



COMPARATIVE EVALUATION OF ANTERIOR CHAMBER ANGLE BY GONIOSCOPY AND ANTERIOR SEGMENT ATTACHMENT OPTICAL COHERENCE TOMOGRAPHY IN INDIVIDUALS WITH NARROW ANGLES

Dr. Yernena Mytrei^{1*}, Dr. Vudaya Narayana Sai Lakshmi Rambha², Dr. Adapa Sri Khyathi³, Dr. Kandula Satish⁴

^{1*}Senior Resident, Department of Ophthalmology, NRI Institute of Medical Sciences, Sanghivalasa, Bheemunipatnam, Visakhapatnam, Andhra Pradesh, India.

²Assistant Professor, Department of Ophthalmology, GSL Medical College and General Hospital, Rajahmundry, Andhra Pradesh, India.

³Consultant Ophthalmologist, Dr. Agarwals Eye Hospital, Madeenaguda, Hyderabad, Telangana, India.

⁴Professor & HOD, Department of Ophthalmology, GSL Medical College and General Hospital, Rajahmundry.

Corresponding Author: Dr. Yernena Mytrei,
Senior Resident, Department of Ophthalmology, NRI Institute of Medical Sciences, Sanghivalasa, Bheemunipatnam, Visakhapatnam, Andhra Pradesh, India.

ABSTRACT

Background: Accurate assessment of the ACA (Anterior Chamber Angle) is essential for the diagnosis and management of primary angle-closure disease. Gonioscopy remains the gold standard for angle evaluation but is examiner-dependent and invasive. AS-OCT (Anterior Segment Optical Coherence Tomography), using an anterior segment attachment to a conventional posterior segment OCT, offers a non-contact alternative. This study aimed to compare the diagnostic performance of gonioscopy and AS-att-OCT in assessing narrow anterior chamber angles.

Methods: A hospital-based cross-sectional study was conducted at a tertiary care teaching hospital between November 2019 and June 2021. A total of 160 patients with narrow angles identified by Van Herick grade ≤ 2 was enrolled. All participants underwent detailed ophthalmic examination, including visual acuity assessment, intraocular pressure measurement, Van Herick grading, gonioscopy using a Goldmann three-mirror gonioscope, and evaluation with an anterior segment attachment OCT (Carl Zeiss Primus 200). Angle status was assessed in all quadrants, and agreement between the methods was analyzed using kappa statistics.

Results: The study population ranged from 26 to 66 years with a mean age of 46.2 ± 10.15 years; 55.6% were males. Blurring of vision, eye ache, and redness were common presenting complaints. Elevated intraocular pressure (>21 mmHg) was observed in 9.38% of patients. Hypermetropia was present in 43.1% of subjects and showed the highest prevalence of angle closure. Gonioscopy detected angle closure in 87.5% of eyes with Van Herick grade 1, while AS-ATT-OCT detected closure in 78.7%. The superior quadrant showed the highest proportion of closed angles (86.25%). Agreement between gonioscopy and AS-ATT-OCT for detecting angle closure was good ($\kappa = 0.68$), whereas agreement of either modality with Van Herick grading was only fair to poor.

Conclusion: Anterior segment attachment OCT demonstrated good agreement with gonioscopy in detecting narrow and closed anterior chamber angles. As a rapid, non-contact, and objective technique, AS-ATT-OCT can serve as a valuable adjunct for anterior chamber angle assessment, particularly in settings where gonioscopy expertise is limited.

Keywords: Anterior Chamber Angle, Gonioscopy, Optical Coherence Tomography, AS-Att-OCT, Narrow Angles, Primary Angle Closure Disease, Van Herick Grading.

