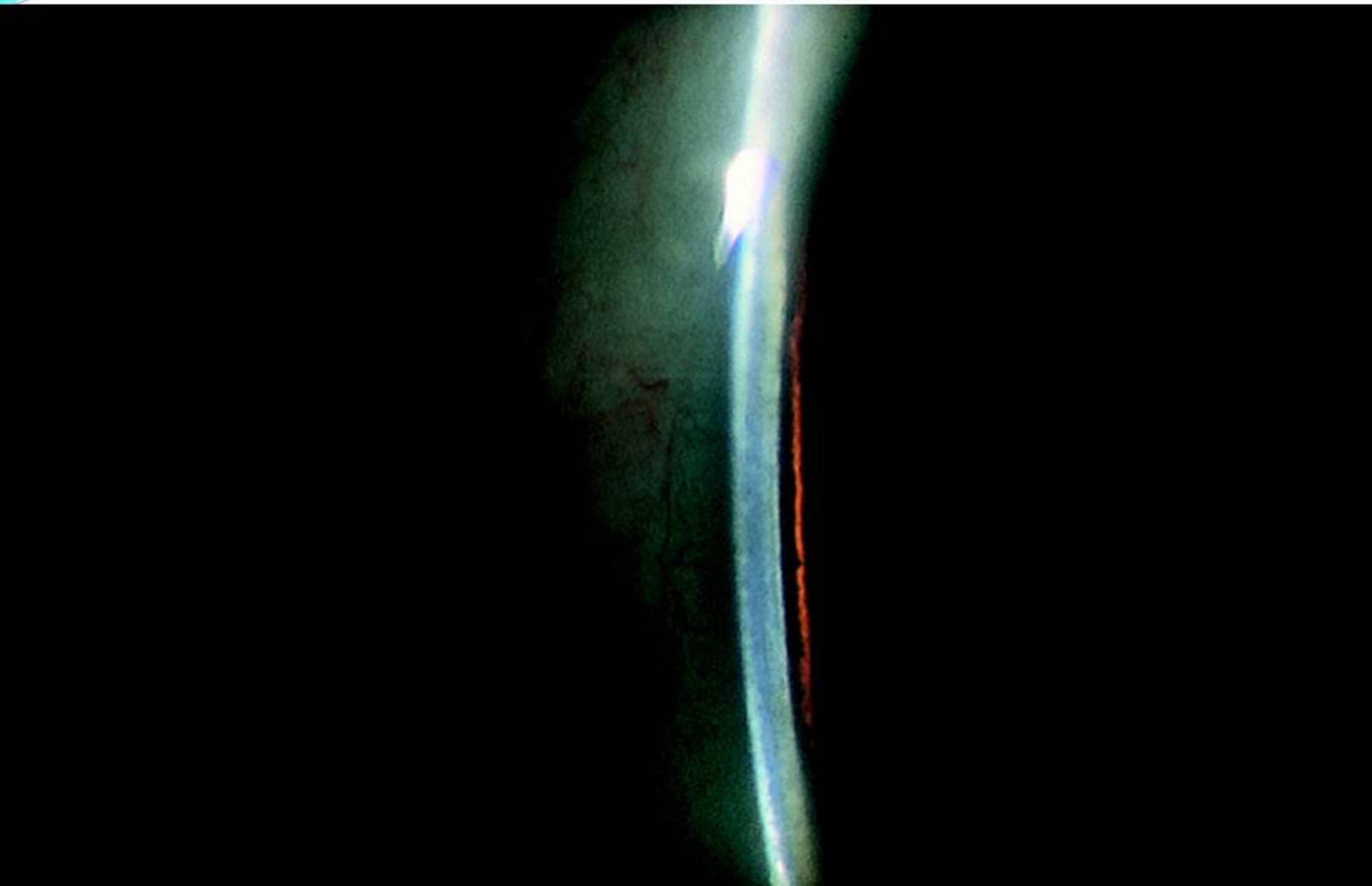
LCD = 5% of PCT



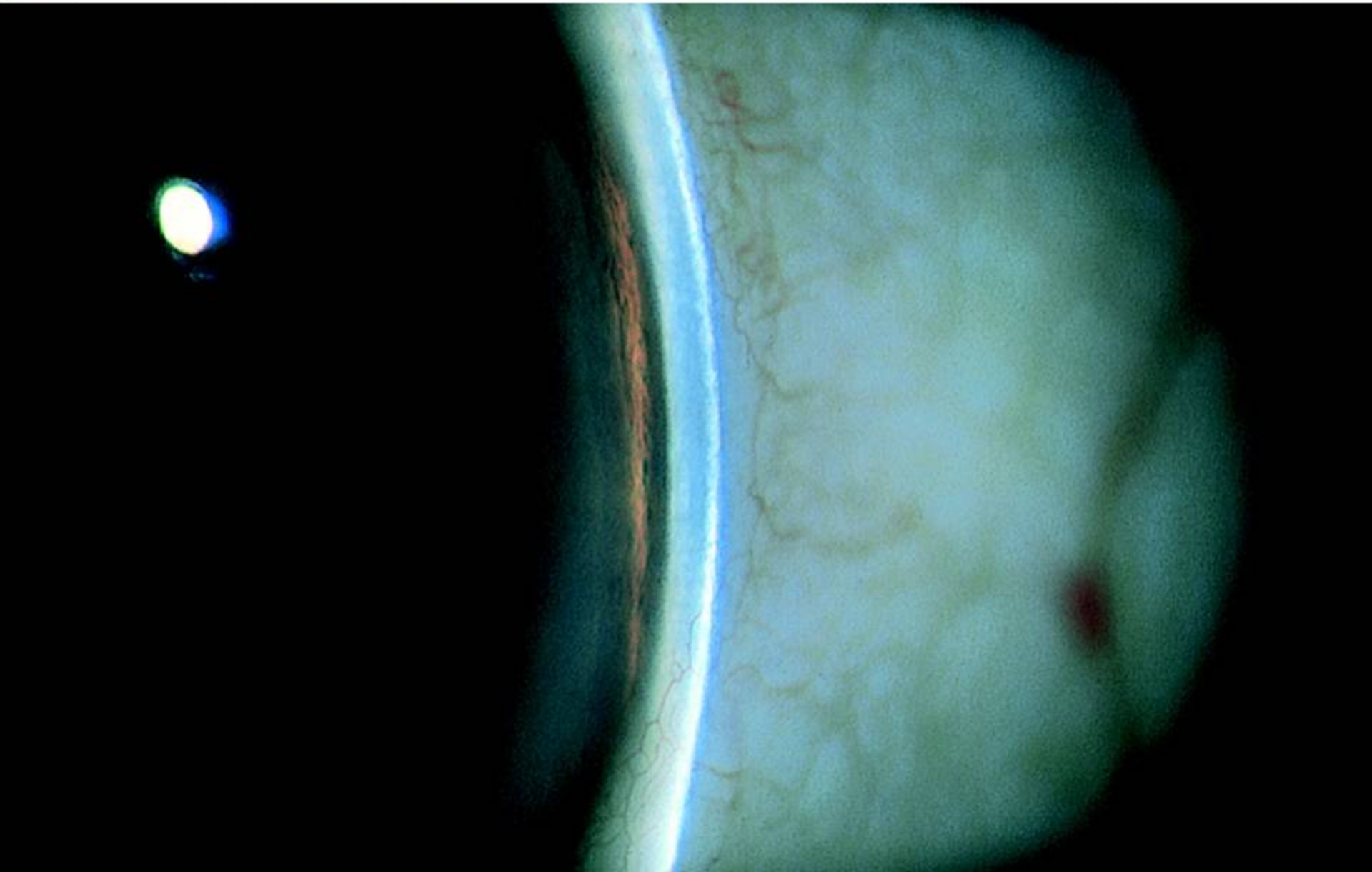
LCD = 25% of PCT



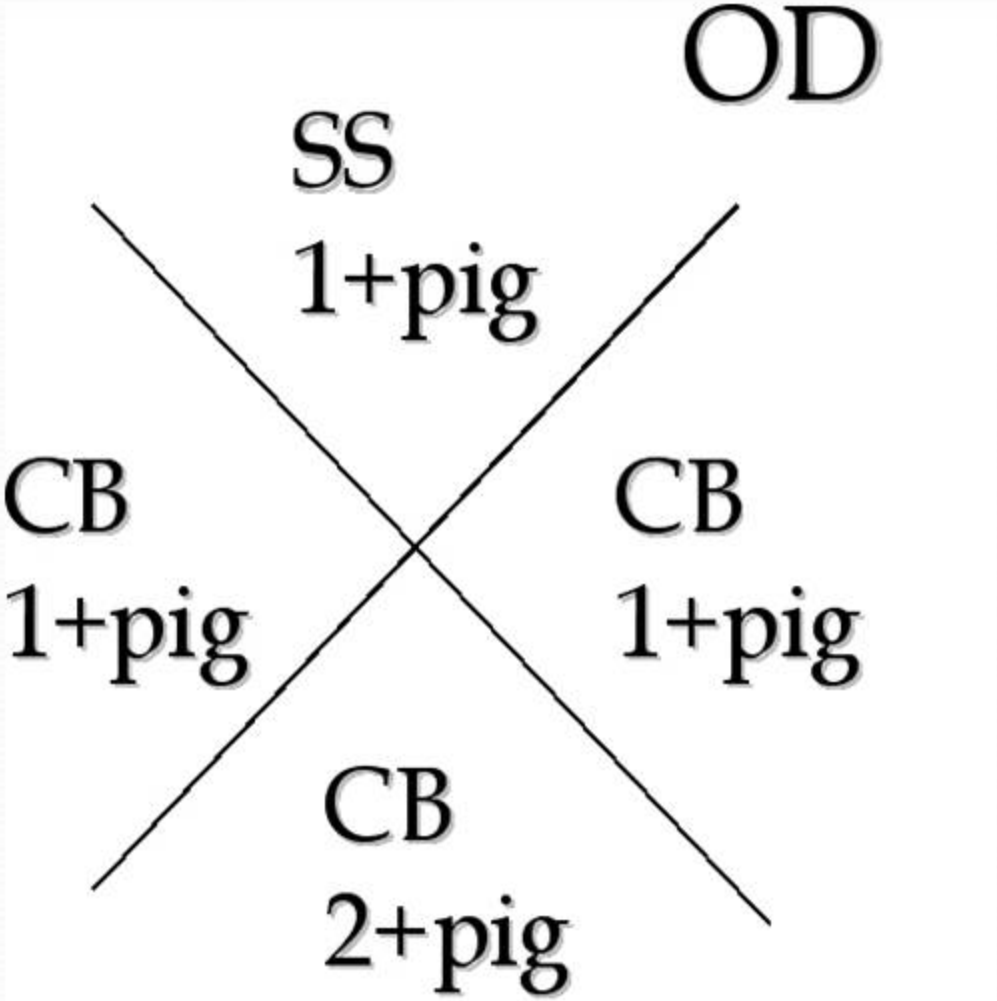
LCD = 40% of PCT



LCD = 75% of PCT



LCD >100% of PCT



Iris flat 360°

- For each quadrant a minimum of 3 features should be recorded.
  - most posterior structure that is visible (CB, SS, TM, SL).
  - pigmentation of TM, graded on a scale 0 to 4.
  - the topography of the iris (flat, convex, or concave appearance).
- In addition, it is also important to record any abnormalities seen within A.Ch. angle.

Gonioscopic classification systems

- Scheie system (1957).
- Describe the degree of angle closure based upon the examiner's visualization of A.Ch. angle's structures; the degree of angle pigmentation was also recorded.

Gonioscopic classification systems

- Schaffer system (1960).
- estimates the angle width at the peripheral iris insertion (i.e., the point of insertion of the iris to the internal lining of the eye).

Gonioscopic classification systems

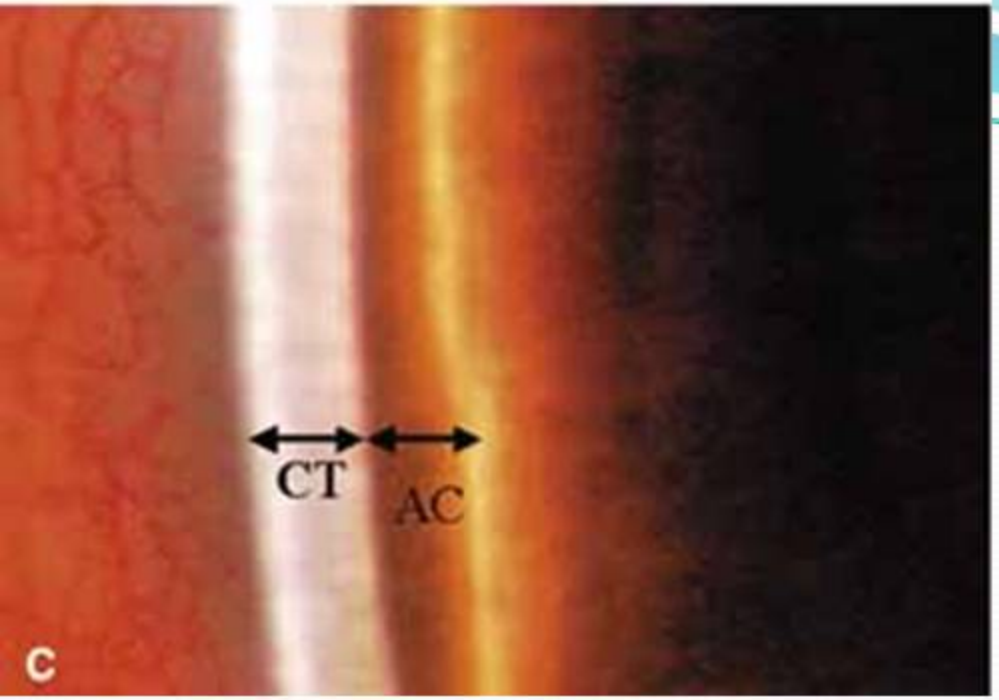
- In 1972, Becker proposed combining the examiner's estimation of the anterior chamber angle's width with the height of the iris insertion.

SCHEIE CLASSIFICATION

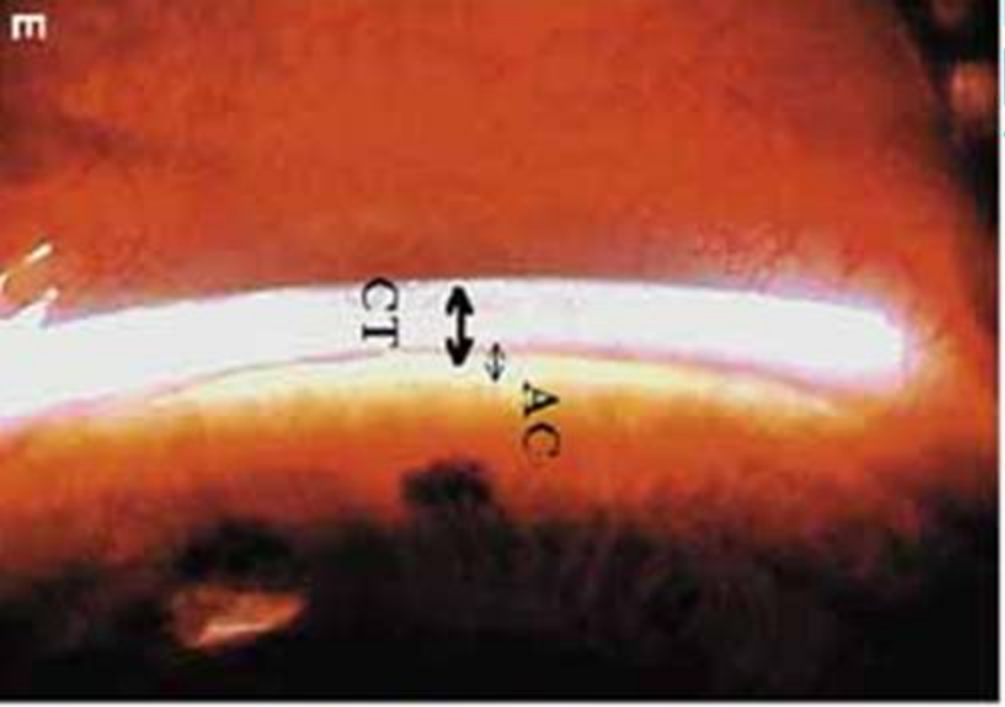
Wide open	All structures visible
Grade I	Iris root visible
Grade II	Ciliary body obscured
Grade III	Posterior trabeculum obscured
Grade IV	Only Schwalbe's line visible
Angle depth system based on structures visualized.	

SHAFFER SYSTEM

Grade 4	45° to 35° angle	Wide open
Grade 3	35° to 20° angle	Wide open
Grade 2	20° angle	Narrow
Grade 1	≤ 10° angle	Extremely narrow
Slit	0° angle	Narrowed to slit
Based on the angular width of the angle recess		



grading systems correlate together.
Grade 4 angle (widely open).



Van Herick grade 2. High insertion of the iris into CB band.

