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Anterior chamber configuration changes after phacoemulsification and IOL implantation measured by anterior segment optical coherence tomography

Veeralakshmanan S[1], Arsha Ressal S A[2],Biju Gopal[3], Rinita R [4],Rajeevan[5]

1,2,3Junior Resident,3,5 Professor Department of Opthalmology,Sree mookambika institute of medical sciences, Kannyakumari,TamilNadu,India.

Corresponding Author: Arsha Ressal S A,Junior Resident, Department of ophthalmology, Sree Mookambika Institute of Medical Sciences College Kanyakumari, Tamil Nadu, India.email id;rinitaanita@gmail.com.

ABSTRACT

Background: To use anterior segment optical coherence tomography to detect early alterations in anterior chamber morphology following phacoemulsification and IOL implantation.

Material and Methods: A prospective, follow-up interventional investigation was conducted to measure the changes in anterior chamber configuration in twenty (20) eyes followin8g a month of posterior chamber IOL implantation and phacoemulsification.

Result: A p-value of (0.027_0.009_0.02_0.012) indicates a significant change in the nasal, superior, temporal, and inferior angles assessed by anterior segment optical coherence tomography before and after the phacoemulsification procedure.

Conclusion: After a smooth phacoemulsification and IOL implantation, quantitative values indicated an increase in the anterior chamber angle (ACA), as determined by AS-OCT.

Keywords: chamber, anterior, implantation.

Introduction:

Overview Anterior segment optical coherence tomography (ASOCT) is a noninvasive, noncontact technique that offers important insights into the pathophysiology of disorders and allows for the observation of tissues in vivo. The anterior region of the eye is being examined using a variety of optical and ultrasonic techniques [1]. Utilizing gonioscopy and ultrasound biomicroscopy (UBM) has been the primary method for assessing angle widening's efficacy following cataract surgery [2]. However, infection or wound dehiscence may happen because gonioscopy and UBM necessitate contact with the ocular surface. As a result, early postoperative usage of gonioscopy and UBM has not been documented, making them inappropriate for surveillance immediately following surgery. Using a long wavelength of light (1,310 nm), It provides quick and simple quantitative examination of different structures [3-5], with minimal intraobserver and interobserver variability and strong repeatability and reproducibility [6, 7]. ASOCT offers superior resolution over traditional UBM. Although ASOCT is a quick and noncontact method, there haven't been many reports of using it for angle analysis following cataract surgery [8]. ASOCT is helpful for evaluating angles because it allows for the quantitative assessment of the degree of angle widening and since the imaging process is quick and easy for the patients to endure [9].

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Materials and Methods

This is a prospective consecutive interventional study carried out on twenty (20eyes) using ASOCT imaging to compare anterior chamber configuration before and 1 month after phacoemulsification and IOL implantation. We analyzed the anterior chamber angle (ACA).these study was done at Sree Mookambika Institute of Medical Sciences Ophthalmology Department.
Inclusion criteria: Senile cataract and Postoperative clear cornea.
Exclusion criteria: Complicated and infantile cataract, previous intraocular surgeries, corneal opacity and intraoperative complication.

Every patient underwent an ophthalmologic examination, which included Goldmann applanation tonometry, slit-lamp biomicroscopy to determine the severity of cataract and any abnormalities in the anterior segment, best-corrected visual acuity (BCVA) in snellen decimal units, and apparent refraction. indirect ophthalmoscopy, as well as gonioscopy. Anterior chamber angle (ACA) was measured preoperatively and one month after surgery using anterior segment optical coherence tomography (AS-OCT). Goldmann three-mirror goniolens was used to perform gonioscopy on all patients both preoperatively and one month after surgery. All measurements were taken again one month after surgery when the patients were reexamined.
Data entered in excel sheet. Statistical Analysis was carried out using SPSS 20.0 version. Significance is assessed at 5% level of significance. Chi-square test was done to assess statistical significance. A p value less than 0.05 was considered statistically significant.

Results

A total of twenty (20 eyes), (13) females (70%) and (7) males (30%) underwent ASOCT imaging to compare anterior chamber angle(ACA) before and 1 month after phacoemulsification and IOL implantation. The mean age was 56.8±4.8 years (range 45- 65).

Table 1: Mean and standard deviation for age and uncorrected visual acuty among the studied population

Age	
Mean±SD	56.8±4.8
Median	60
Range	45-65
UCVA	
Mean±SD	0.11±0.06
Median	0.13
Range	0.05-0.20

Table 2: Frequency distribution for gender and kind of the eye among the studied population

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Sex	**No**	**%**
Male	7	30%
Female	13	70%
Kind of the eye		
OD	13	65%
OS	7	35%

Table 3: Showing that there is significant difference regarding nasal, superior, temporal and inferior angle measured by anterior segment optical coherence tomography before and after phacoemulsification operation with p.value were (0.027_0.009_0.02_0.012) respectively.