INTRODUCTION



www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 02-04-2026
Date Acceptance: 30-05-2026
Date of Publication: 05-06-2026

<https://doi.org/10.65605/a-jmrhs.2026.v04.i02.pp693-698>

Primary angle-closure disease comprises a spectrum of disorders characterized by narrowing or closure of the anterior chamber angle due to forward displacement of the peripheral iris, resulting in obstruction of the trabecular meshwork and subsequent elevation of intraocular pressure. Anatomical factors predisposing individuals to

angle closure include a short axial length, smaller corneal diameter, shallow anterior chamber, and relatively anterior positioning of the lens–iris diaphragm.^[1] PACD (Primary Angle-Closure Disease) is generally a bilateral condition and is classified by the International Society of Geographical Ophthalmology into PACS (Primary Angle Closure Suspect), PAC (Primary Angle Closure), and PACG (Primary Angle Closure Glaucoma). The accurate assessment of the anterior chamber angle is therefore fundamental for the diagnosis, classification, and management of patients at risk of angle-closure glaucoma.^[2-5]

Several techniques are available for evaluating the anatomy and configuration of the anterior chamber angle.^[6,7] Among these, the Van Herrick method is a rapid slit-lamp–based screening technique that estimates peripheral anterior chamber depth by comparing it with adjacent corneal thickness. Owing to its simplicity and ease of application, it is routinely employed in clinical practice; however, the method remains subjective and may vary between observers.^[2,8-10]

Gonioscopy is considered the gold standard for anterior chamber angle assessment. It enables direct visualization of angle structures and anatomical landmarks using a gonio lens under controlled illumination.^[2,8] Despite its diagnostic accuracy, gonioscopy is a contact procedure that requires considerable expertise and is subject to inter-observer variability.

AS-OCT has emerged as a non-contact imaging modality capable of providing high-resolution cross-sectional images of anterior segment structures. It offers rapid image acquisition and objective evaluation of the angle, making it an attractive alternative to conventional techniques.^[5] AS-OCT can also be performed using an anterior segment attachment mounted on a standard posterior segment OCT device.^[11,12]

As posterior segment OCT has become an essential instrument for retinal and glaucoma evaluation, the availability of anterior segment attachments allows additional assessment of the anterior chamber angle without requiring dedicated AS-OCT equipment.^[13]

Aims and Objectives

The present study was undertaken to evaluate the diagnostic utility of anterior segment attachment optical coherence tomography (AS-ATT-OCT) in the assessment of narrow anterior chamber angles and to compare its findings with gonioscopy, the current gold standard. Specifically, the study aimed to assess anterior chamber depth and corneal thickness using the Van Herrick method, evaluate the anterior chamber angle using gonioscopy and AS-ATT-OCT, and determine the level of agreement between these techniques in detecting narrow anterior chamber angles.

MATERIALS AND METHODS

Study Design

This hospital-based comparative cross-sectional study was conducted at a tertiary care teaching hospital affiliated with Dr. NTR University of Health Sciences (Dr. NTRUHS) to evaluate and compare the assessment of anterior chamber angles using anterior segment attachment optical coherence tomography (AS-ATT-OCT) and gonioscopy in individuals with narrow angles. The study was carried out between November 2019 and June 2021 after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrolment after explaining the study procedures and potential risks.

Inclusion and Exclusion Criteria

The study included patients attending the Ophthalmology Outpatient Department with complaints of headache, eye ache, or blurring of vision during the study period, who had phakic eyes, demonstrated similar anterior chamber angle configurations in both eyes on gonioscopy and AS-OCT, and provided written informed consent for participation. Patients with a history of previous intraocular surgery, penetrating ocular injury, corneal disorders, plateau iris configuration, or peripheral anterior synechiae were excluded from the study.

Sample Size

A total of 160 patients were included in this study from the Department of Ophthalmology of a tertiary care teaching hospital affiliated with Dr. NTR UHS, considering the inclusion and exclusion criteria as elaborated above.