Gonioscopic classification systems

- Spaeth system.
- Depends on
  - Site of insertion of iris.
  - Angular approach in degrees.
  - peripheral configuration of iris.

THE SGGS

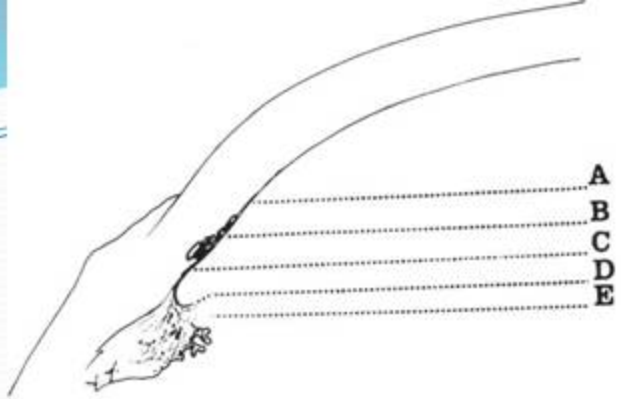
- Developed In 1971 by Spaeth
- relies on 3 separate descriptors of A.Ch. angle's anatomy:
  - Site of insertion of iris.
  - Angular approach in degrees.
  - peripheral configuration of iris.

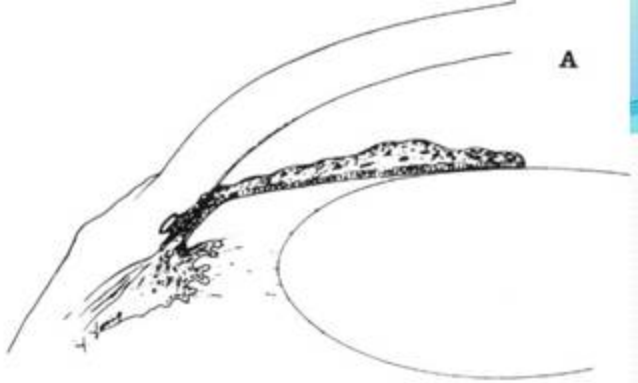
The Iris Insertion

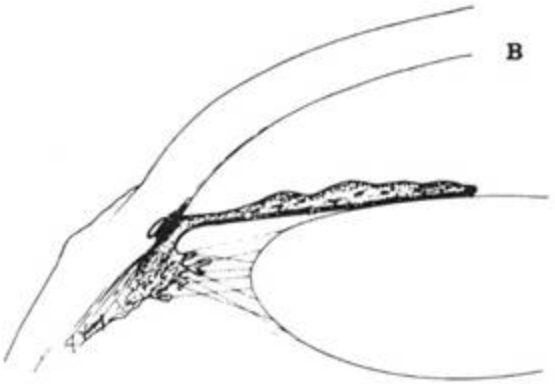
- The most posterior angle structure visible on gonioscopy determines the iris insertion.
- In the SGGS, the individual iris insertion is designated by a capital letter.

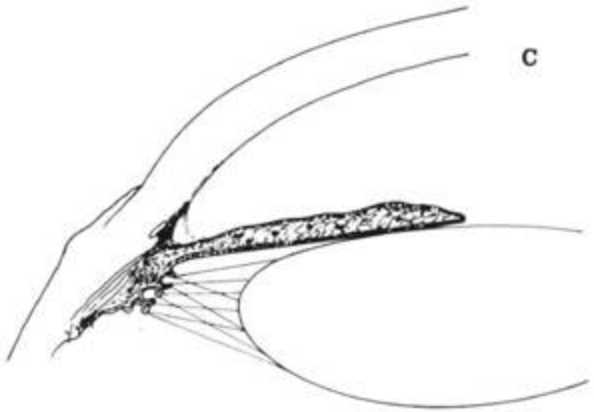
The Iris Insertion

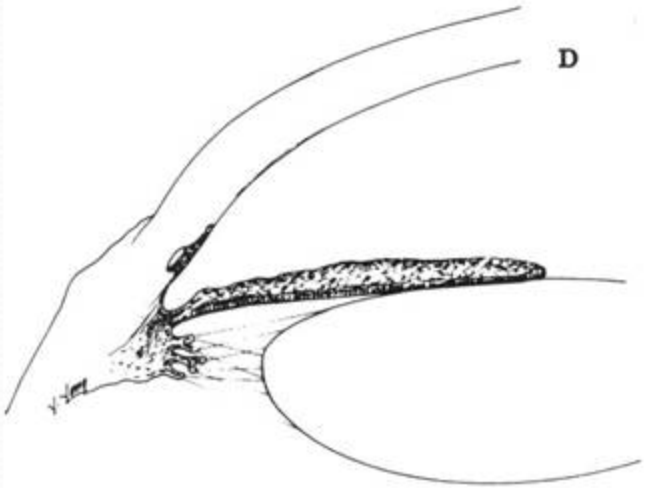
- A : iris insertion anterior to Sch. line.
- B : iris insertion between Sch. line and SS.
- C : the scleral spur is visible.
- D : the iris insertion is deep with CB visible.
- E : the iris insertion is extremely deep with more than 1 mm of ciliary body visible.

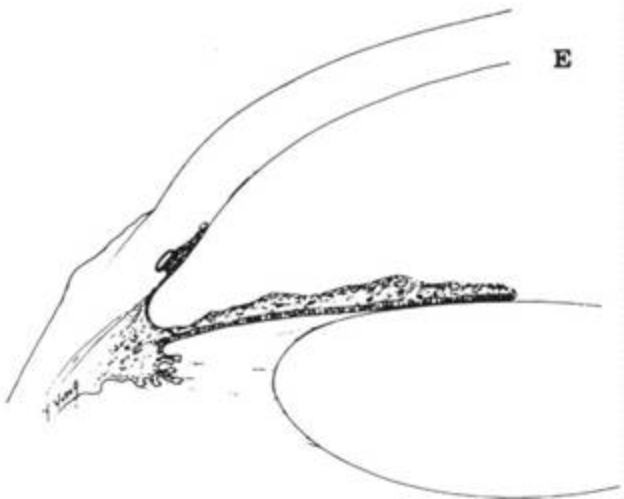

A
B
C
D
E


A


B

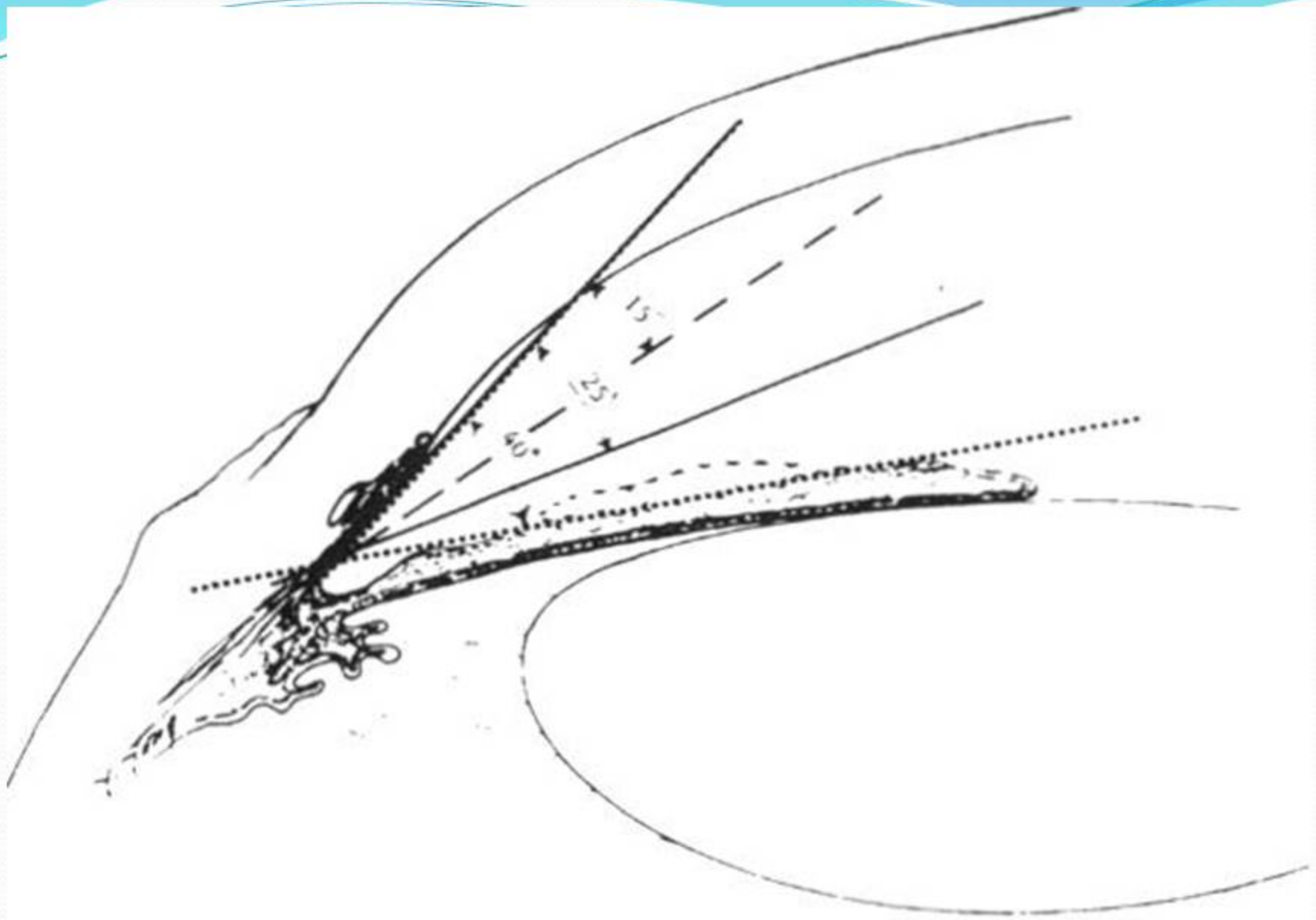

C


D


E

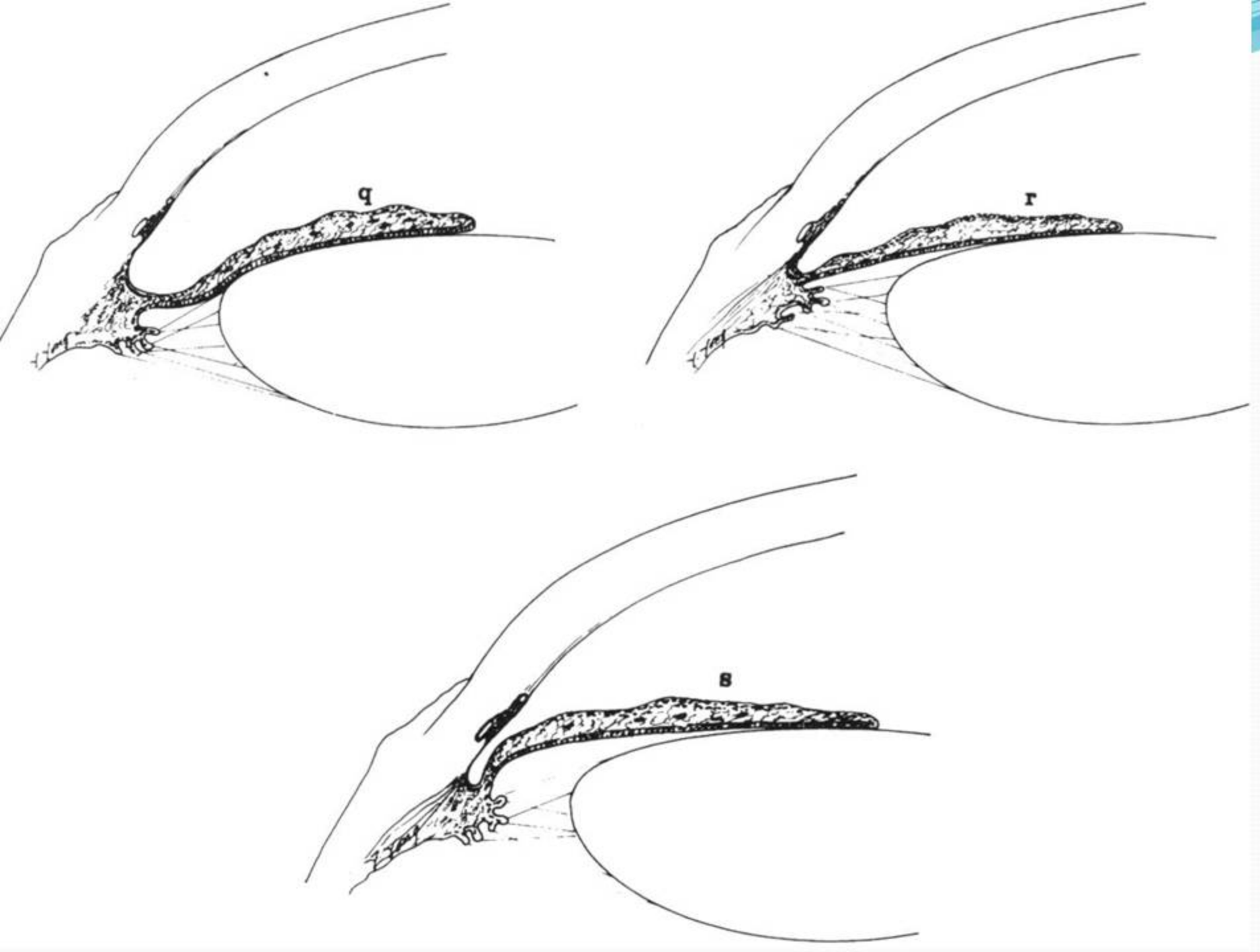
The Angular Approach

- two tangential lines.
  - tangential to the inner surface of TMW
  - tangential to the middle 1/3 of the anterior iris surface.
- The angle formed by these two lines defines the angular approach and is denoted from 0º to 50º.
- It is important to realize that this angle does not identify the angle of the iris recess itself, but rather the angular approach of the iris to this recess.

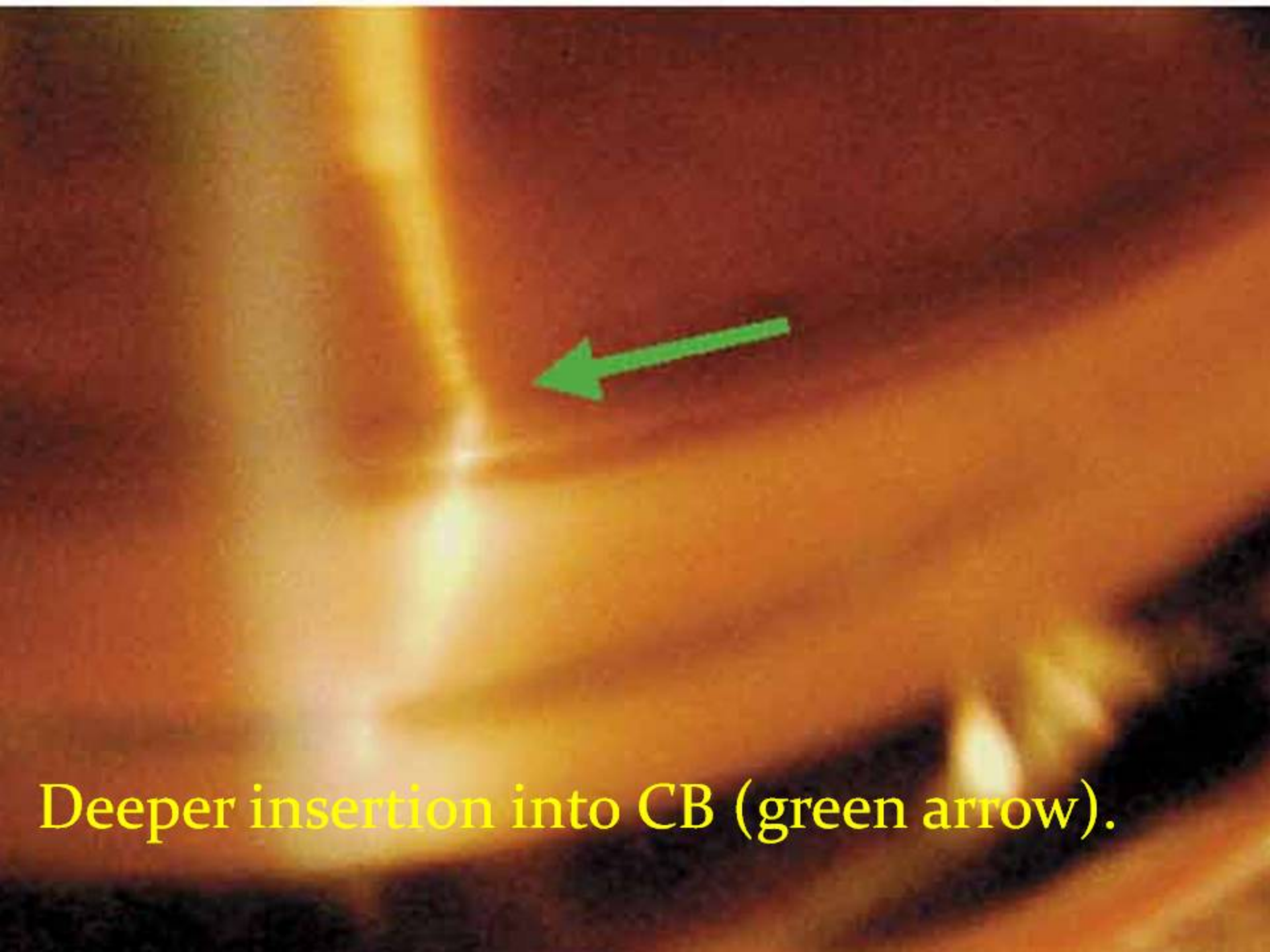


The Peripheral Iris

- Configuration of the peripheral iris is described by a lowercase letter.
  - r signified regular, or smooth, without significant forward or backward arching.
  - q meant queer with posterior bowing or a concave appearance.
  - s translated as steep, or sharp, with a convex curve where the iris arises from its root at the ciliary body.


q
r
s


The iris inserts just below SS.


