

ANATOMY OF THE ANGLE OF THE ANTERIOR CHAMBER

THESIS

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By

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C O N T E N T S

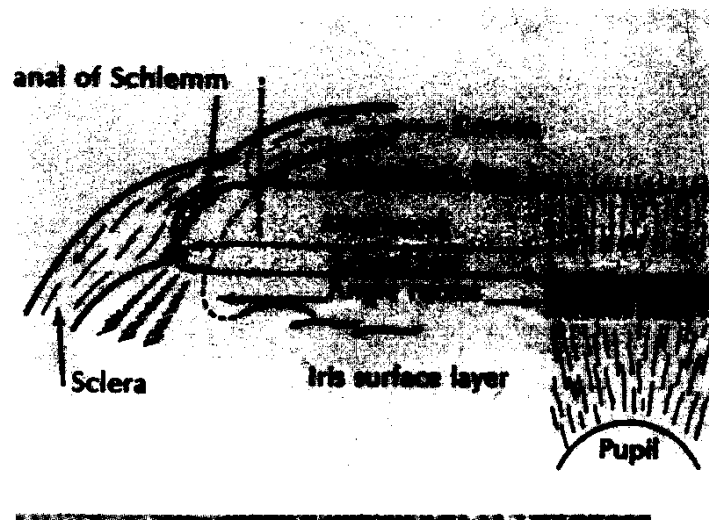
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INTRODUCTION

The angle of the anterior chamber of HYENA is an extremely important region from the point of view both of physiology and pathology, for it is here that the intra ocular fluid finds its most ready exit from the eye, and here its drainage tends to be impeded in primary glaucoma. For this reason it is frequently called the filtration angle. Moreover, it is important surgically, for the limbus forms the usual site of entry in intraocular operations. In this connection one point in topography is important; the root of the iris lies opposite a point about 1.5mm. behind the corneoscleral margin. Lagrange (1920) gave the following figures: 1.7mm. at the top, and 1.45 mm. at the bottom of the vertical meridian, and 1.0 mm. at either extremity of the horizontal meridian. The depth of the filtration angle is influenced by several factors notably the age, the state of refraction, the size of the pupil and accommodation. We know that the crystalline lens continues to grow throughout life and although there is a compensatory mechanism, its antero posterior diameter increases from 3.6 mm. at 12 years to 4.0 mm. at 25 years, to 4.5 mm. at 60 years to 5.0 mm. at 80 years. With the advance of age therefore the anterior chamber becomes

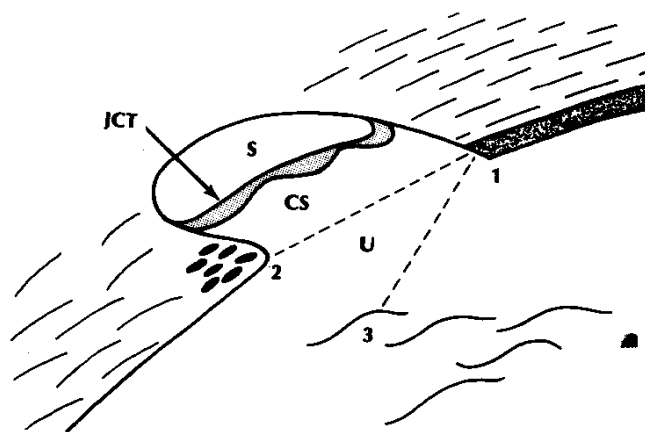
shallower and this reflects on the angle. As to refraction, gonioscopic observations indicate that in hypermetropic eyes the root of the iris appears to be inserted farther forwards on the ciliary body than in myopic eyes, with the result that the angle is shallower in hypermetropia than in myopia. Dilatation of the pupil and accommodation tend to decrease the angle depth, the former by increasing the thickness of the iris and folding it at its root and the latter by displacing the iris forwards. Both factors can produce a significant change if the angle is already relatively shallow.



Schematic drawing to illustrate histologic land marks in drainage angle (left) and comparable zones that may be seen from anterior chamber side by gonioscopy (Right).
 (Bens. Fine and Yanoff, 1972: Ocular histology).