Data Collection Procedure

All eligible participants underwent a comprehensive ophthalmic evaluation, including uncorrected and best-corrected visual acuity assessment, refraction, intraocular pressure measurement using Goldmann applanation tonometry, and detailed anterior segment examination. Peripheral anterior chamber depth was initially assessed using the Van Herrick method, and patients with grade 1 or grade 2 narrow angles were included for further evaluation. These subjects subsequently underwent gonioscopy using a Goldmann three-mirror gonioscope and anterior segment attachment optical coherence tomography (AS-ATT-OCT; Carl Zeiss Primus 200, 832 nm) for anterior chamber angle assessment. Fundus examination was performed using a 90D lens. Angle grading was recorded for all quadrants, and findings from eyes with similar bilateral configurations were analyzed using the right eye data. Intraocular pressure values were averaged when the inter-eye difference was ≤ 3 mmHg, and angle assessments obtained by gonioscopy and AS-ATT-OCT were compared for analysis.

RESULTS

Variable	Category	N	%
Age	≤30 years	6	3.75
	31–40 years	49	30.6
	41–50 years	45	28.1
	51–60 years	47	29.4
	>60 years	13	8.1
Sex	Male	89	55.6
	Female	71	44.4
Mean age: 46.2 ± 10.15 years			
Table 1. Demographic Characteristics of the Study Population (N=160)			

Table 1 illustrates the demographic profile of the study population. Most participants belonged to the 31–60-year age group, accounting for nearly 88% of

the sample. Males slightly predominated over females.

Variable	N	%
Blurring of vision, eye ache and redness	64	40.0
Other symptoms	96	60.0
IOP ≤21 mmHg	145	90.62
IOP >21 mmHg	15	9.38
Table 2. Presenting Complaints and Intraocular Pressure		

Table 2 highlights the clinical presentation of patients. Approximately two-fifths presented with the classic symptoms of angle closure, while

elevated intraocular pressure was observed in less than one-tenth of subjects.

Refractive Status	Total (N)	Gonioscopy Closed N (%)	As-Att-Oct Closed N (%)
Hypermetropia	69	69 (100)	64 (92.8)
Emmetropia	64	60 (93.8)	52 (81.3)
Myopia	27	11 (40.7)	18 (66.7)
Table 3. Refractive Status and Detection of Angle Closure			

Table 3 demonstrates the relationship between refractive error and angle closure. Hypermetropic eyes showed the highest prevalence of angle closure

by both techniques, whereas myopic eyes demonstrated the lowest prevalence.

Van Herrick Grade	N (%)	Gonioscopy Closed N (%)	As-Att-Oct Closed N (%)
Grade 1	90 (56.3)	79 (87.5)	71 (78.7)
Grade 2	70 (43.7)	61 (87.1)	63 (90.0)
Table 4. Van Herrick Grading and Angle Closure Detection			

Table 4 shows the distribution of van Herrick grades and their association with angle closure. Grade 1 eyes demonstrated a very high prevalence of closure

on gonioscopy and AS-ATT-OCT, confirming the usefulness of van Herrick grading as a screening tool.

Quadrant	Closed N	% Closed
Superior	138	86.25
Inferior	123	76.8
Nasal	91	56.8
Temporal	28	17.5
Table 5. Gonioscopic Distribution of Closed Angles by Quadrant		

Table 5 highlights gonioscopic findings across quadrants. The superior quadrant exhibited the highest frequency of angle closure, followed by the

inferior quadrant, indicating a vertical predominance of angle narrowing.

Quadrant	Closed N	% Closed
Superior	123	76.8
Inferior	92	57.5
Nasal	103	64.4
Temporal	27	16.9

Table 6. AS-ATT-OCT Distribution of Closed Angles by Quadrant

Table 6 presents AS-ATT-OCT findings. Similar to gonioscopy, the superior quadrant showed the greatest proportion of angle closure. However, AS-

ATT-OCT detected relatively more nasal quadrant closures.