Deeper insertion into CB (green arrow).

- In a recent modification of this grading system, further differentiation of the peripheral iris insertion was included by replacing the peripheral iris designators r, q, and s with f, c, b, and p.
- These letters signify, respectively, flat, concave with posterior bowing, bowing anteriorly, and plateau configuration.

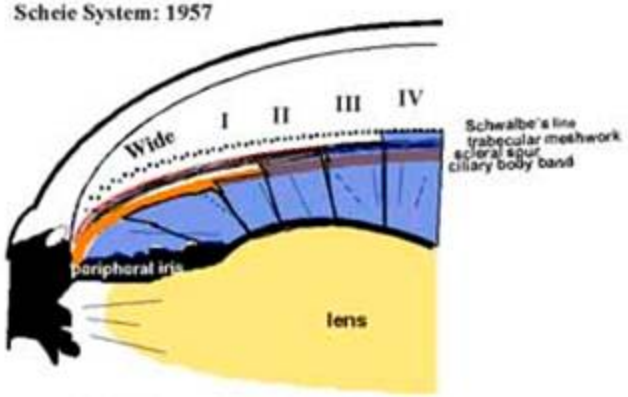
Iris Insertion	Angular Approach	Peripheral iris		Pigmentation of TMW
A anterior to Schwalbe's line	0-50 degrees	R regular	F flat	0 no pigment
B Between Schwalbe's line and sclera spur		S Steep	B bowed anteriorly	1+ minimal
C Scleral spur visible			P plateau iris	2+ mild
D Deep with ciliary body visible		q queer	C concave	3+ moderate
E Extremely deep with >1 mm of ciliary body visible				4+ intense

- Thus, in the SGGS, the individual AC angle configuration is designated with a code consisting of at least *one capital letter, one number, and one lowercase letter.*
- For example, an A.Ch. angle with the iris insertion posterior to SS, with a normal angular approach and regular (or flat) peripheral iris configuration, would be described as *D4or (or D4of in the new SGGS).*

- In addition to the 3 main factors of angular configuration, the clinician may comment on features such as the pigmentation of TMW, the presence of PAS, and the details of iris processes.

- advantage of the new designators is that, previously, steep may not have adequately distinguished between the anterior bowing of the iris with *pupillary block or plateau iris configuration.*
- This differentiation has therapeutic implications.
- angle closure due to pupillary block would be alleviated by PI.
- angle closure 2nd to a plateau iris configuration likely requires a peripheral iridoplasty.

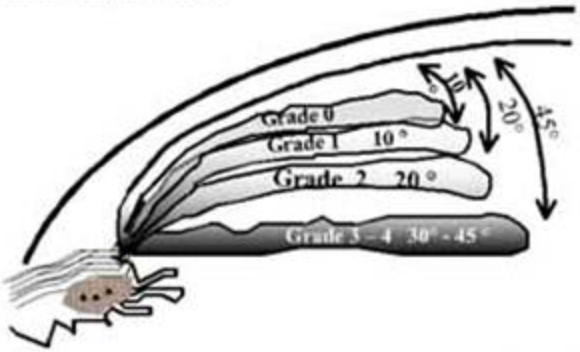
Scheie System: 1957



Scheie System: based on visible posterior angle structures

A

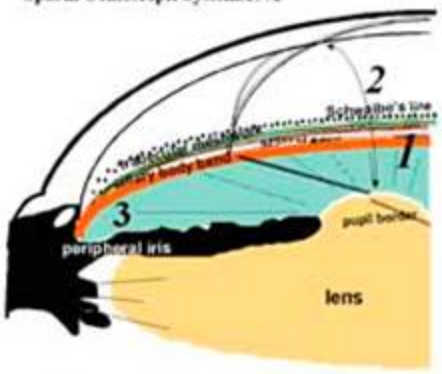
Shaffer system: 1960



Shaffer system is based on visible angular width of the angle recess

B

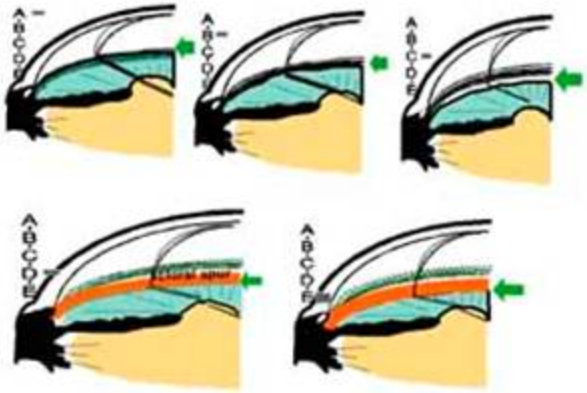
Spaeth Gonioscopic System: 1971



1. Where does the iris insert? A,B,C,D,E
2. Angular approach to recess? 0 - 40°
3. Peripheral iris configuration? b,c,f,p

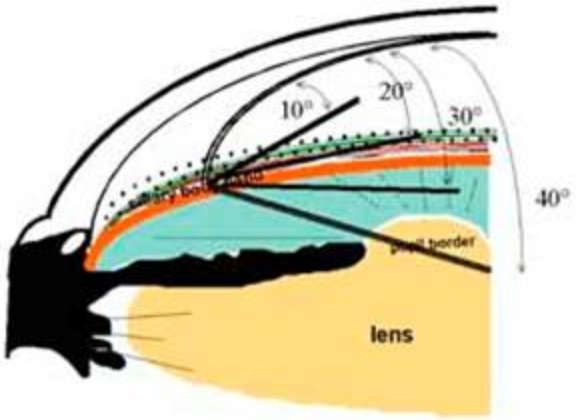
Three aspects define the angle creating a three dimensional image

C



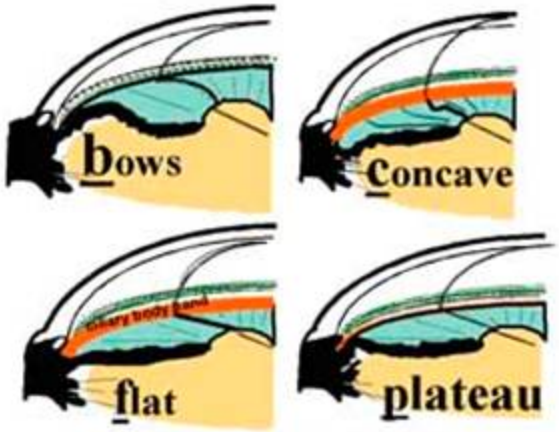
1. Where does the iris insert onto the inner wall of the eye?

D



2. What is the angular approach of the iris?

E



3. Peripheral iris configuration? b, c, f, p

F

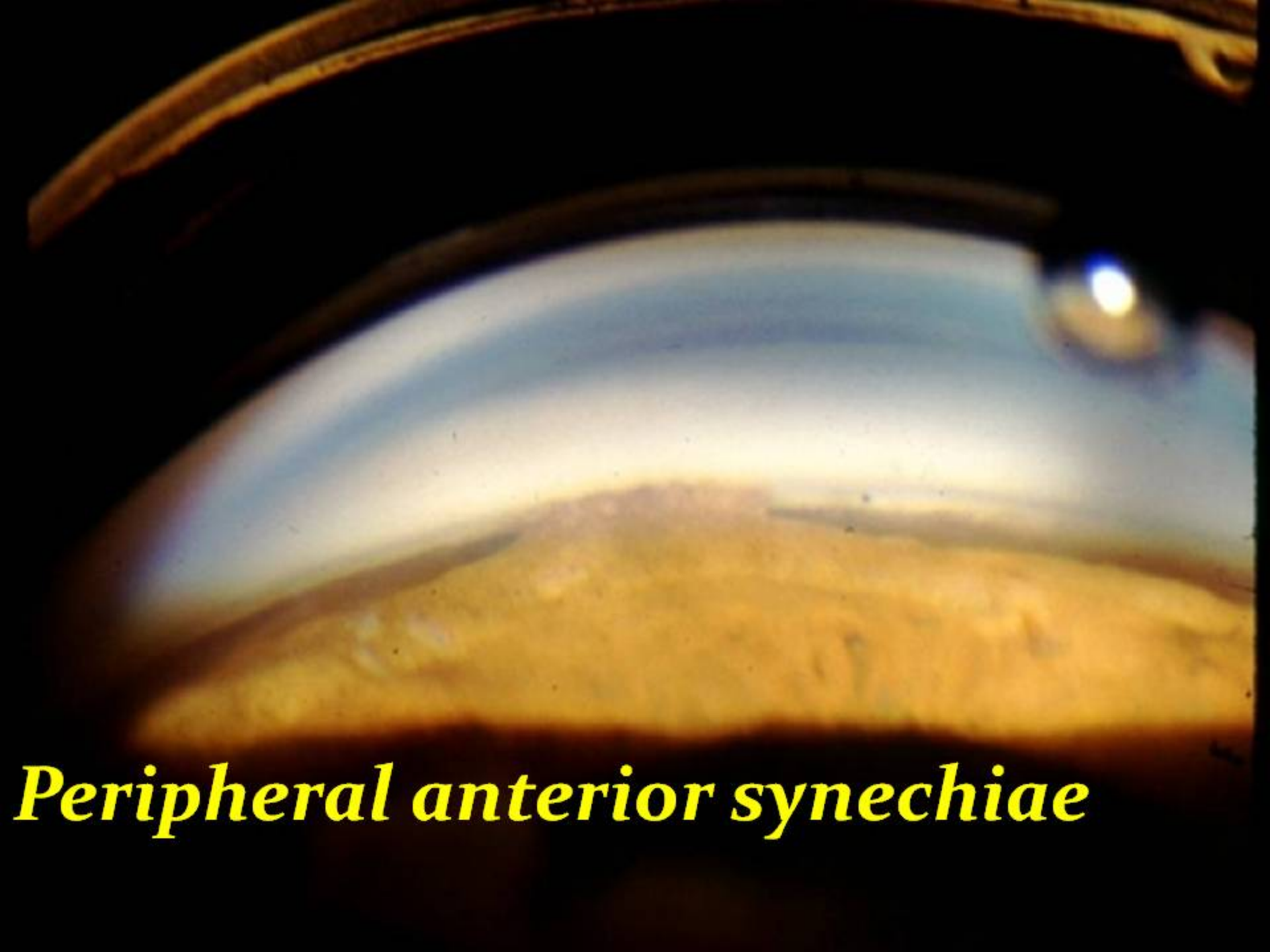
Iris processes

Iris Processes

- may be confused with PAS.
- most common nasally and gradually diminish with age.
- Allow some view of posterior angle structures.
- 35% of normal eyes.
- pigmented in brown eyes and grey in blue eyes.
- typically finer than PAS.

Anterior synechiae

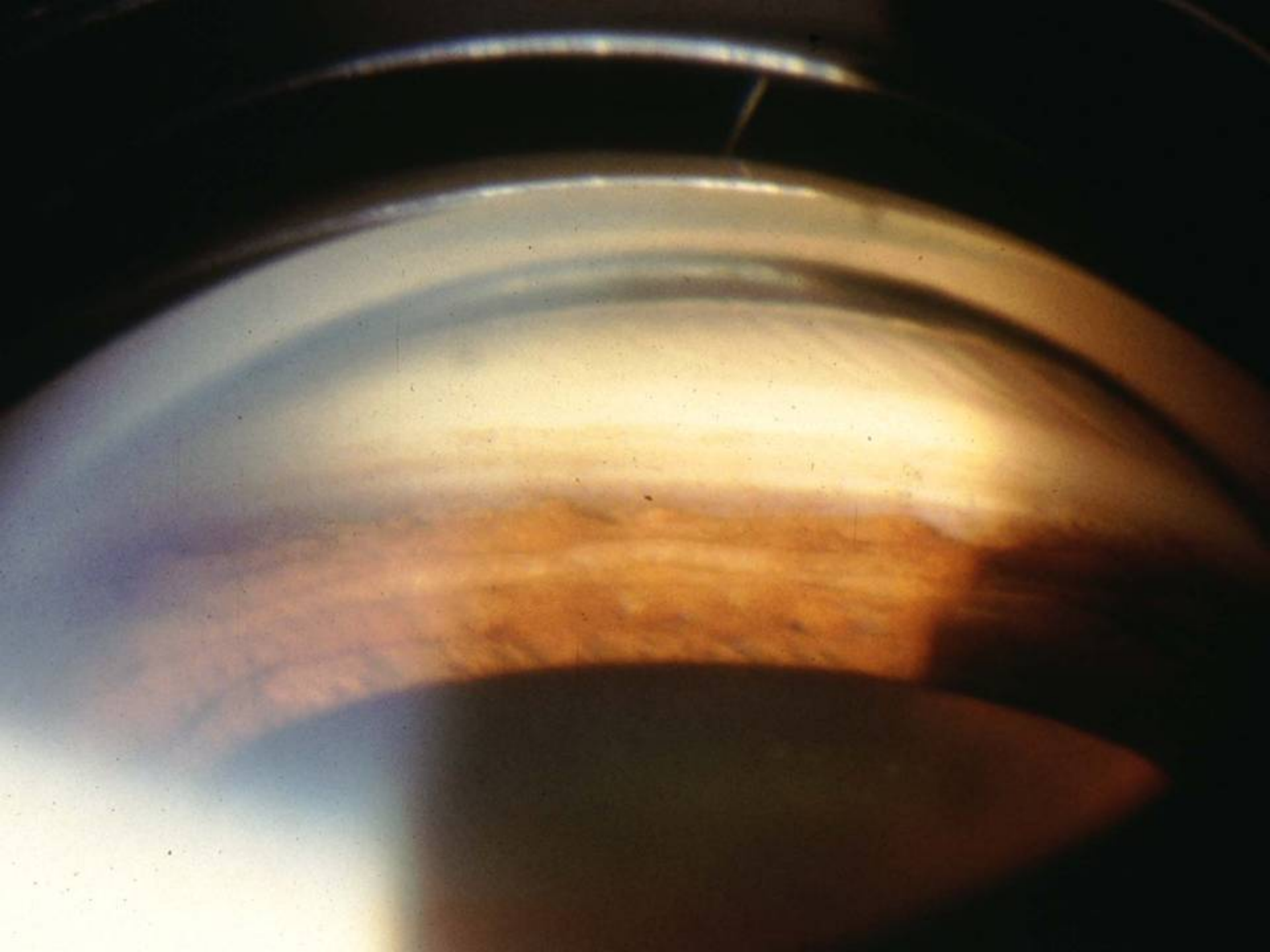
- adhesions of the iris to TMW.
- Synechia of angle closure glaucoma is most often found in the superior quadrant since the superior angle is the narrowest.
- Synechiae associated with inflammation are more commonly found in the inferior angle due to increased inflammatory debris gravitationally moving downward.


