

# **Role of Anterior Chamber Angle Assessment Techniques in Diagnosis of Angle - Closure Glaucoma**

**Essay**

**Submitted by**

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**(M.B., B.CH.)**

**In Partial Fulfillment of Master Degree in Ophthalmology**

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**2010**

# **Abstract**

Angle-closure glaucoma is a leading cause of irreversible blindness. Diagnosis and treatment are strongly related to angle assessment techniques

## **Gonioscopy:**

Gonioscopy is the current reference standard for assessing ACA structures and configuration. It requires a subjective assessment by an observer placing a contact lens on the eye of the patient. Definitions of angle findings vary across grading schemes. Gonioscopy is prone to potential measurement errors including artificially opening the angle or closing the angle due to how the lens is placed on the eye. (Friedman & Mingguang , 2008)

## **Key Words:**

**Outflow Apparatus Anatomy, Anterior chamber angle assessment techniques, Comparative studies of different techniques of angle assessment**

# Acknowledgement

I would like to express my real and deepest gratitude, respect and appreciation to **Professor Dr. Mostafa Mostafa Bahgat, Professor of Ophthalmology, Cairo University**, for his valuable advices, continuous support, scientific additions and sincere help throughout the work.

My profound thanks and deep gratitude to **Professor Dr. Amr Abd EL- latif Osman, Assistant Professor of Ophthalmology, Cairo University**, for his fruitful assistance and valuable suggestions.

My deepest gratitude to **Dr. Amanne Feisal Esmael Lecturer of Ophthalmology, Cairo University**, for her fruitful advices and support.

Special thanks to all my **Professors, colleagues and staff members in the Ophthalmology Department, Faculty of medicine, Cairo University**, for their encouragement and help.

*Moataz Hamed*

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## **List of abbreviations**

<b>ACA</b>	anterior chamber angle.
<b>ACD</b>	Anterior chamber depth.
<b>ACG</b>	Angle-closure glaucoma.
<b>ACV</b>	Anterior chamber volume.
<b>AOD</b>	Angle opening distance.
<b>ARA</b>	Angle recess area.
<b>AS-OCT</b>	Anterior segment optical coherence tomography.
<b>ATA</b>	Angle-to-angle distance.
<b>CB</b>	Ciliary body.
<b>CBT</b>	Ciliary body thickness.
<b>CCD</b>	Charge coupled device.
<b>CCT</b>	Central corneal thickness.
<b>CRC</b>	Radius of corneal curvature.
<b>CT</b>	Corneal thickness.
<b>HOCT</b>	High-resolution optical coherence tomography.
<b>IAS</b>	Iridocorneal angle size.
<b>ICPD</b>	Iris–ciliary process distance.
<b>ILA</b>	Iris– lens angle.
<b>ILCD</b>	Iris– lens contact distance.
<b>IOLs</b>	Intraocular lenses.
<b>IZD</b>	Iris–zonule distance.
<b>LACD</b>	Limbal Anterior Chamber Depth Measurement.
<b>LOCT</b>	Low-resolution optical coherence tomography.
<b>LPI</b>	Laser peripheral iridotomy.
<b>PACD</b>	Peripheral anterior chamber deph.
<b>PACG</b>	Primary angle closure glaucoma.
<b>PAS</b>	Peripheral anterior synechia.
<b>PCT</b>	Peripheral corneal thickness.
<b>PIC</b>	Plateau iris configuration.
<b>RPB</b>	Relative pupillary block.
<b>SLD</b>	Superluminescent diode.
<b>SL-OCT</b>	Slitlamp optical coherence tomography.
<b>SPAC</b>	Scanning Peripheral Anterior Chamber Depth Analysis.

<b>TCPD</b>	Trabecular–ciliary process distance.
<b>TIA</b>	Trabecular– iris angle.
<b>TICL</b>	Trabeculo-iris contact length.
<b>TISA</b>	Trabeculo-iris space area.
<b>UBM</b>	Ultrasound biomicroscopy.

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## **Introduction**

Angle-closure glaucoma (ACG) is a leading cause of irreversible blindness. Diagnosis and treatment are closely related to angle assessment techniques. Different approaches have been developed to aid in the assessment of the anterior chamber angle (ACA). Those approaches include:

1. Clinical techniques:
  - a. Gonioscopy.
  - b. Limbal Anterior Chamber Depth Measurement (LACD), (van Herick Technique).
2. Ultrasound biomicroscopy (UBM).
3. Anterior segment optical coherence tomography (AS-OCT).
4. Pentacam and other devices using Scheimpflug photography.
5. Scanning Peripheral Anterior Chamber Depth Analysis (SPAC)

**Gonioscopy:** is the current reference standard for evaluation of the anterior chamber angle. It has substantial inter-observer variability and relies on subjective assessment of ACA findings.

**Limbal Anterior Chamber Depth Measurement (LACD) (van Herick Technique):** is a quick, easy test that can identify the persons with gonioscopically closed anterior chamber angles and can be used in screening. (Friedman & Mingguang, 2008).