Quadrant	Gonioscopy Closed (%)	AS-ATT-OCT Closed (%)	P-Value
Superior	86.25	76.8	0.03
Inferior	76.8	57.5	0.0002
Nasal	56.8	64.4	0.169
Temporal	17.5	16.9	0.88

Table 7. Comparison between Gonioscopy and AS-ATT-OCT

Table 7 compares angle closure detection between gonioscopy and AS-ATT-OCT. Significant differences were observed in the superior and

inferior quadrants, whereas nasal and temporal quadrant findings were comparable between the two methods.

Comparison	Kappa Value	95% CI	Interpretation
Van Herrick vs Gonioscopy	0.22	0.06–0.38	Fair
Van Herrick vs AS-ATT-OCT	0.17	0.01–0.33	Poor
Gonioscopy vs AS-ATT-OCT	0.68	0.52–0.84	Good

Table 8. Agreement between Diagnostic Methods for Angle Closure Detection

Table 8 summarizes the agreement between the diagnostic modalities. Gonioscopy and AS-ATT-OCT demonstrated good agreement, whereas van Herrick grading showed only fair-to-poor agreement with the other techniques, reinforcing its role as a screening rather than diagnostic tool.

DISCUSSION

The present study evaluated the accuracy of anterior chamber angle assessment using gonioscopy and anterior segment attachment optical coherence tomography (AS-ATT--ATT-OCT) in individuals with narrow angles. The study population predominantly belonged to the middle-aged group, with a mean age of 46.2 ± 10.15 years. This finding is consistent with previous reports indicating that primary angle-closure disease is more common in middle-aged and elderly individuals. Sihota et al. reported that primary angle-closure glaucoma constitutes a substantial proportion of adult glaucoma cases in India, particularly among individuals above 40 years of age.^[1,14] Similarly, Rigi et al. reported a comparable mean age among patients evaluated for angle assessment using gonioscopy and AS-OCT.^[15]

A slight male predominance was observed in the present study, although the distribution between sexes was relatively balanced. Similar gender distributions have been reported by Tay et al.^[16] and Park et al.^[2] Although epidemiological studies

suggest a higher risk of angle closure among females, the present findings may be influenced by the study sample size and selection criteria.^[17,18]

Hypermetropia was the most common refractive error observed among participants and demonstrated the highest proportion of angle closure by both gonioscopy and AS-ATT--ATT-OCT. These findings support the established association between hypermetropia, shallow anterior chamber depth, and angle-closure disease.^[19] Similar observations have been reported by Loh et al.^[19] and Shen et al.^[20] who demonstrated a strong relationship between hyperopia and primary angle-closure glaucoma. Nevertheless, a small proportion of myopic eyes also demonstrated angle closure, indicating that myopia does not completely eliminate the risk of angle-closure disease.^[19,21]

Van Herrick grading identified a large proportion of eyes with narrow angles, confirming its value as a screening technique. However, gonioscopy detected a greater number of closed angles than the Van Herrick assessment, emphasizing the limitations of slit-lamp estimation of peripheral anterior chamber depth. Previous studies have similarly reported that while van Herrick grading is useful for screening, it cannot replace definitive angle evaluation by gonioscopy.^[22-24] The agreement between van Herrick grading and gonioscopy in the present study was only fair, while agreement with AS-ATT--ATT-

OCT was poor, findings comparable to those reported by Park et al.^[2]

Gonioscopy demonstrated that angle closure occurred most frequently in the superior quadrant, followed by the inferior quadrant. Similar observations have been reported by Lan et al., who found that gonioscopic grade 0 angles and iridotrabecular contact were significantly more common in the superior quadrant. The predominance of superior quadrant closure reflects the natural anatomical tendency for superior angles to narrow earlier than other quadrants in primary angle-closure disease.^[25]

AS-ATT--ATT-OCT showed a similar pattern of quadrant involvement, with the highest frequency of closure in the superior quadrant. The distribution of closed quadrants detected by AS-ATT--ATT-OCT closely paralleled gonioscopic findings, although differences were observed in individual quadrants. Gonioscopy identified a greater proportion of closed quadrants overall, a finding that agrees with previous studies comparing OCT-based imaging with gonioscopy.^[5,14]