Peripheral anterior synechiae

Angle Pigmentation

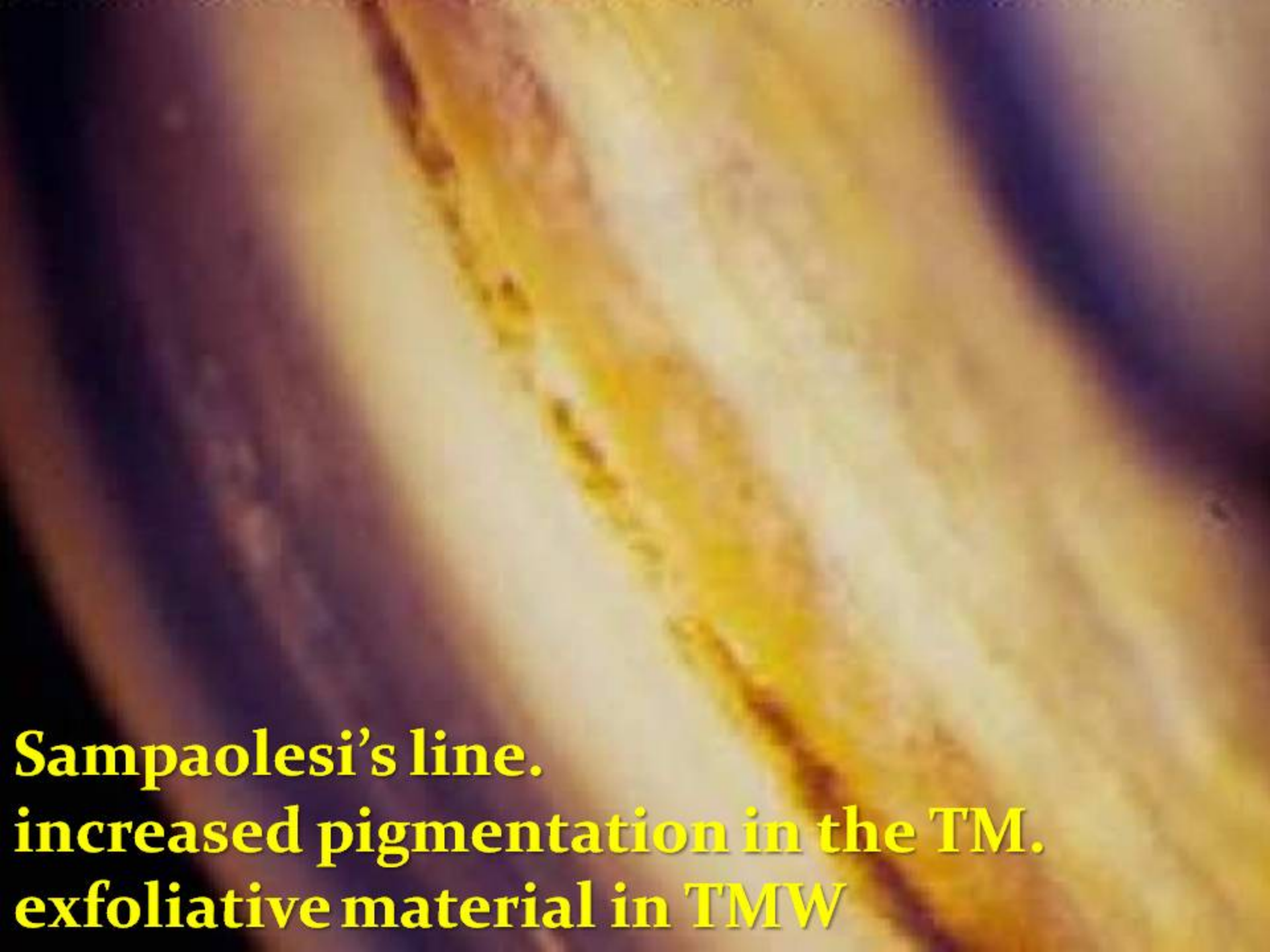
Angle Pigmentation

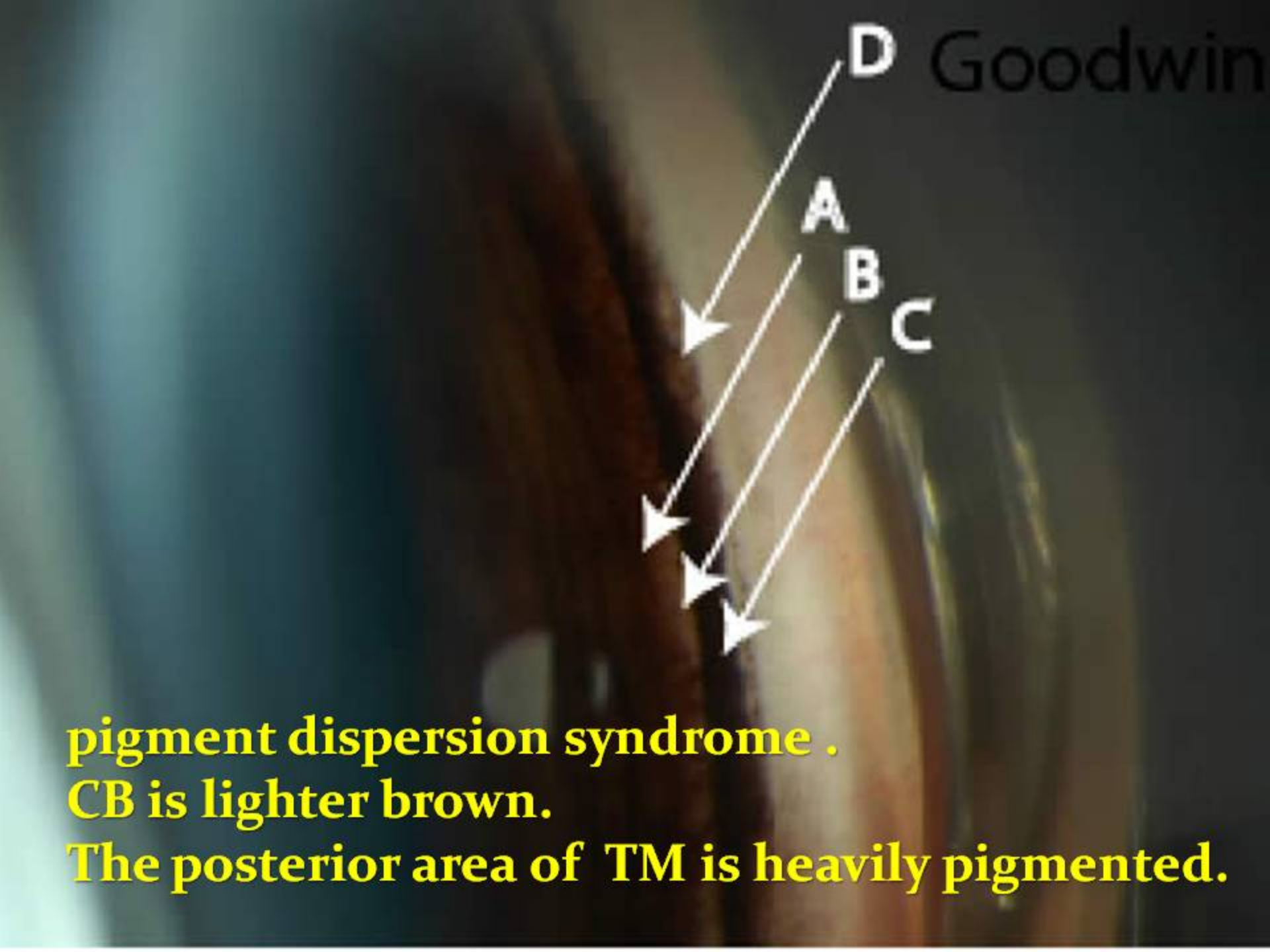
- A minimal amount of angle pigment is expected .
- More in the inferior portion of the angle, especially in individuals over age 50.
- excessive angle pigmentation should prompt the examiner to search for its cause.



Prominent Schwalbe's line (posterior embryotoxon).

Pigment along the Schwalbe's line .
This pigment deposition is called Sampaolesi's line.


Sampaolesi's line.
increased pigmentation in the TM.
exfoliative material in TMW



pigment dispersion syndrome .
CB is lighter brown.
The posterior area of TM is heavily pigmented.

Schlemm's canal

Schlemm's canal

- Blood may normally reflux in to Schlemm's canal and this may be seen during routine gonioscopy.
- Blood in the canal is more common under conditions of elevated episcleral venous pressure + dilated episcleral vessels.
- Hypotony may also cause blood to reflux in to the canal.

Iris Vessels

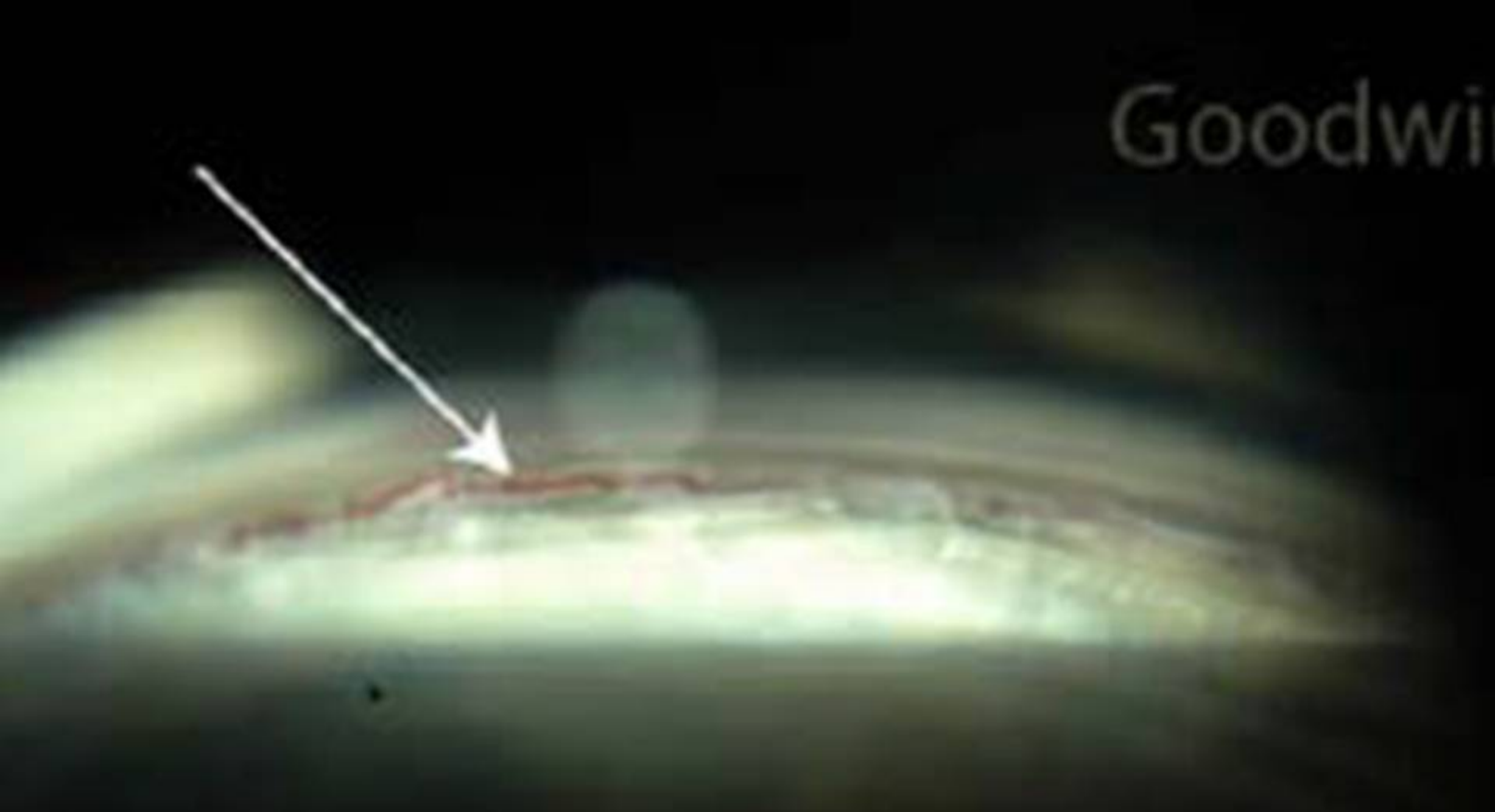
Normal Angle Vessels

- rarely bridge the scleral spur.
- do not branch.
- usually single vessels without arborization.
- 62% of individuals with blue eyes and only 9% with brown eyes.
- It is rare to see a blood vessel run the entire quadrant length of the angle.

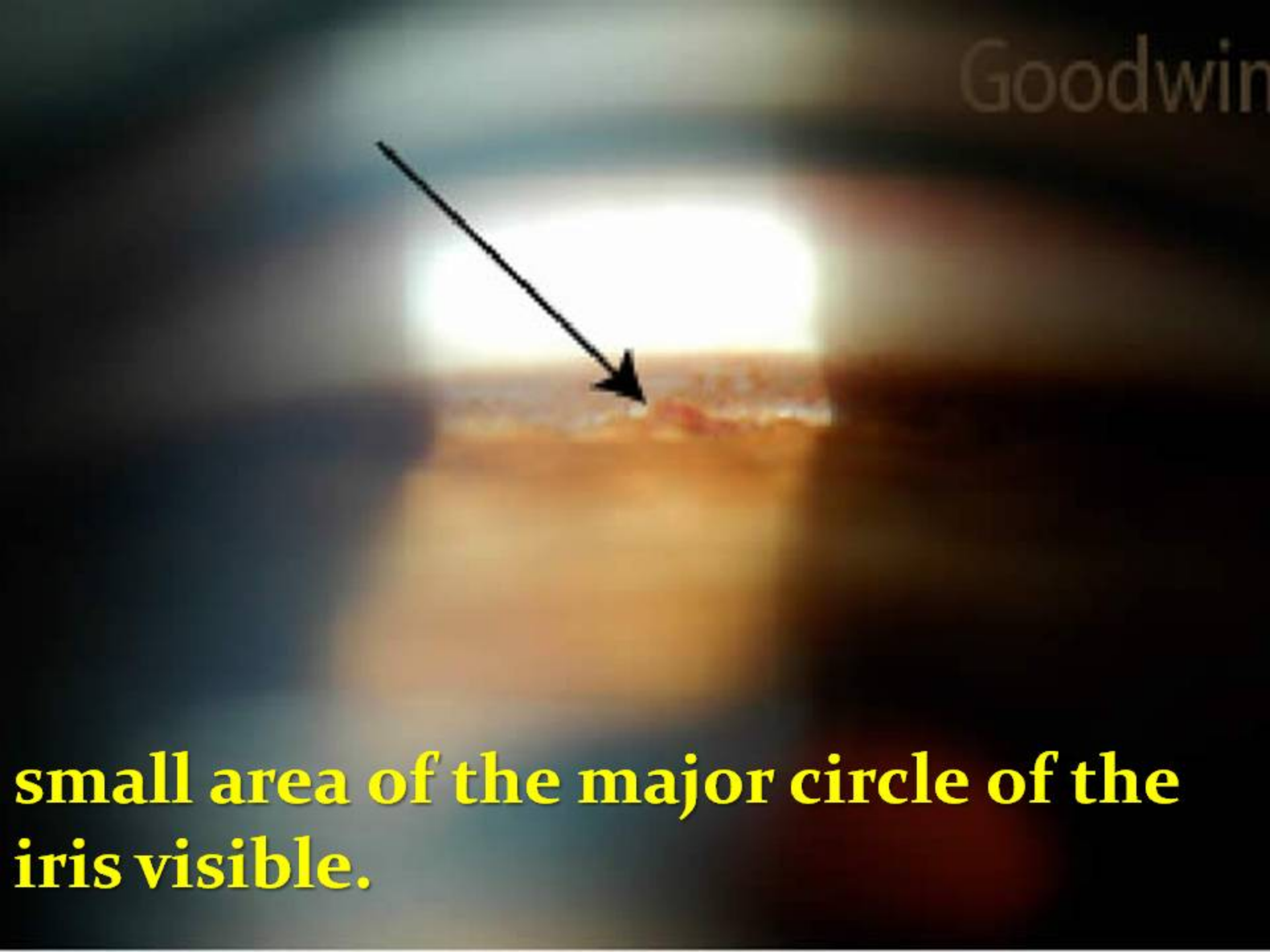
Normal Angle Vessels

- The normal angle has 3 types:
  1. circular ciliary body band vessels (commonest).
  2. radial iris vessels.
  3. radial ciliary body band vessels.


normal angle vessel



Shows a large branch of the major circle of the iris.



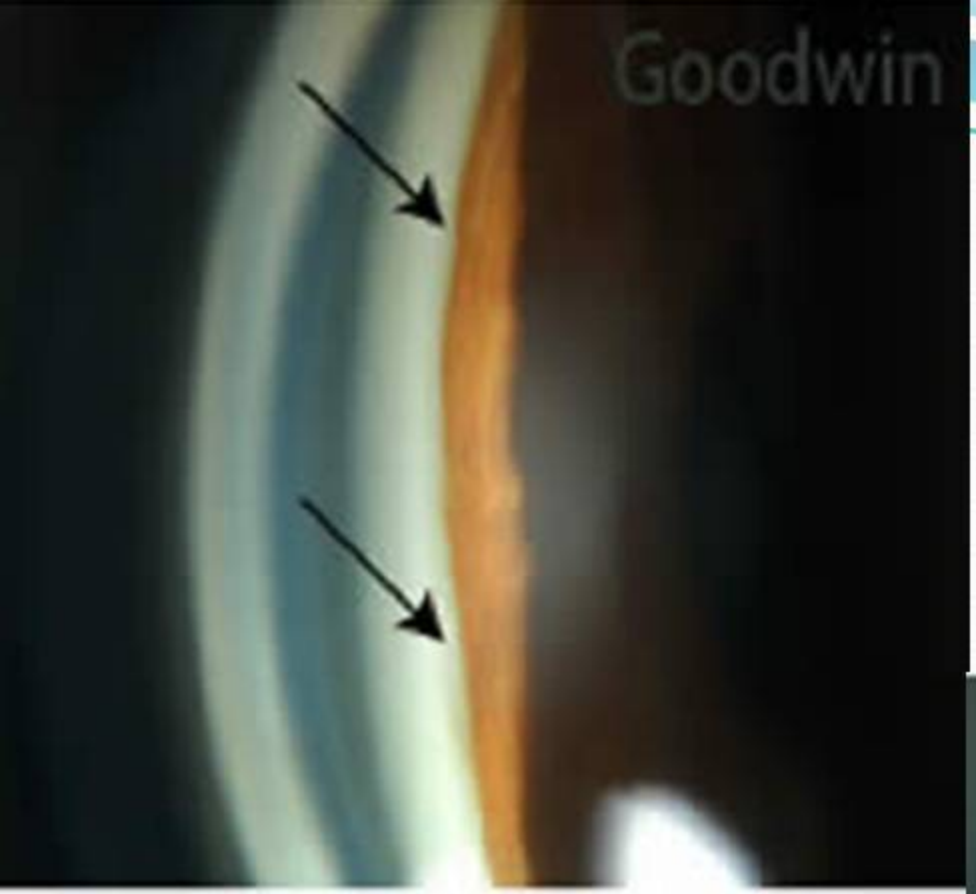
small area of the major circle of the iris visible.