**Ultrasound Biomicroscopy (UBM):** offers tremendous insight into the anterior chamber angle configuration and allows for detailed imaging of the ciliary body and the posterior chamber. Pathophysiologic changes involving anterior segment architecture can be evaluated qualitatively and quantitatively. **(Ishikawa & Schuman, 2004)**

**Anterior Segment Optical Coherence Tomography (AS-OCT):** is an alternative cross-sectional imaging modality that has several advantages over other techniques used for objective assessment of the AC angle. It has a higher image resolution than UBM, is totally noncontact, and is easily performed with minimal expertise. **(Radhakrishnan et al., 2005)**

**Pentacam:** and other device using the rotating Scheimpflug principle can be used in grading of angle width. Although this technique offers a non-contact approach to angle assessment (which is highly appealing for screening purposes), it does not allow detailed visualization of angle structures, compared to UBM. **(Konstantopoulos et al., 2007)**

**Scanning Peripheral Anterior Chamber Depth Analysis (SPAC):** is a new, non-contact, optical alternative method of ACA assessment. The SPAC does not image the angle directly, and therefore does not give detailed information on angle anatomy. **(Friedman and Mingguang, 2008 and Lavanya et al., 2008)**

## **Aim of work**

This is a review of techniques for assessment of the ACA and their role in diagnosis of angle closure glaucoma. Each technique will be discussed along with its currently used parameters. An assessment of the strengths and limitations of each approach will also be provided. Finally, comparisons of findings using the various techniques will be detailed.

## **Outflow Apparatus Anatomy**

### **1- Internal scleral sulcus**

#### **The Sulcus:**

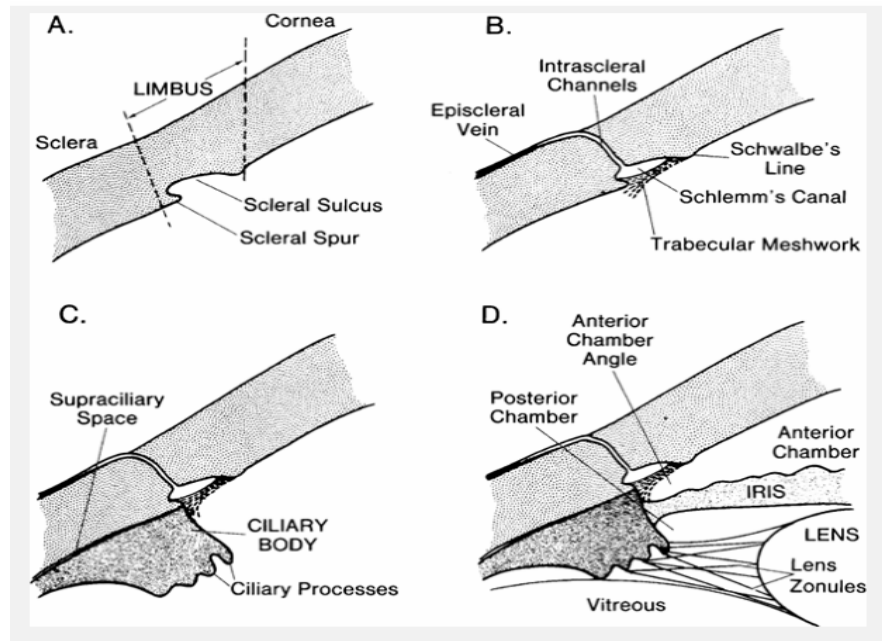
The sulcus is a circular groove on the inner aspect of the corneoscleral limbus, extending from the termination of Descemet's membrane anteriorly (demarcated by Schwalbe's ring) to the scleral spur posteriorly. The sulcus completely accommodates the canal of Schlemm externally, and the corneoscleral portion of the trabecular meshwork internally **Figure ( 1 ).** (Snell and Lemp, 1998)

#### **Schwalbe's ring:**

Schwalbe's ring is the anterior border ring of the trabecular region. The ring marks the transition between the corneal endothelium and the trabecular cells and also the termination of Descemet's membrane. (Shields et al., 2005)

#### **Scleral spur:**

The scleral spur is a wedge-shaped circular ridge which marks the deep aspect of the sclerolimbic junction. It receives the insertion of the anterior tendons of the longitudinal ciliary muscle on its inner aspect. Its anteromedial base forms the posterior margin of the scleral sulcus and receives the posterior attachment of the corneoscleral meshwork. Contraction of the ciliary muscle pulls the spur posteriorly and opens up the trabecular spaces. (Bron et al., 1997)



**Figure ( 1 ):** Stepwise construction of a schematic model, depicting the relationship of structures involved in aqueous humor dynamics. A: Limbus. B: Main route of aqueous humor outflow (conventional or trabecular outflow). C: Ciliary body (site of aqueous humor production and other outflow route of the unconventional or uveoscleral outflow). D: Iris and lens. **(Shields et al., 2005)**

## 2- Trabecular meshwork: Figure ( 2 )

The trabecular meshwork is a sponge work of connective tissue beams which are arranged as superimposed perforated sheets. The beams are arranged circularly in the chamber angle and extend from Schwalbe's ring anteriorly to the scleral spur and junction of iris and ciliary body posteriorly. The inner portion of the trabecular meshwork is referred to as the uveal meshwork and the outer portion, connected to the spur and closer to Schlemm's canal, is the corneoscleral meshwork. The spaces of the trabecular meshwork decrease in size progressively from within outwards. **(Bron et al., 1997).**