Comparison of gonioscopy and AS-ATT--ATT-OCT demonstrated good overall agreement in detecting angle closure, with a kappa value of 0.68. Agreement was strongest in the superior quadrant and progressively lower in the inferior, nasal, and temporal quadrants. Similar trends have been reported by Sakata et al.^[8] and Tun et al.^[5] who found the highest agreement in superior quadrants and relatively lower agreement in horizontal quadrants. The reduced agreement in nasal and temporal quadrants may be related to differences in anatomical landmarks used by the two techniques and challenges in identifying scleral spur location on OCT images.^[5,8]

The overall findings suggest that AS-ATT--ATT-OCT provides a reliable, non-contact, and objective method for anterior chamber angle evaluation. The technique demonstrated good agreement with gonioscopy and offers practical advantages such as ease of image acquisition, reproducibility, and reduced observer dependence.^[5,14] Nevertheless, gonioscopy remains the gold standard because it permits direct visualization of angle structures and dynamic assessment of the anterior chamber angle.^[14]

AS-ATT--ATT-OCT should be considered a valuable adjunctive tool and a potential screening modality for angle-closure disease, particularly in settings where rapid, non-contact evaluation is desirable. However, confirmation by gonioscopy remains essential for definitive diagnosis and management decisions.

CONCLUSION

This hospital-based cross-sectional study demonstrated that AS-ATT--ATT-OCT shows good

agreement with gonioscopy in the assessment of narrow anterior chamber angles. Angle closure was more commonly observed among middle-aged individuals and hypermetropic eyes, with the superior quadrant being the most frequently involved. While Van Herick grading proved useful as a screening method, its agreement with gonioscopy and AS-ATT--ATT-OCT was limited. Gonioscopy remained the gold standard for angle assessment; however, AS-ATT--ATT-OCT provided a reliable, non-contact, and objective alternative with good overall agreement ($\kappa=0.68$) for detecting angle closure. Therefore, AS-ATT--ATT-OCT can serve as a valuable adjunct and potential screening tool for the evaluation of narrow angles and angle-closure disease in clinical practice.

REFERENCES

1. Sihota R. An Indian perspective on primary angle closure and glaucoma. *Indian J Ophthalmol* 2011;59 Suppl(Suppl 1):S76-81.
2. Park SB, Sung KR, Kang SY, et al. Assessment of narrow angles by gonioscopy, Van Herick method and anterior segment optical coherence tomography. *Jpn J Ophthalmol* 2011;55(4):343-50.
3. Flores-Sánchez BC, Tatham AJ. Acute angle closure glaucoma. *Br J Hosp Med Lond Engl* 2019;80(12):C174-9.
4. Mantravadi AV, Vadhar N. Glaucoma. *Prim Care* 2015;42(3):437-49.
5. Tun TA, Baskaran M, Tan SS, et al. Evaluation of the anterior segment angle-to-angle scan of cirrus high-definition optical coherence tomography and comparison with gonioscopy and with the visante OCT. *Invest Ophthalmol Vis Sci* 2017;58(1):59-64.
6. Porporato N, Baskaran M, Husain R, et al. Recent advances in anterior chamber angle imaging. *Eye Lond Engl* 2020;34(1):51-9.
7. Riva I, Micheletti E, Oddone F, et al. Anterior chamber angle assessment techniques: a review. *J Clin Med* 2020;9(12).
8. Sakata LM, Lavanya R, Friedman DS, et al. Comparison of gonioscopy and anterior segment ocular coherence tomography in detecting angle closure in different quadrants of the anterior chamber angle. *Ophthalmology* 2008;115(5):769-74.
9. Choudhari NS, Chanda S, Khanna R, et al. Diagnostic accuracy of van Herick technique to detect pre-disease states of primary angle closure glaucoma in a resource constraint region. *Ophthalmic Epidemiol* 2019;26(3):175-82.
10. Bhartiya S, Shaarawy T. Evaluation of the Van Herick technique for screening for Occludable angles in an African population. *J Curr Glaucoma Pract* 2013;7(2):88-90.