Neovessels

- more feathery, and thin.
- have an erratic pattern.
- can extend past SC into TMW.
- do not follow the typical radial or circumferential pattern of iris bl.Vs.

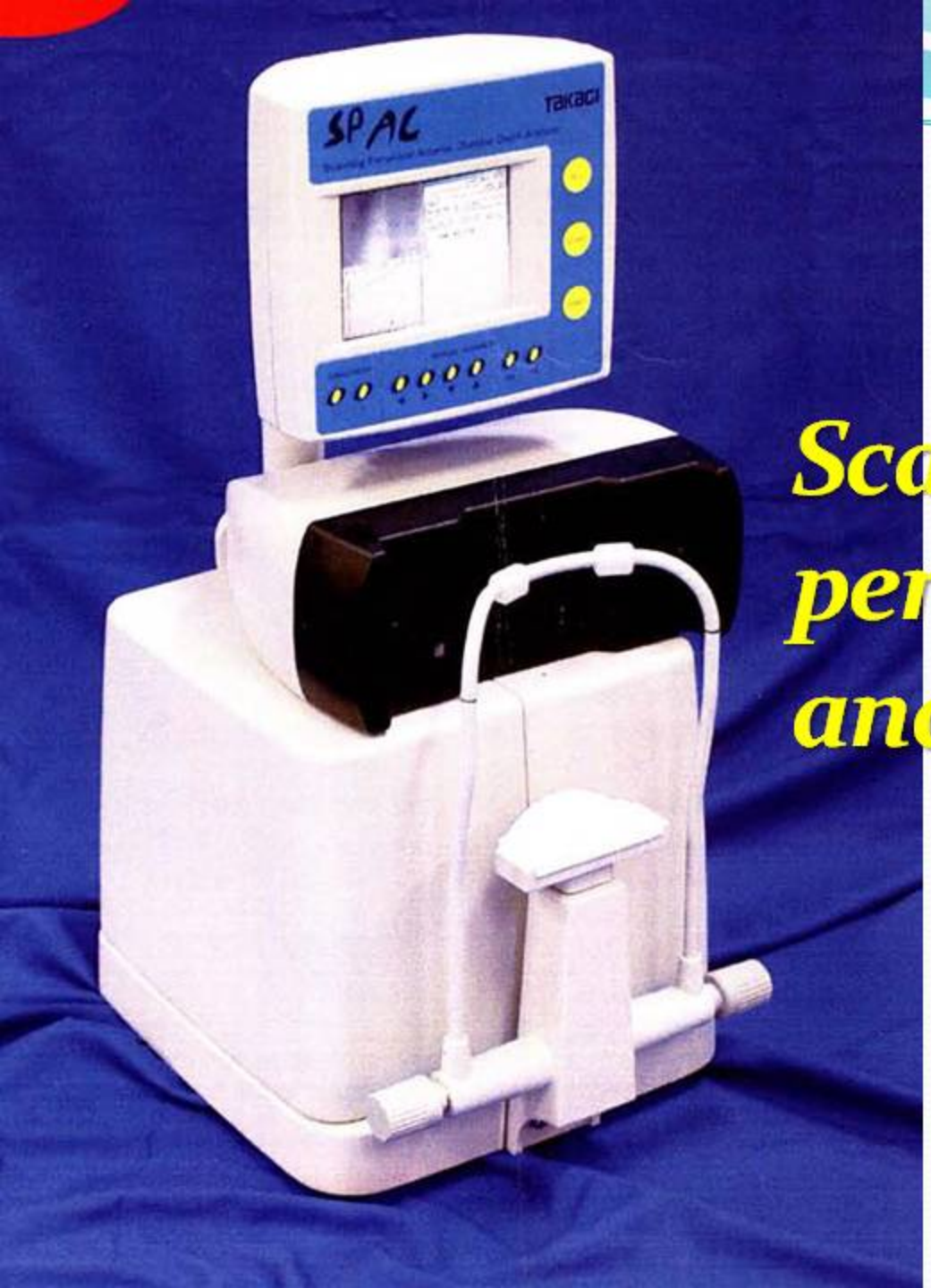
Neovs. in A.Ch angle in a eye with DR.

- By gonioscopy , we can determine the accessibility of the aqueous to MW.
- With Van Herrick method, grade 2 or less, gonioscopy should be performed on these patients.
- If the posterior TMW is present in at least 180° of the A.Ch. angle, the person is typically considered safe for pupil dilation.


Goodwin


Goodwin

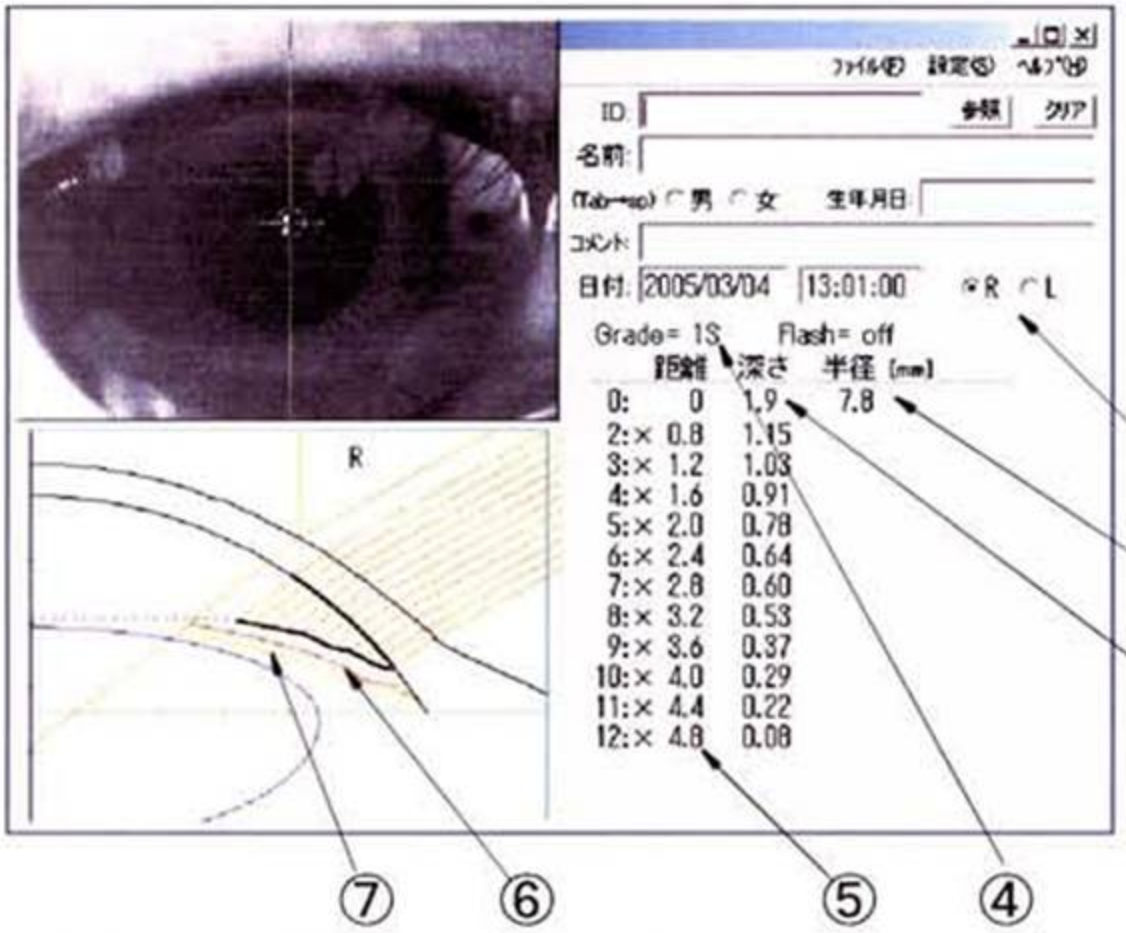
- Show a patient with subacute angle closure glaucoma.
- The angles are narrow with Van Herrick estimation.
- Only a portion of the TMW is visible with gonioscopy.



Scanning peripheral AC width analyzer (SPAC)

SPAC

- Non-invasive, quantitative.
- Measure AC depth from the pupil center to the limbus.



1 OD, OS

2.Corneal radius of curvature.

3.AC depth

4.Grade.

5.Distacne from the optical axis.

Grading for assessment

- 12 grades (grade 1 (shallow) to grade 12 (deep).
- The suffix attachment S (danger) and P (caution) to the grade number represent the potential risk of angle closure.

Difference from the conventional methods

- Effective but invasive.
- complicated operation.
- accuracy depends on the examiner's skill.
- Expensive.
- can not measure the outermost peripheral area because of the influence of refraction but measures only the apparent angle openness.

SPAC

- Non-contact quantitative measure.
- not limited to ophthalmologists.
- Needs 30 sec. for binocular examination.

SCHEIE CLASSIFICATION

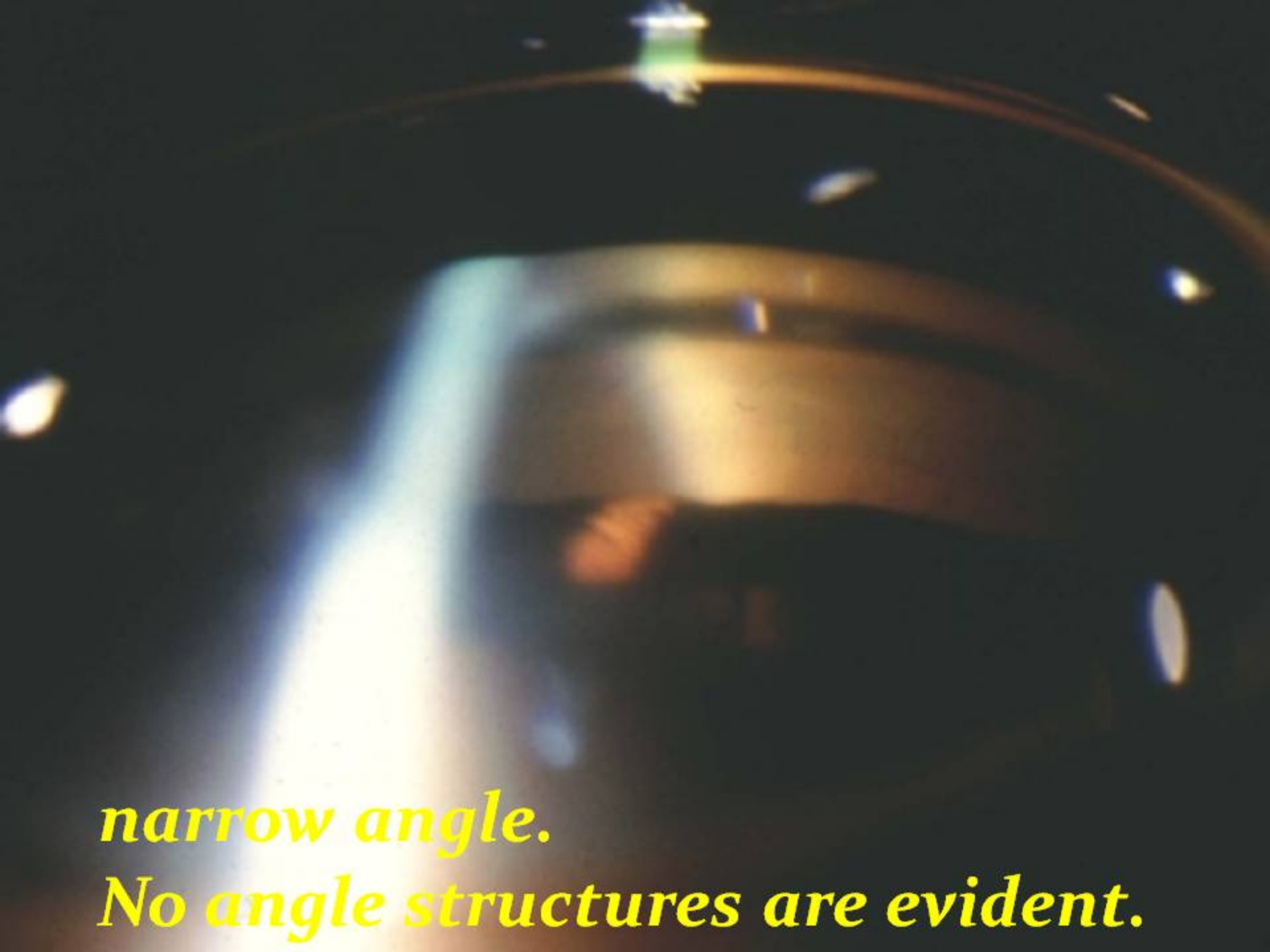
Wide open	All structures visible
Grade I	Iris root visible
Grade II	Ciliary body obscured
Grade III	Posterior trabeculum obscured
Grade IV	Only Schwalbe's line visible
Angle depth system based on structures visualized.	

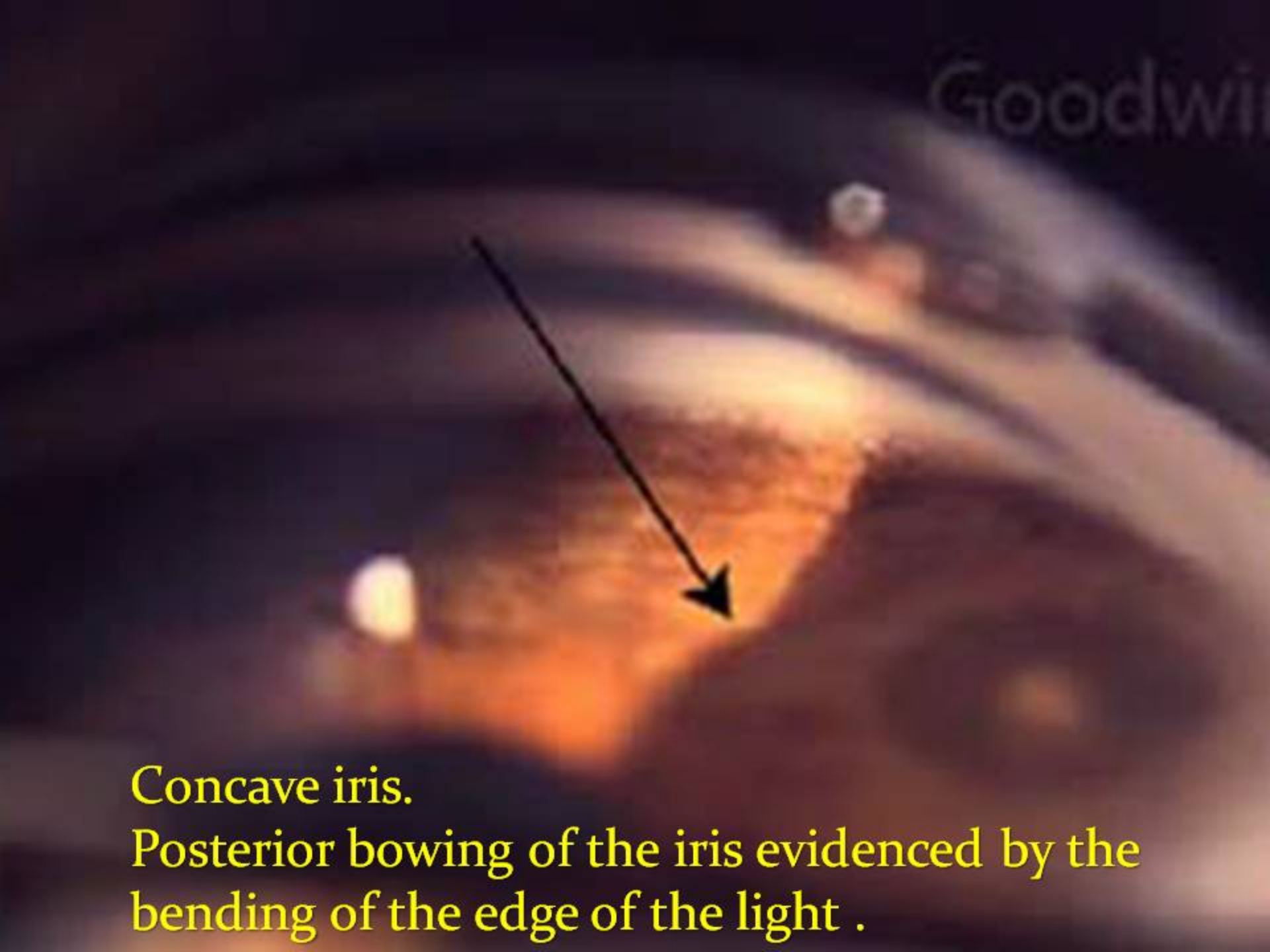
SHAFFER SYSTEM

Grade 4	45° to 35° angle	Wide open
Grade 3	35° to 20° angle	Wide open
Grade 2	20° angle	Narrow
Grade 1	≤ 10° angle	Extremely narrow
Slit	0° angle	Narrowed to slit
Based on the angular width of the angle recess		