GROSS STRUCTURE

In the normal eye, the angle of the anterior chamber is shaped more like a circumferential outpocketing which lies just behind the corneo-scleral junction, and the sclera which bounds it anteriorly is slightly hollowed out by an annular furrow, the scleral groove, which is largely filled by loose reticular tissue known as the trabecular meshwork. This loosely arranged network of fine connective tissue separates the angle of anterior chamber from the sinus venous sclerae (canal of schlemm) which runs completely round the eye near the angle in an annular manner. The posterior wall of the angle is formed by the peripheral zone of the iris, while its anterior wall is represented by the trabecular meshwork which extends from the line of schwalbe anteriorly to the scleral spur posteriorly. The line of Schwalbe is a white line which is formed by a fusion of the trabecular meshwork and abuts against the peripheral edge of descemet's membrane. It is in away the peripheral termination of descemet's membrane. The scleral spur is seen as another white line more deeply situated to which is anchored the ciliary body. The trabecular band is 0.5 mm wide. The canal of Schlemm is about 0.2mm wide and is situated deep to the posterior half of the trabecular band. The inner or uveal portion of the trabecular meshwork is colourless in the young person, but becomes pigmented with age. It is loosely



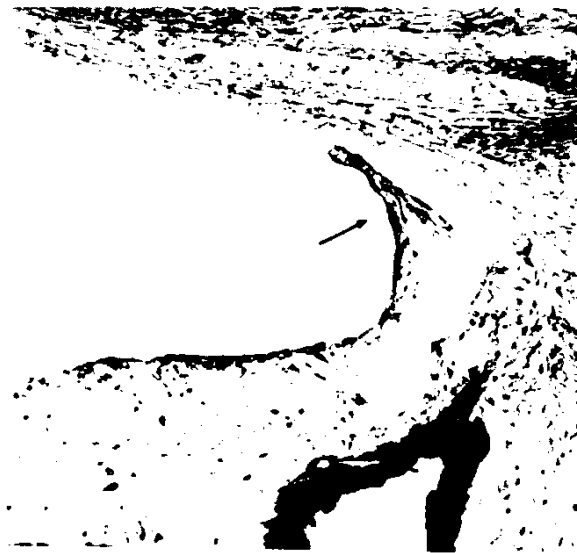
Schematic drawing of drainage angle.

1. end of Descemet's membrane.
2. Tip of scleral roll
3. End of anterior border layer of iris.

C_s : corneoscleral meshwork. JCT; juxta canalicular connective tissue layer, S : canal of Schlemm, U: uveal meshwork
 Fine BS: Trans. Am. Acad. Ophthalmol. Otolaryngol 70:777,1966).

structured and variable in development. It is of no importance except that in some cases its pigment covered fibres may be mistaken for peripheral synechiae. The outer or corneo-scleral portion of the meshwork is also colourless in the young, but becomes greyish in the adult and brownish in the old, especially in the presence of capsular exfoliation when it may appear almost black. The pigmentation is most pronounced in the posterior half of the trabecular band which corresponds in location to the canal of Schlemm. Beyond the scleral spur is the recess of the angle. It is variable in extent, both as to width and depth. In the myopic eye it tends to be wider than in the hyperopic eye. The recess is bounded peripherally by the anterior surface of the ciliary body, and is usually traversed by fine fibrillar iris processes which extend from the iris behind to the scleral spur in front. These structures are probably related to the pectinate ligament seen in the eyes of certain animals where they are better developed and appear as distinct bands bridging the angle.

In general configuration, the angle in the eye of an adult is marked by its roundness. In an infant, it is rather acute, the iris inserting in a more or less horizontal plane and the inner surface of the meshwork describing an almost straight line from the ring of Schwalbe to the base of the ciliary body.



Iris process (arrow) is a sporadic continuation of anterior border layer. beyond iris root, processes are most easily appreciated when pigmented as here. (Fine BS: Invest Ophthalmol., X 110).