11. Binotti WW, Bayraktutar B, Ozmen MC, et al. A Review of Imaging Biomarkers of the Ocular Surface. *Eye Contact Lens*. 2020;46(Suppl 2):S84-105.
12. Niwas SI, Lin W, Bai X, et al. Automated anterior segment OCT image analysis for Angle Closure Glaucoma mechanisms classification. *Comput Methods Programs Biomed* 2016;130:65-75.
13. Sun X, Dai Y, Chen Y, et al. Primary angle closure glaucoma: what we know and what we don't know. *Prog Retin Eye Res* 2017;57:26-45.
14. Hu CX, Mantravadi A, Zangalli C, et al. Comparing gonioscopy with Visante and cirrus optical coherence tomography for anterior chamber angle assessment in glaucoma patients. *J Glaucoma* 2016;25(2):177-83.
15. Rigi M, Bell NP, Lee DA, et al. Agreement between gonioscopic examination and swept source Fourier domain anterior segment optical coherence tomography imaging. *J Ophthalmol* 2016;2016:1727039.
16. Tay ELT, Yong VKY, Lim BA, et al. Agreement of angle closure assessments between gonioscopy, anterior segment optical coherence tomography, and spectral-domain optical coherence tomography. *Int J Ophthalmol* 2015;8(2):342-6.
17. Vajaranant TS, Nayak S, Wilensky JT, et al. Gender and glaucoma: what we know and what we need to know. *Curr Opin Ophthalmol* 2010;21(2):91-9.
18. Oh WH, Kim BG, Kyung H, et al. Primary angle-closure glaucoma with normal intraocular pressure at the first visit: its prevalence and ocular characteristics. *J Glaucoma* 2019;28(1):32-7.
19. Loh CC, Kamaruddin H, Bastion MLC, et al. Evaluation of refractive status and ocular biometric parameters in primary angle closure disease. *Ophthalmic Res* 2021;64(2):246-52.
20. Shen L, Melles RB, Metlapally R, et al. The association of refractive error with glaucoma in a multiethnic population. *Ophthalmology* 2016;123(1):92-101.
21. Mohamed-Noor J, Abd-Salam D. Refractive errors and biometry of primary angle-closure disease in a mixed Malaysian population. *Int J Ophthalmol* 2017;10(8):1246-50.
22. Friedman DS, He M. Anterior chamber angle assessment techniques. *Surv Ophthalmol* 2008;53(3):250-73.
23. Yi JH, Hong S, Seong GJ, et al. Anterior chamber measurements by pentacam and AS-OCT in eyes with normal open angles. *Korean J Ophthalmol KJO* 2008;22(4):242-5.
24. Tornquist R. Peripheral chamber depth in the shallow anterior chamber. *Br J Ophthalmol* 1959;43(3):169-76.
25. Lan J, Sun D, Alabdulrasool K, et al. Evaluation of the narrow anterior chamber angle by anterior segment optical coherence tomography. *Ophthalmic Res* 2017;57(2):87-91.

How to cite this article: Dr. Yernena Mytreysi, Dr. Vudaya Narayana Sai Lakshmi Rambha, Dr. Adapa Sri Khyathi, Dr. Kandula Satish, COMPARATIVE EVALUATION OF ANTERIOR CHAMBER ANGLE BY GONIOSCOPY AND ANTERIOR SEGMENT ATTACHMENT OPTICAL COHERENCE TOMOGRAPHY IN INDIVIDUALS WITH NARROW ANGLES, *Asian J. Med. Res. Health Sci.*, 2026; 4 (2):693-698.

Source of Support: Nil, Conflicts of Interest: None declared.