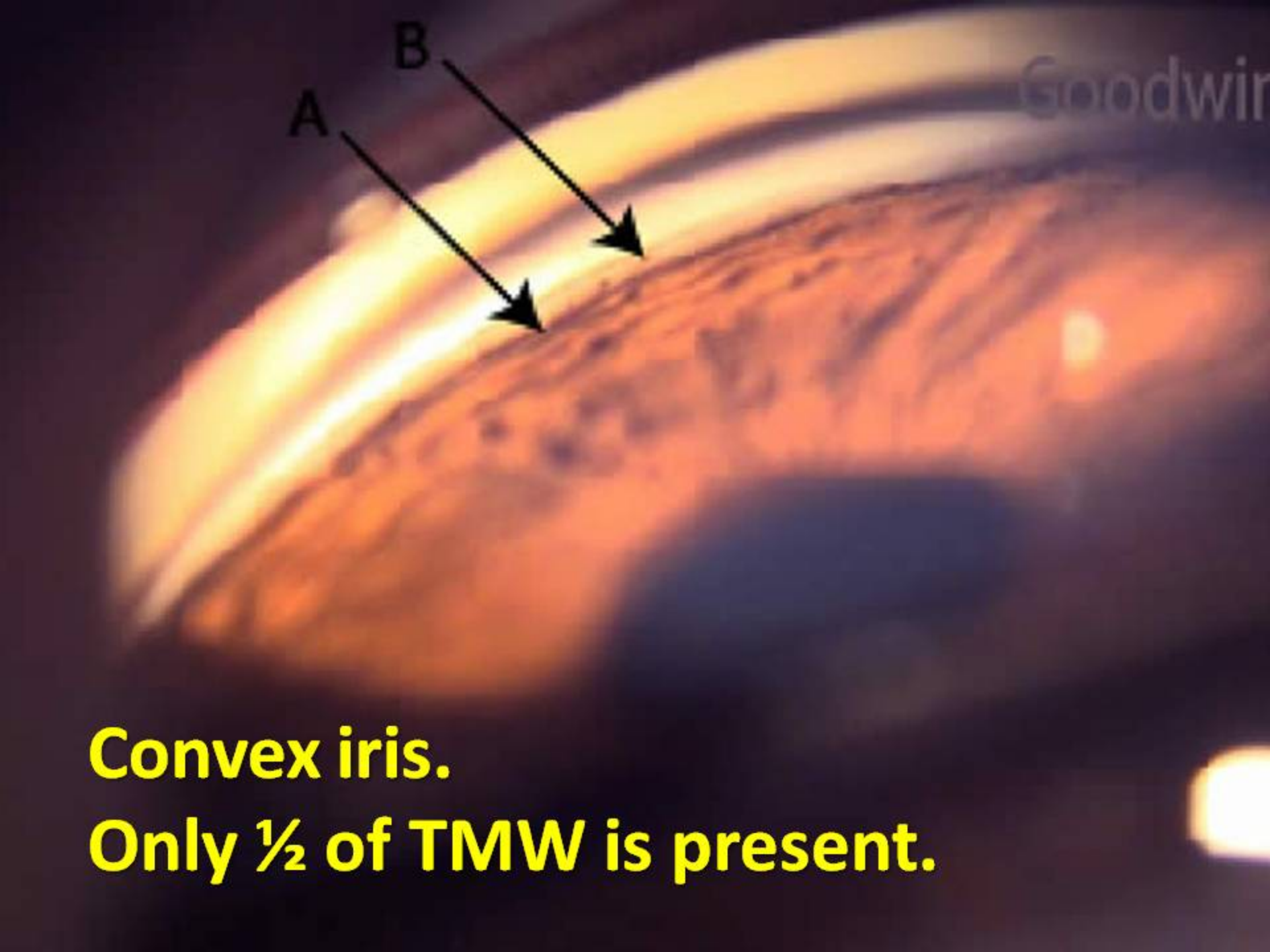
Iris Insertion	Angular Approach	Peripheral iris		Pigmentation of TMW
A anterior to Schwalbe's line	0-50 degrees	R regular	F flat	0 no pigment
B Between Schwalbe's line and sclera spur		S Steep	B bowed anteriorly	1+ minimal
C Scleral spur visible			P plateau iris	2+ mild
D Deep with ciliary body visible		q queer	C concave	3+ moderate
E Extremely deep with >1 mm of ciliary body visible				4+ intense

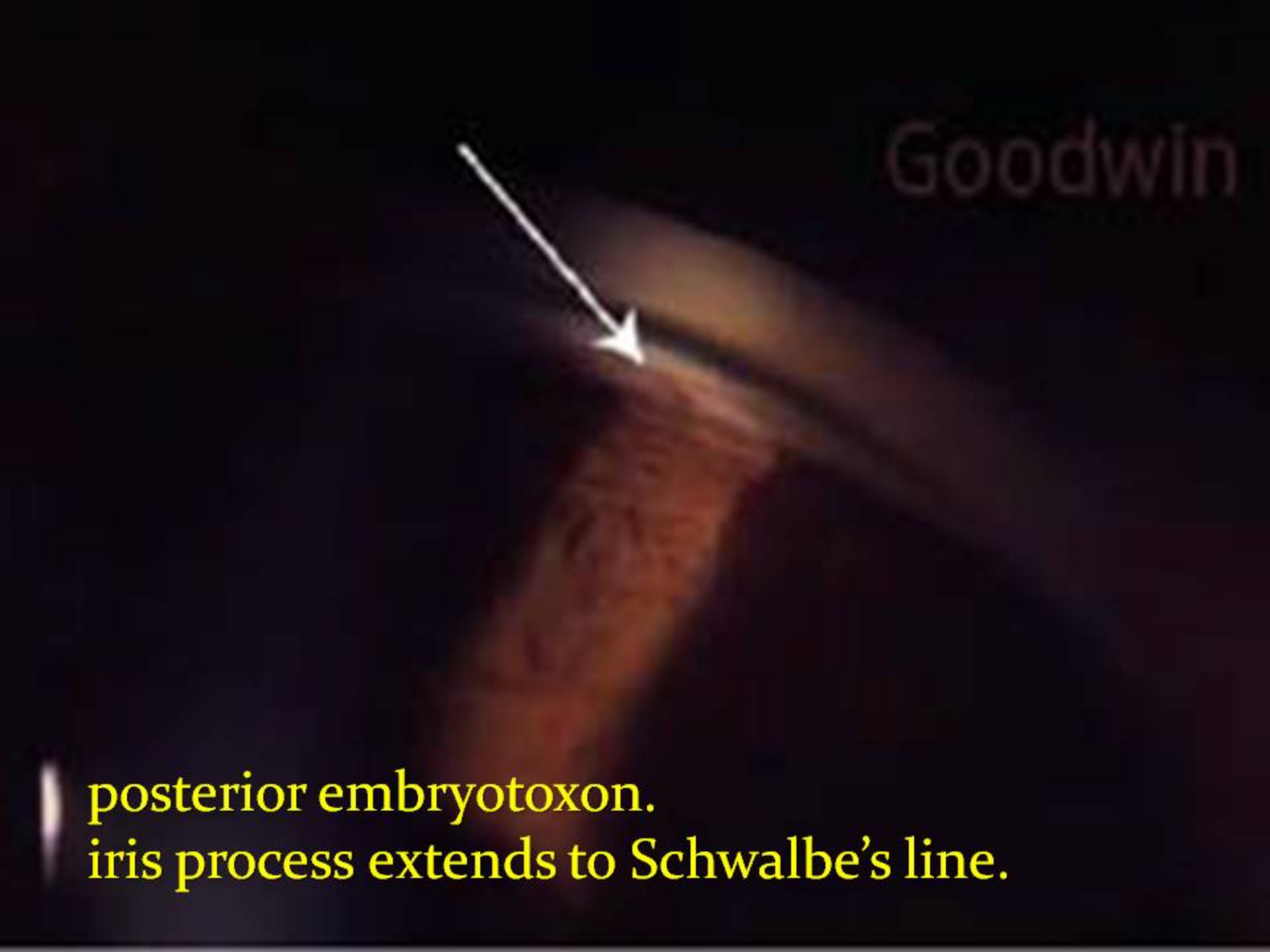

A widely open angle


narrow angle.
No angle structures are evident.

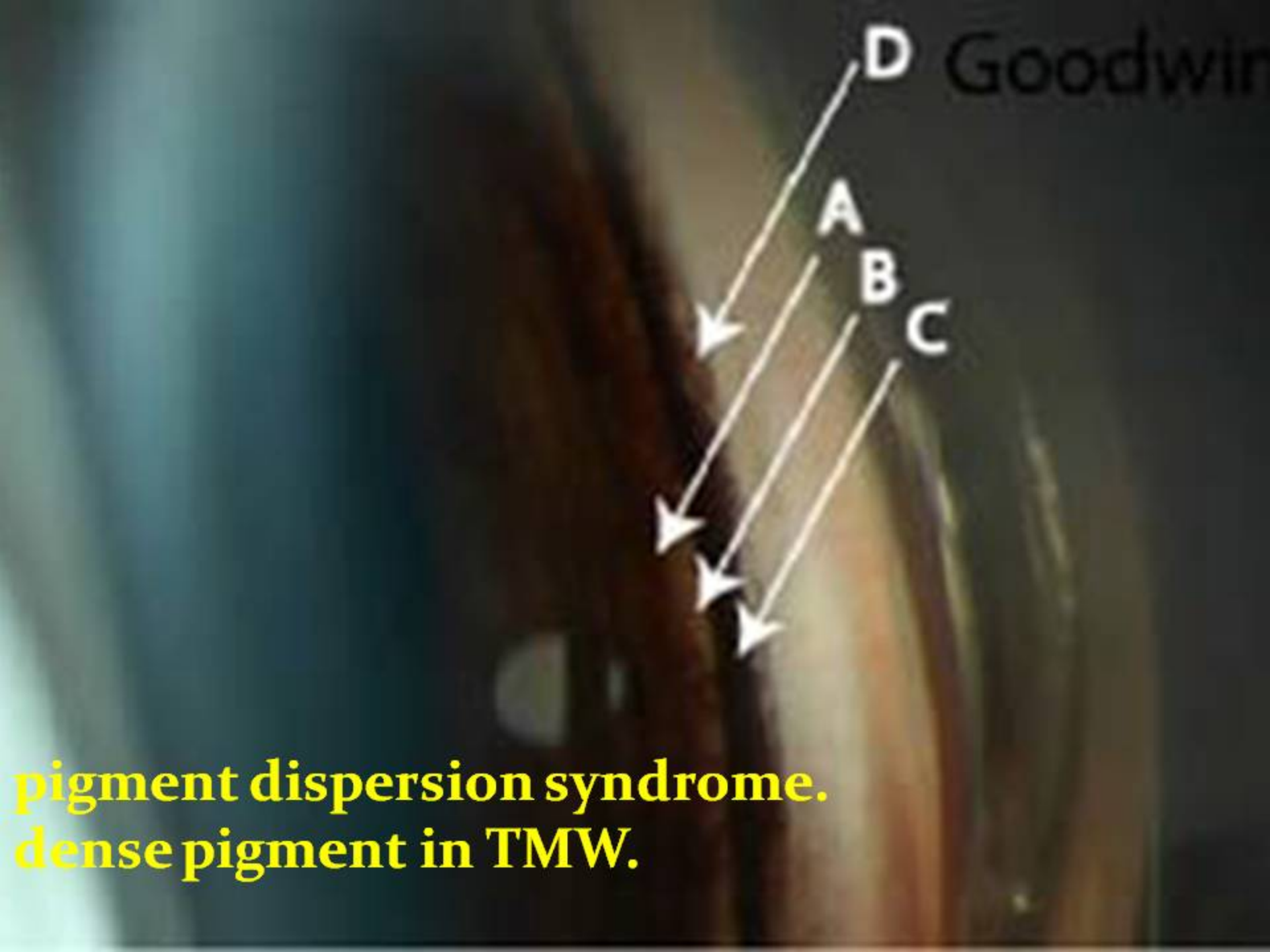


Concave iris.
Posterior bowing of the iris evidenced by the bending of the edge of the light .


B
A
Convex iris.
Only ½ of TMW is present.


Goodwin
posterior embryotoxon.
iris process extends to Schwalbe's line.

pigment along Schwalbe's line (Sampaolesi's line).

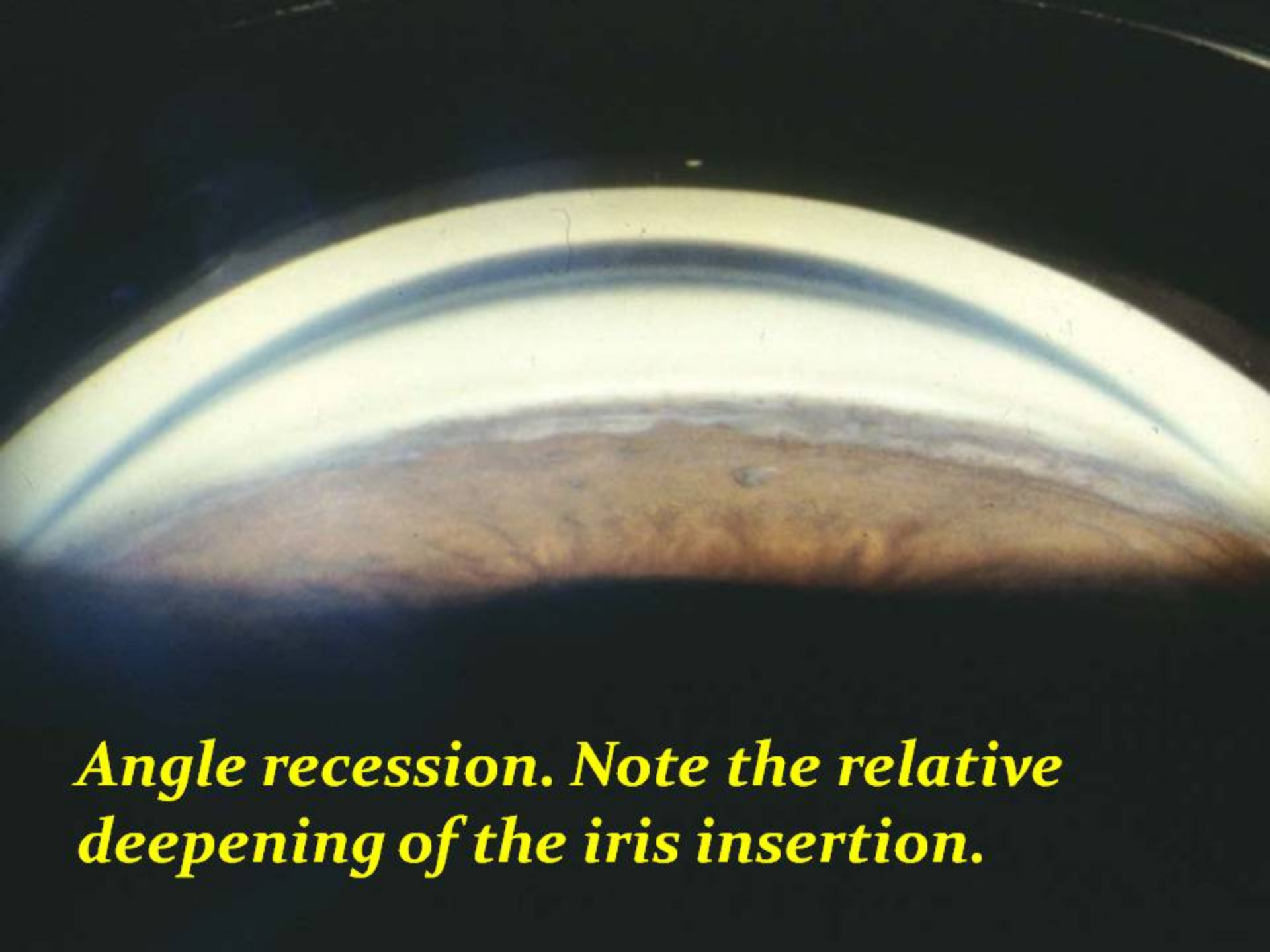


pigment dispersion syndrome.
dense pigment in TMW.

