The angle of the anterior chamber needs to be assessed in all glaucomas. It usually holds the secrets to pathogenesis in that particular case. It may also reveal pathology in other cases in the form of a retained intraocular foreign body, small hyphemas, small hypopyon, etc. The object of this write up is to guide one through the examination procedure.

Due to total internal reflection we are unable to see the angle of the anterior chamber without compensating for the air cornea interphase. This can be achieved by direct gonioprisms used in surgeries (not dealt in detail in this treatise) and by indirect goniolenses that use a mirror to see the angle.

In general we use Goldman two or single mirror lenses as well as Sussman or Zeiss 4 mirror lenses in diagnostic gonioscopy with slit lamp examination.

**The Procedure**

First we need to explain the procedure to the patient. Under topical anaesthetic (Proparacain) both the patient and the surgeon are to be seated comfortably at the slit lamp. For the surgeon’s comfort one has to place the elbow rest in a convenient position prior to inserting the goniolens.

**Placing the contact lens**

The Ziess or Sussman lens requires no coupling fluid. These lenses are placed onto the patient’s eye with the patient looking straight ahead (fig 1). (Great care is taken so as not to put undue pressure on the eye which can cause the angle to open up with indentation, cause corneal folds that obscure visualization of the angle and make the patient uncomfortable due to vagal stimulation.

When using a Goldmann lens we need to fill the contact lens partly with a coupling fluid (one drop of our surgical viscoelastic / surgical methyl cellulose or even a couple of drops of artificial tears will do). I say partly fill because once on the eye there is need of only about 1 - 2 drops. The excess always flows down the patient’s cheek during the procedure making it uncomfortable for the patient. It would also mess up your slit lamp. After instilling the coupling fluid we can ask the patient to look down, retract the upper lid with your nondominant hand and place the goniolens onto the eye using the edge of the goniolens to retract the lower lid.

Now one can ask the patient to look up and move the goniolens with the eye (fig 2). Alternatively we can ask the patient to look up and place the goniolens over the inferior sclera. Now when the patient looks straight we rotate and place the lens onto the eye (fig 3).

**Slit lamp adjustments**

Now we need to adjust the slit lamp. The beam is kept vertical and the illumination housing slant at about 30 degrees. To assess occludability the slit beam is made as thin and short as possible to view structures in the angle (this will avoid light from going into the pupil and constricting it). This position will allow for good visualization of the upper and lower angles.

To visualize the nasal and temporal angles one needs to make a few other adjustments. The illumination and microscope housings are aligned to be coaxial (0-2 deg). The housing is now tilted so that the beam is directed at about 15 degrees

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from below. The slit beam is made horizontal by rotating the lamp housing. This will allow for enough parallax to assess the angle structures without glare from the proximal glass cover of the goniolens. (Fig 4)

Magnification. Use just enough magnification to visualize the angle. Higher magnification makes one lose depth of focus and can be confusing. If a specific feature like new vessels in the angle is to be looked at closely, the change magnification for that instant alone.

Gonioscopy
The questions to be asked in gonioscopy are:
1. Grading
2. Is the angle occludable?
3. How much can it potentially open up to?
4. Is there any other features? (e.g. Secondary glaucoma features)

Anatomical landmarks
For grading we need to be clear about landmarks in the angle. The anteriormost landmark is the Schwalbe’s line. This is the edge of the Descemet’s membrane and can be identified by following the corneal parallelepiped to its end where all lines coincide (the epithelial, endothelial and iris lines of illumination) (Fig 5)

Schlemm’s canal is sometimes seen if blood has refluxed into it as a pinkish line in the middle third of the trab meshwork. This would be the middle third of the trab meshwork or the anteriormost part of the filtering part of trab meshwork. The trabecular meshwork itself has a granular appearance. Pigmentation can vary a lot in normal patients.

Posterior to this one may see a glistening white line – the scleral spur. This is often a broken line than a continuous one. Behind this would be the grayish ciliary body band. The width of this is very variable and needs to be compared to the contra lateral eye in suspected angle recession. Beyond this would be the root of the iris.

Grading
For grading I prefer an anatomical system of grading as developed at RP center by Dr Madanmohan. (Fig 6). This eliminates subjective assessment of the angle entry from interfering with the grading system. This note however about the angle recess should be mentioned as one’s judgment of “whether this patient has an occludable angle or not?” (i.e. is this patient prone for primary angle closure?)