GONIOSCOPIC APPEARANCE

The structures which may be made out with the gonioscope are from behind foreward:

1. The last ridge or roll of the iris root.
2. A portion of the anterior surface of the ciliary body which is responsible for the ciliary band forms a concave recess or sinus. It looks like the iris but is much darker (Troncoso 1947).
3. The iris processes which are the remains of the faetal or true ligamentum pectinatum, bridgeover the angle and are usually visible as thin yellowish semitransparent lines which run vertically from the edge of the iris upwards to disappear in the line formed by the scleral trabeculae (Troncoso 1947). These iris processes vary in number and so the extent of the angle hidden varies.
4. The trabecular meshwork with the scleral spur behind, schwalbe's ring infront, and the scleral venous sinus externally. It forms a band which in young persons is bluish or grey, but in older people is yellowish, possibly with pigment deposits. Behind it the scleral spur forms a narrow whitish line (The posterior annular line) while anterior to it Schwalbe's ring also forms a whitish line which may or may not project (the anterior annular line).
5. The posterior aspect of the cornea which is covered by a single layer of flattened epithelial like cells,

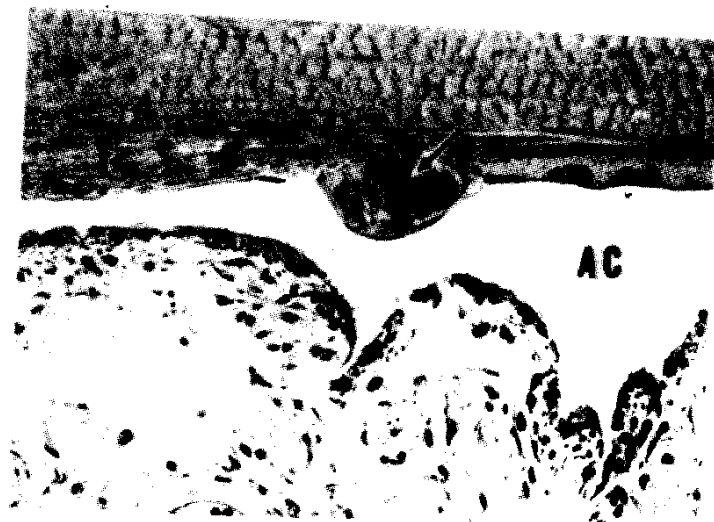
continuous round the angle of the anterior chamber with any remnants of the foetal endothelium which may have persisted on the front of the iris.

When the examiner views the angle with a narrow slit, a V of light that heightens the appreciation of the depth of the angle will be seen. One leg of the V outlines the corneal side of the angle, while the other leg lights the surface of the iris. The two beams come together in the angle recess. As the examiner views the corneal beam, the most anterior structure that can be identified is Schwalbe's line, which is sometimes inconspicuous and all that is noted is a slight deviation in the light beam due to a change in the radius of curvature. Immediately posterior to Schwalbe's line is the trabecular meshwork which usually has a whitish colour. But if blood refluxes into Schlemm's canal a pinkish line is seen deep to this portion of the meshwork.

As seen gonioscopically, the angle varies in width. A wide angle is one in which the entire ciliary body recess is visible. It occurs in about 40% of eyes. An intermediate angle is one in which at least part of the recess is visible and is found in 50% of eyes. The remaining 10% of eyes have a narrow angle in which practically no part of the recess is visible; only Schwalbe's line and perhaps the top of the non pigmented trabeculum

can be seen. A slit angle is one in which the observer is unable to see frank contact between the cornea and the iris but is also unable to identify clearly any angle structure. A completely closed angle is that where contact is noted between the iris and the cornea.

Gonioscopically the trabecular zone is readily seen. By direct view in the non transparent tissue of the limbus the trabeculum appears as a golden glow in the region of the angle of the anterior chamber. It is normally grey-white showing numerous minute cavities corresponding to the interstices of the meshwork (Busacca, 1945). It is frequently pigmented particularly in its posterior part corresponding to the site of Schlemm's canal, the pigment being partly endogenous due to uveal pigment found in the uveal portion of the trabeculae and most abundant in darkly pigmented eyes, and partly exogenous comprised of granules trapped in the meshwork from the aqueous humour as it filters through, most common and profuse in the aged and in pathological eyes. Anteriorly the band is sharply limited by the anterior border ring of Schwalbe, readily identifiable as a glistening white line of variable prominence, often appearing to bulge into the anterior chamber. On the corneal side of this band, Vrabec (1957) described an additional zone visible gonioscopically which marks the region wherein the corneal endothelial cells elongate in a meridional direction. Posteriorly the trabecular zone is bounded by



Termination of Descemet's membrane may occur as thickened band (Schwalbe's anterior border ring) which appears as a large nodule (arrow). AC, ant. ch., T., Trabecular meshwork. Anterior border layer of iris and adjacent stroma lie in lower half of figure (Epon meridional section, PD, X 130).