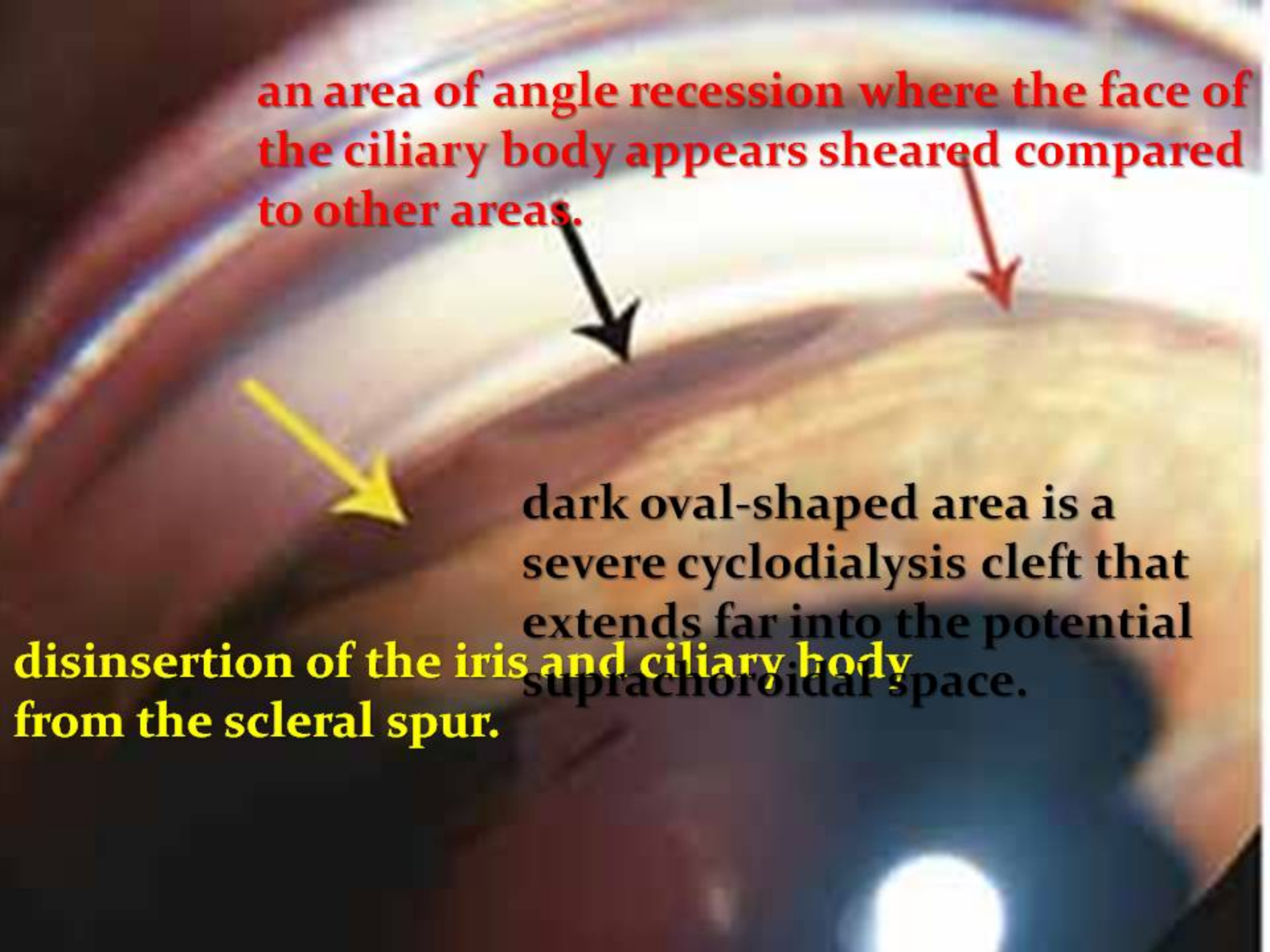
Angle recession

- occurs when the ciliary muscle has been torn due to blunt trauma.
- CB is typically the same size as SS + TMW combined.
- Also, a cobweb by appearance or visualization of the sclera posterior to CB.
- Iridodialysis, where the iris is completely torn from the ciliary body.

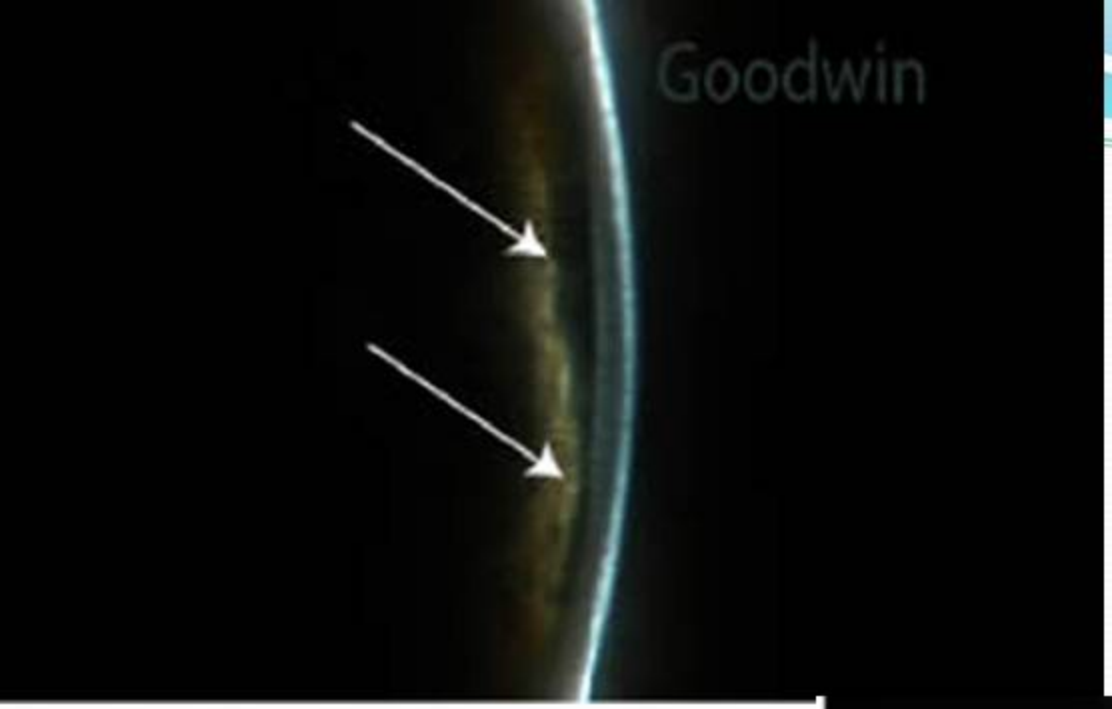

patient with an angle recession.



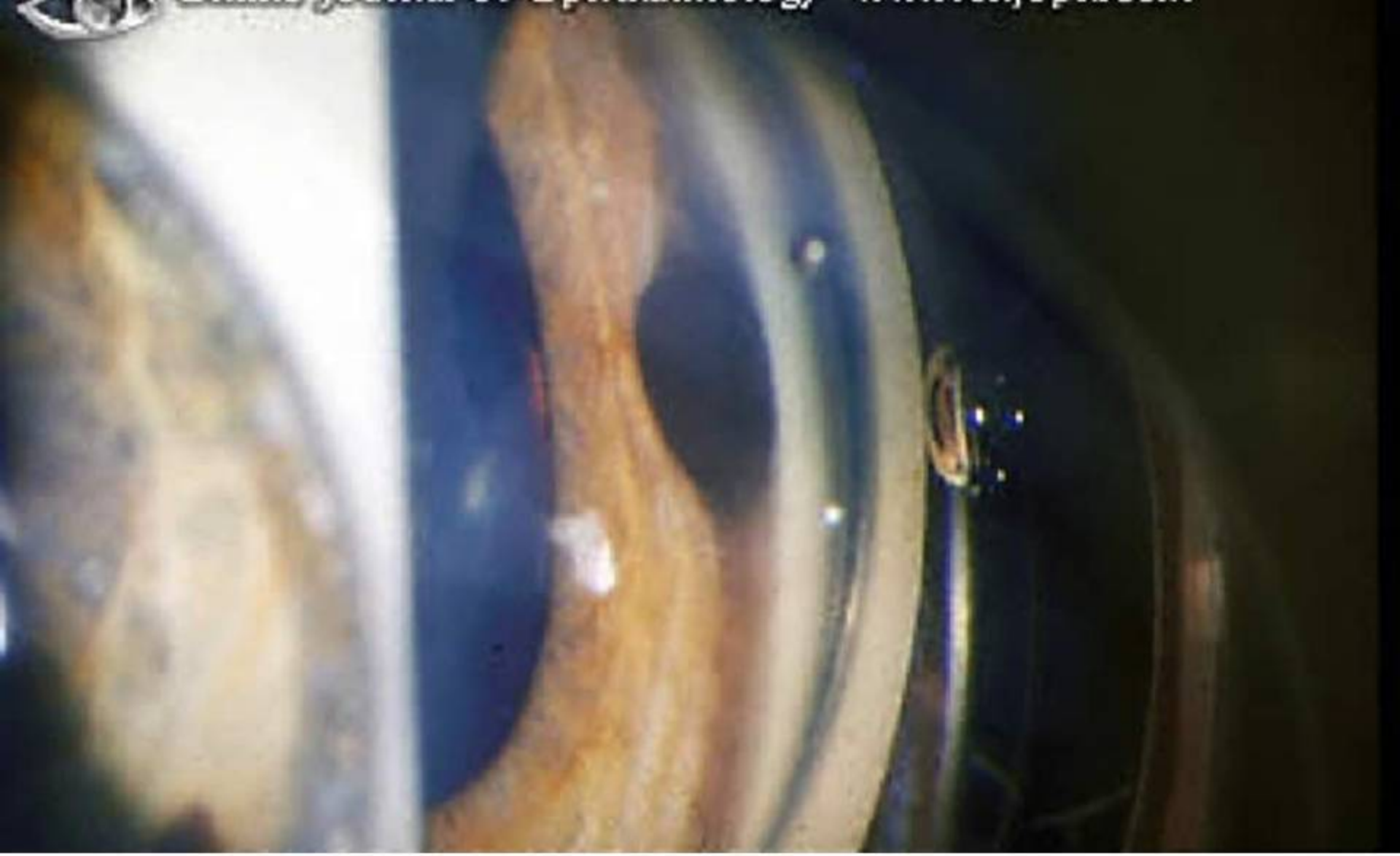
Angle recession. Note the relative deepening of the iris insertion.


an area of angle recession where the face of the ciliary body appears sheared compared to other areas.
dark oval-shaped area is a severe cyclodialysis cleft that extends far into the potential suprachoroidal space.
disinsertion of the iris and ciliary body from the scleral spur.

- Gonioscopy is an excellent way to evaluate elevated areas of the iris.
- It is critical to differentiate iris cysts from a neoplasia.
- Note that there is no distortion of the iris architecture or aberrant blood vessels.
- Iris cysts can be monitored for progression or collapsed by penetrating the cyst with a YAG laser.


Goodwin

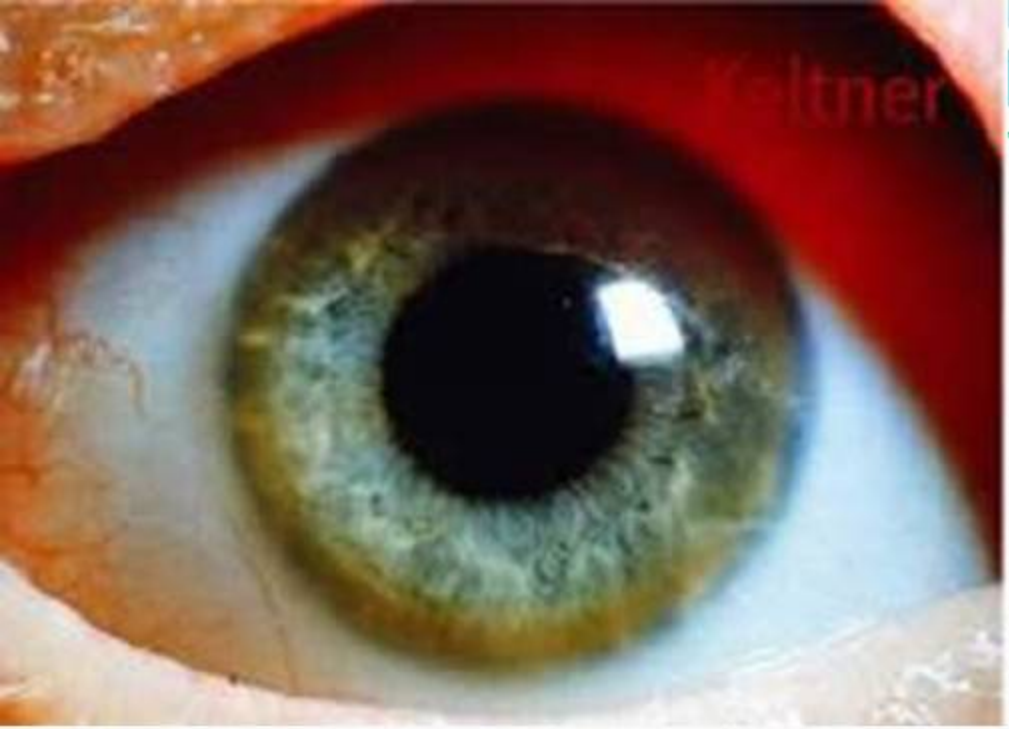

Goodwin

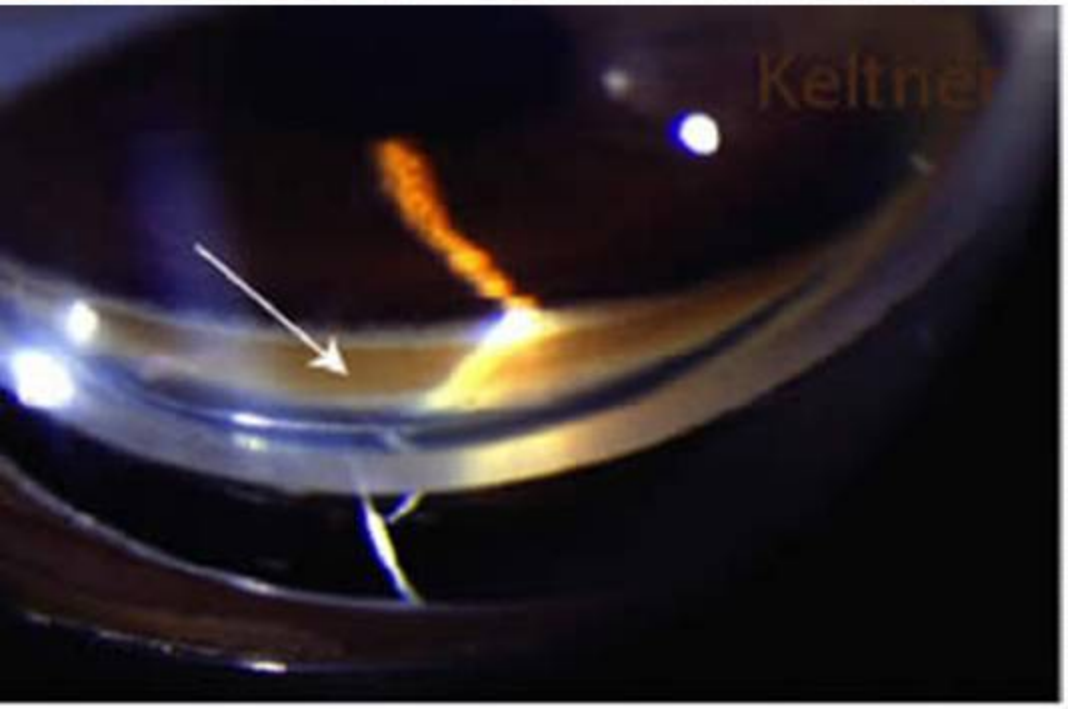


In cases of malignant melanoma of the ciliary body, the ciliary body will appear abnormally dark .

Wilson's disease

- genetic disorder affecting copper metabolism.
- Copper also accumulates in the peripheral cornea (Kayser-Fleisher rings) and the lens.