Grading
- Anatomical Grading Preferred
  - Madanmohan’s Grading
    0 - No Dipping Of Beam (False Angle)
    1 - Schwalbe’s Line Seen
    2 - Anterior 1/3 Of Trab
    3 - Middle 1/3 Of Trab (Schlem’s)
    4 - Posterior 1/3 Of Trab (filtering part)
    5 - Scleral Spur
    6 - Ciliary Body Band

- Add note on occludability

Peeping into the angle recess
To see into the angle recess one can peep over the hill. This is done when the lens is jutting into the AC obscuring the angle recess. The goniolens is tilted towards the angle in question taking great care not to indent the angle open. (Fig 7).
A case

Now let me take you through gonioscopy of a particular patient (Fig 8). Top left picture is with the slit beam not hitting the pupil and the angle appears totally closed. The corneal parallelepiped has not joined up at Schwalbe’s line - grade 0. The beam is now widened and the pupil starts to constrict causing the angle to open up. Top right picture of the same angle shows up the Schwalbe’s line and with the beam length also increased the anterior trab meshwork is seen in the bottom left picture. The bottom right picture shows the angle to be fully open on indentation - Grade 6. Thus if we had not gone step by step we could go wrong here. If we had full illumination and a little pressure on the eye, then the angle would have been fully open and the patient labeled as POAG/NTG requiring life long therapy. When we go step by step it turns out to be an appositional PACG requiring a onetime peripheral iridotomy.

**Indentation. (How much can this angle potentially open up?)**

Indentation with a Sussman lens or Zeiss lens is straightforward pressure on the corneal apex (Fig 9). When the corneal apex is indented, the limbal ring gets stretched. The peripheral cornea is pushed outward and the iris root rotates backwards. The zonules are stretched pushing the lens (lens iris diaphragm) backwards. All these contribute to the angle opening up fully.

The same can be achieved with a Goldman lens. We need to ask the patient to look towards the mirror we are looking at. At the same time we resist this movement with the goniolens and thus use the edge of the lens to indent the angle open. (Fig 10).

This is less efficient when one uses a Goldmann lens than when one uses a Sussman or Zeiss lens. Therefore if there is a doubt confirm with one of these lenses.

The Goldmann 3 mirror lens is too big to do indentation gonioscopy. The lens does not allow one to tilt at all and even peeping into the recess is impossible. Furthermore the mirror angulation is different and hence one would call an angle more closed than it really is when using a three mirror lens. I would strongly advise all to maintain the three mirror lens as a retinal contact lens and invest in a dedicated goniolens for gonioscopy.
Once we have got grading out of the way we look for telltale signs of angle closure – peripheral synechiae, coarse pigment deposits etc. Any features of secondary glaucomas, developmental glaucomas are also noted. This entire information is put down in the case record for each quadrant. (Minimum grade and maximum grade of the angle opening, ocludability, secondary features)

**Synechiae** (Fig 11)
Peripheral anterior synechiae are adhesions between the iris and angle structures or peripheral cornea.

Synechia of an appositional closure tend to be a smooth anterior edged bump with some areas more open on indentation than others. i.e. synechiae have varying height.

Where as for creeping angle closure the synechia seems to have a uniform height and again has a regular anterior edge.

Inflammation leads to patchy synechia. These have an irregular anterior edge. Often they are point synechiae that look triangular (teepees – as they are called in comparison to the red Indian tents). Inflammatory synechiae are more often in the inferior angle whereas angle closure synechiae are more often in the superior angle.

These need to be differentiated from iris processes that are strands of iris and not full thickness areas of iris plastered on to the angle.

**Plateau Iris** (Fig 12)
The peripheral iris seems to drop off as in a plateau. The central parts of AC are deeper than one expects from the look of the angle. On indentation one can see the sine wave sign. The iris goes back the up over the ciliary processes and back again before coming up along the convexity of the lens.

**Pigmentation** (Fig 13)
Pigmentation of the trabecular meshwork varies a lot in normals. But it assumes significance in the presence of pseudoexfoliation on the lens surface and features of pigment dispersion syndrome such as Kruckenbergs. Dense pigmentation of the posterior trabeculum tends to be significant compared to uniform pigmentation of trabeculum. Coarse clumps of pigment in an ocludable angle may suggest previous apposition even in the absence of synechiae.

**Angle recession** (Fig 14)
Always compare width of ciliary body band between the 2 eyes. Look for additional features of trauma. Here the ciliary body band is widened. The width often varies a lot in different parts of the same eye in recession. One may note torn iris processes when present. (one half on iris and the other on trab). There may be old blood in form of hemosiderin balls (black in Colour not brown – that would be iris pigment).

**Cyclodialysis** (Fig 15)
Invariably here there is recession in the angle. One sees sclera through a cleft like opening. This opening widens and narrows when one presses with goniolens slightly (on indentation). An associated feature would be low IOP.

**Neovascularisation** (Fig 16a and Fig 16b)
New vessels in the angle may precede new vessels on the iris in neovascular glaucoma. These vessels arise from the iris root and brach in an arborising pattern onto the trabecular meshwork surface. These later contract and cause pulled up synechiae with vascular anterior edges.

**Axenfeld anomaly** (Fig 17)
There is ridge like posterior embryotoxon. Iris strands attach to this as bridging synechia (with a gap behind).

**Iridocorneal Endothelial syndromes** (Fig 18)
There is some corneal edema in all 3 forms of ICE. The synechia are broad and have a pulled up appearance due to the contracting membrane.

**Post Trauma progressive inferior corneal edema** (Fig 19)
This is often due to a retained foreign body in the anterior chamber angle.

**References:**