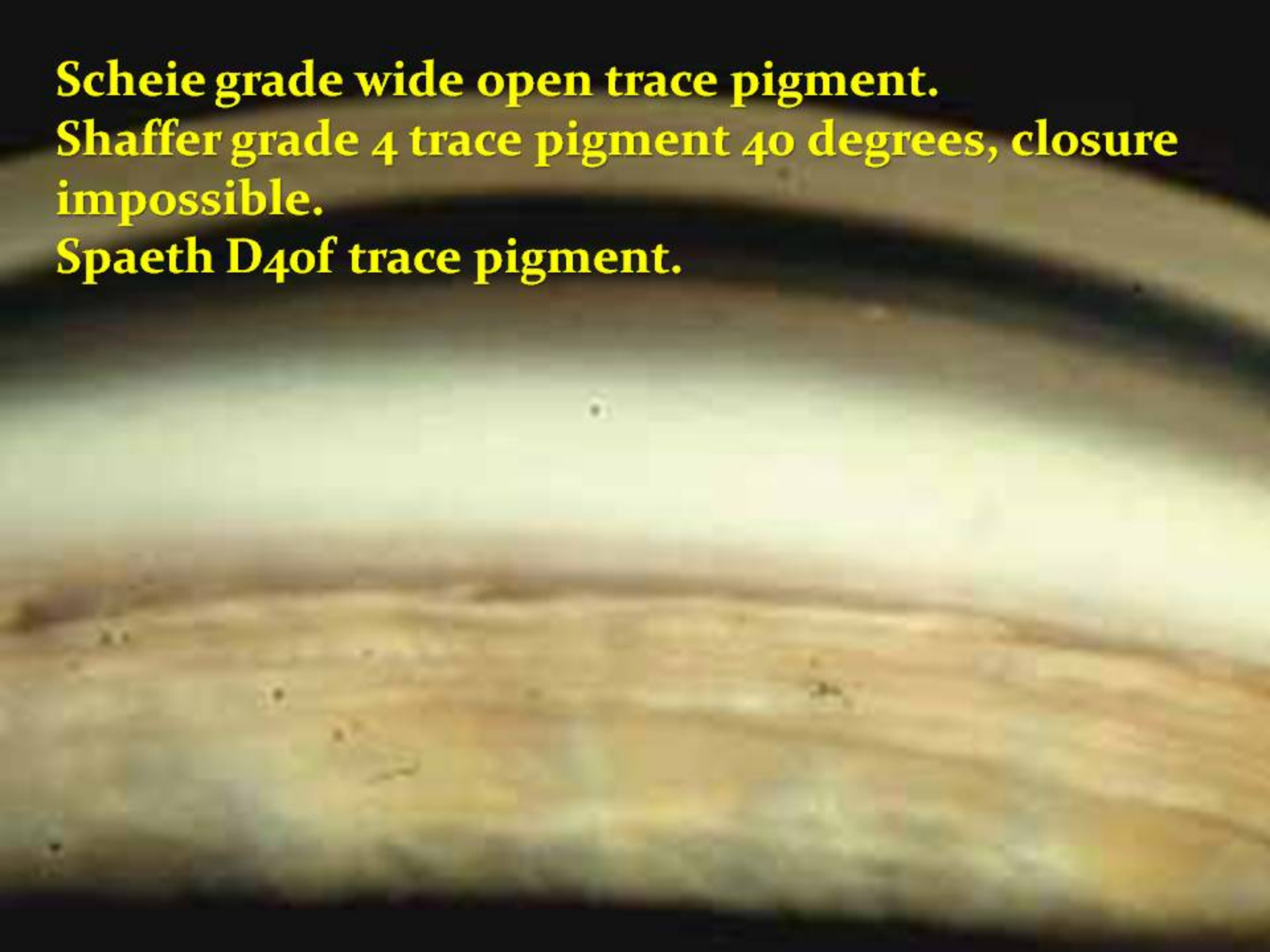
Shows a patient with copper deposits in the cornea secondary to Wilson's disease.


IOFB in the angle.

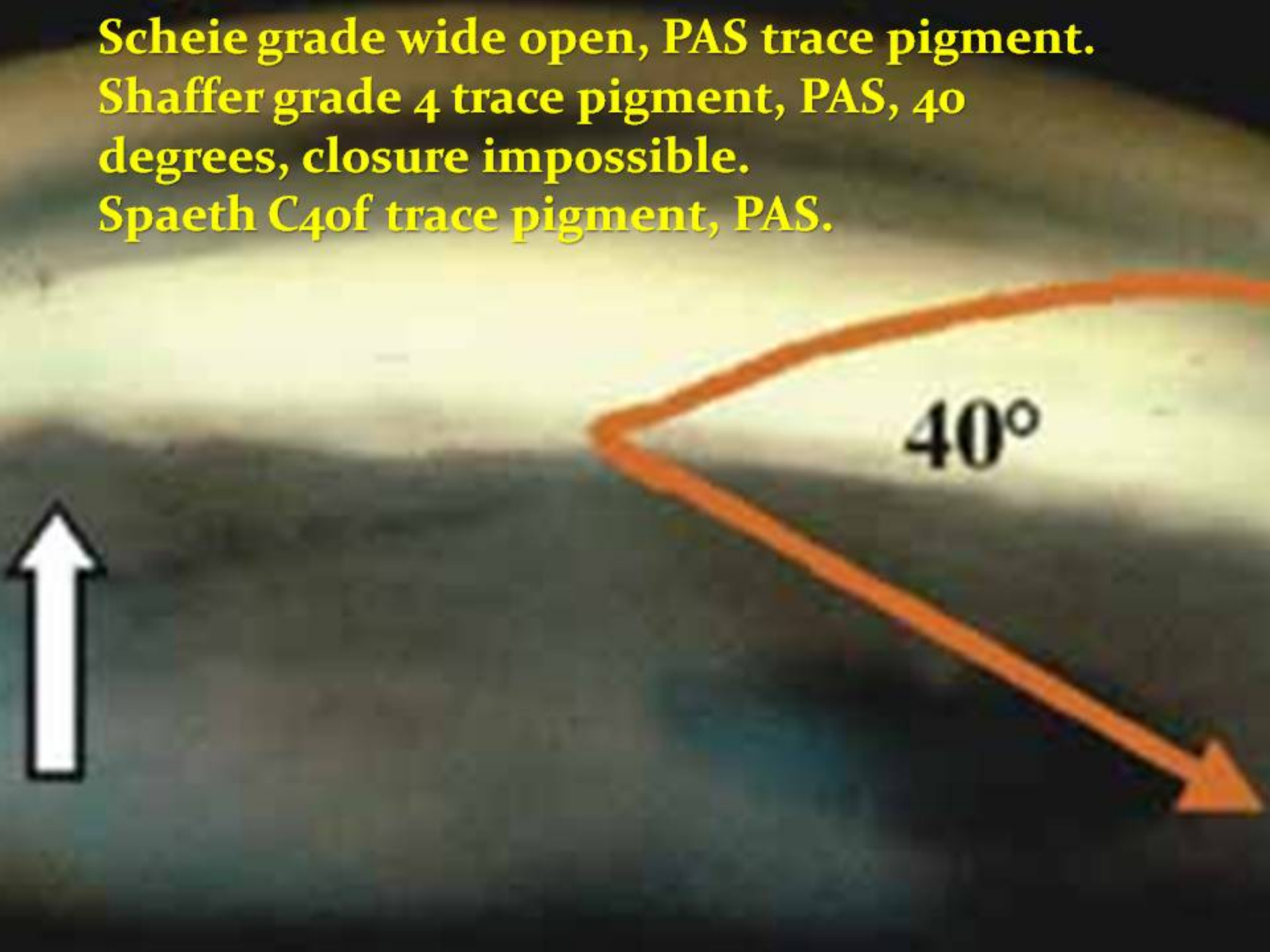
Scheie grade, wide open 4+ pigment.

Shaffer grade, 4+ pigment, 40 degrees closure impossible.

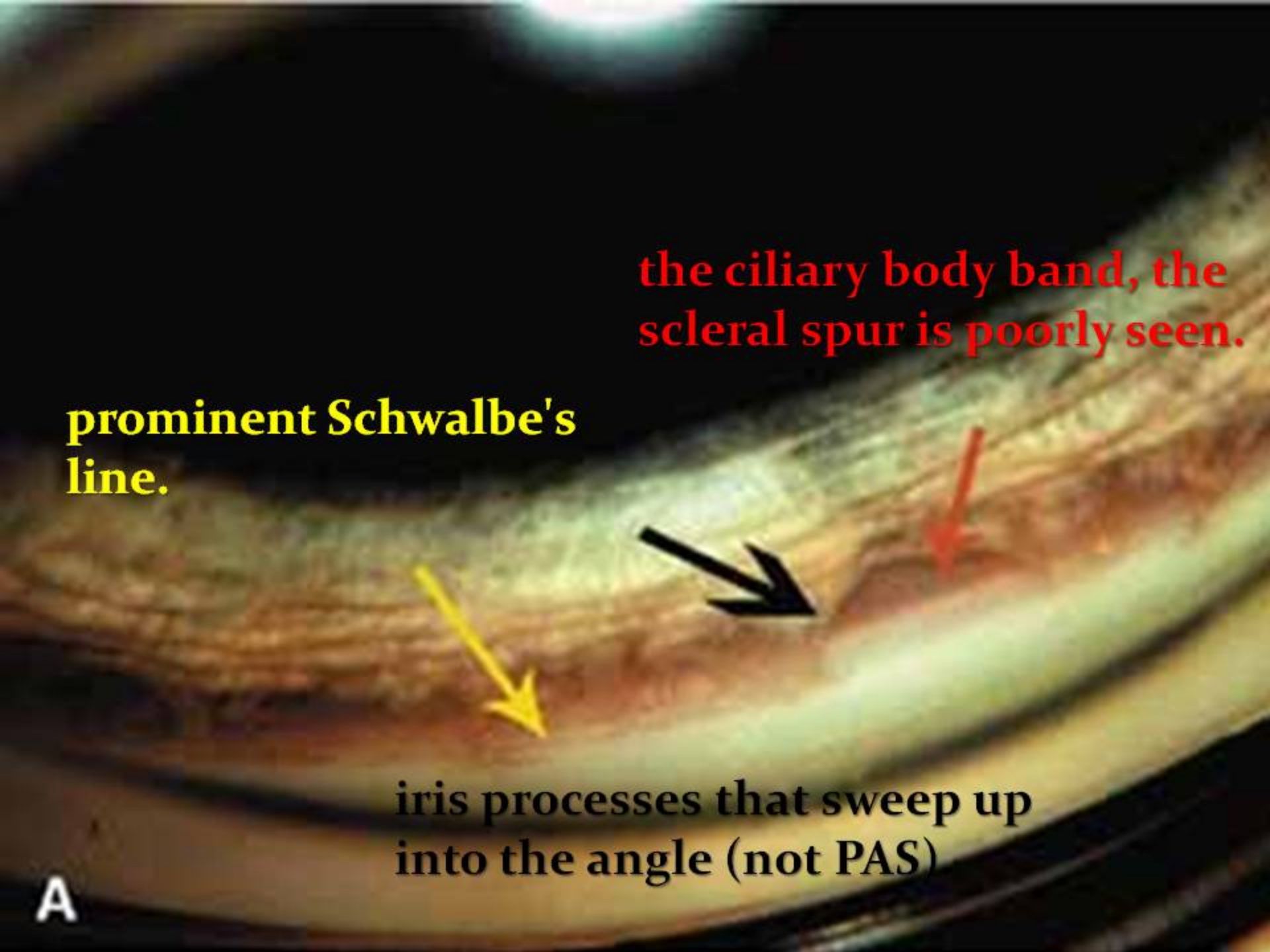
Spaeth, 40.


Scheie grade wide open trace pigment.
Shaffer grade 4 trace pigment 40 degrees, closure impossible.
Spaeth D40f trace pigment.

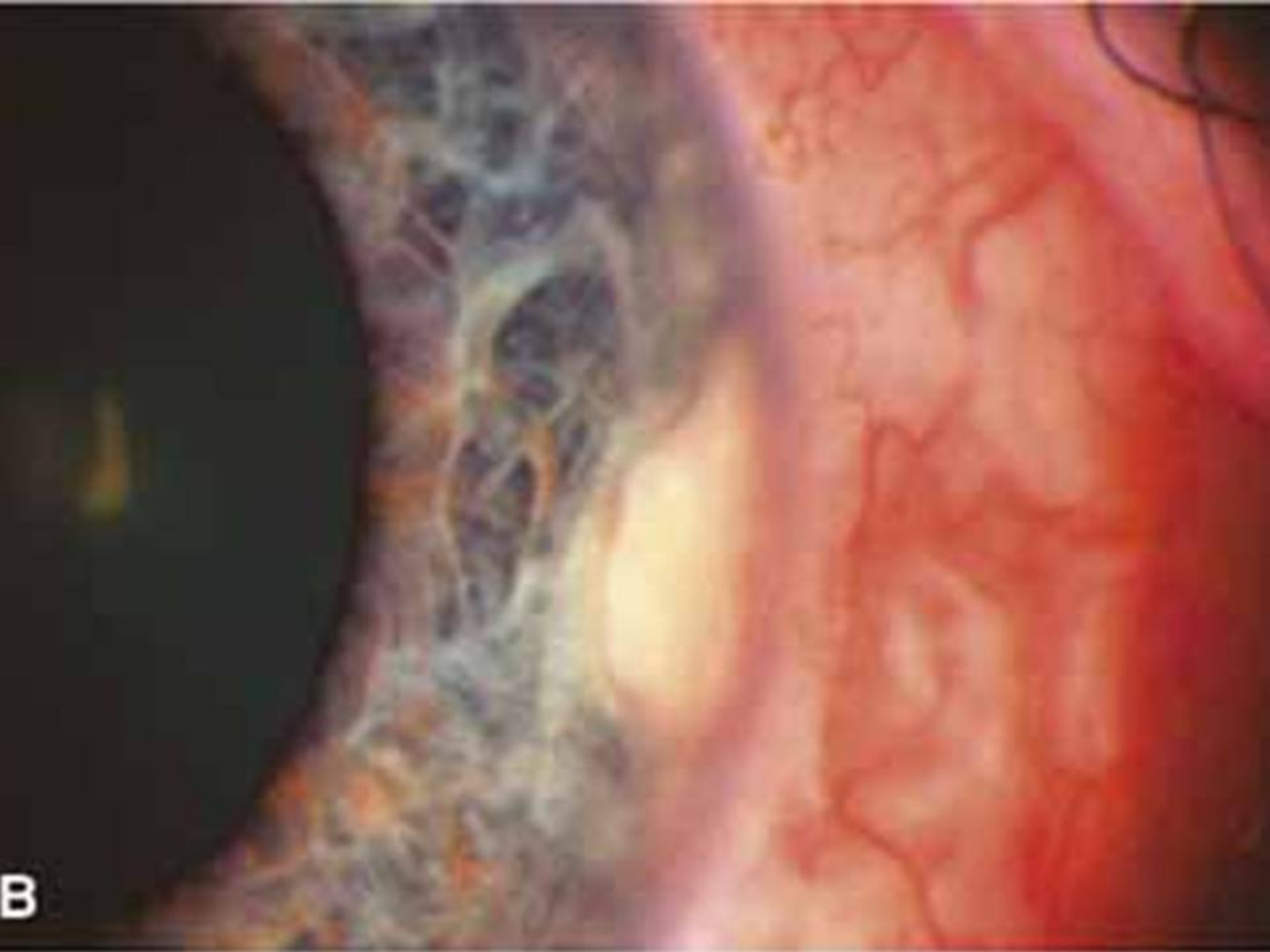
Scheie grade wide open, PAS trace pigment.
Shaffer grade 4 trace pigment, PAS, 40 degrees, closure impossible.
Spaeth C4of trace pigment, PAS.



- The iris inserts high directly into scleral spur increasing the likelihood of chronic angle closure glaucoma.
- The angular approach is wide open and the peripheral configuration is flat.
- The point is according to the Shaffer system the angle would not be capable of closure, but there are PAS and the eye required PI.
- Thus the angular approach does not have to be steep to have angle closure disease. Clearly, more than one descriptor is necessary for many angles.


the ciliary body band, the scleral spur is poorly seen.
prominent Schwalbe's line.
iris processes that sweep up into the angle (not PAS)
A

- 4-year boy with suspicious optic discs and borderline IOPs.
- The fellow eye has the same appearance.
- What is your diagnosis?
- Axenfeld's syndrome


B

- Slit-lamp photograph of a limbal lesion. The lesion appears confined to the cornea and the IOP is normal.
- Treatment included aggressive cryotherapy of the area.
- Squamous cell carcinoma at the limbus

- The goniophotograph of reveals the lesion has invaded the chamber angle. A white mass is seen in the angle. What is your diagnosis?
- Squamous cell carcinoma invading the angle.

- 54-year-old female with a 30-year history of initially open-angle glaucoma.
- The angle originally appeared open; however, over the past 10 years has developed the captured appearance.
- What is your differential and diagnosis?.
- iridocorneal endothelial syndromes (ICE) if unilateral .
- Posterior polymorphous dystrophy (PPD) if bilateral.

summary

- gonioscopy is an essential ophthalmic skill necessary for the correct diagnosis and treatment of multiple eye diseases.
- Maintenance of gonioscopic skills will increase the likelihood of a lifetime of vision for patients at risk for any type of angle pathology.


Thank You