	Pre	**Post**	**t. test**	**P. value**
NA. Asoct				
Mean±SD	24.98 ±7.8	31.11±9.01	-2.294	0.027
Median	24.5	29.5		
Range	11.5-38.5	18.1-50.6		
SA. Asoct				
Mean±SD	23.83±5.99	29.57±6.83	-2.761	0.009
Median	23.65	28.05		
Range	11.8-32	19.6-42.2		
TA. Asoct				
Mean±SD	27.63±8.9	33.96±7.53	-2.429	0.020
Median	26.85	33.15		
Range	10-38.8	20.2-43.2		
IA. Asoct				
Mean±SD	31.42±8.9	38.78±9.11	-2.647	0.012
Median	32.45	36.5		
Range	12-40	22.3-52.5		

NA ASOCT: Nasal angle ASOCT; **SA ASOCT:** Superior angle ASOCT; **TA ASOCT:** Temporal angle ASOCT; **IA ASOCT**: Inferior angle ASOCT

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Table 4: There is significant difference regarding nasal, super, temporal and inferior angle measured by gonioscopy before and after phacoemulsification operation with p.value (0.04_0.038_0.0358_0.043)

	Pre		**Post**		**X2**	**P.value**
NA. Gonioscopy	No	%	No	%		
II	5	20%	2	10%	6.429[a]	0.04
III	15	80%	13	65%		
IV	0	0%	5	25%		
SA. Gonioscopy						
II	8	40%	3	15%	6.553[a]	0.038
III	12	60%	14	70%		
IV	0	0%	3	15%		
TA. Gonioscopy						
II	3	15%	0	0%	5.692[a]	0.0358
III	12	60%	9	45%		
IV	5	25%	11	55%		
IA. Gonioscopy						
II	3	15%	0	0%	6.273[a]	0.043
III	9	45%	5	25%		
IV	8	40%	15	75%		

NA Gonioscopy: Nasal angle Gonioscopy; **SA Gonioscopy:** Superior angle Gonioscopy **TA Gonioscopy**: Temporal angle Gonioscopy; **IA Gonioscopy**: Inferior angle Gonioscopy

Discussion:

The Goldmann applanation tonometer was used in our investigation to assess intraocular pr essure. Following phacoemulsification and IOL implantation, documented alterations in an terior chamber characteristics have been linked to Studies on both normotensive eyes (Ceki c et al., 1998; Hayashi et al., 2000) [10, 11] and eyes with OAG (Hayashi et al., 2000) [11] or ACG (Cekic et al., 1998; Hayashi et al., 2000) [10, 11] have shown considerable reducti ons in IOP. While there was a followup IOP measurement for up to nine months in previou s studies, our study's mean IOP measurement, which was taken only at one month after sur gery, did not differ significantly from the mean measurement taken before surgery; this cou ld be due to scheduling.

The nasal, super, temporal, and inferior angles assessed by gonioscopy before and after phacoemulsification surgery and posterior chamber IOL implantation showed statistically significant differences in our study, with p values of (0.04_0.03_0.03_0.04), respectively. Using SD-ASOCT to objectively assess parameters, we examined the changes in anterior chamber angle following posterior chamber IOL implantation and phacoemulsification surgery.

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Our outcomes before and after surgery were very different. The nasal angle increased with (p=0.027) from 24.98± 7.8o to 31.11± 9.01o; the temporal angle increased with (p=0.02) from 27.63± 8.9o to 33.96± 7.53o; the inferior angle increased with (p=0.012) from 31.42± 8.9o to 38.78± 9.11o; and the superior angle increased with (p=0.009) from 23.83 ± 5.99o to 29.57 ± 6.83o.

Kim *et al*. (2011) [8] evaluated the changes in anterior chamber depth (ACD) and angle width induced by phacoemulsification and intraocular lens (IOL) implantation in normal eyes using anterior segment optical coherence tomography (AS-OCT). Forty-five eyes (45 patients) underwent AS-OCT imaging to evaluate anterior chamber configuration before and 2 days after phacoemulsification and IOL implantation. They analyzed the central ACD and angle width using different methods: anterior chamber angle (ACA), trabecular-iris angle (TIA), angle opening distance (AOD), and trabecular iris surface area (TISA) in the nasal and temporal quadrants. Comparison between preoperative and postoperative measurement was done. Before surgery, the mean anterior chamber angle widths were 23.21 ± 6.70° in the nasal quadrant and 24.89 ± 7.66° in the temporal quadrant. After phacoemulsification and IOL implantation, the anterior chamber angle width increased significantly to 35.16 ±4.65° in the nasal quadrant (p = 0.001) and 36.03 ± 4.86° in the temporal quadrant (p = 0.001). Also, AOD, and TISA, increased significantly after cataract surgery and showed positive correlation with ACA. Differences from our study is the use of Visante, enabling them to compare pre and postoperative changes in ACD, AOD and TIA.

Kasai et al. (2015) [12] used anterior segment optical coherence tomography (ASOCT) to assess the sequential changes in angle parameters shortly after cataract surgery. This case-control research involved the retrospective chart analysis of 150 eyes from 106 individuals who had cataract surgery. The eyes were divided into two groups: open-angle eyes (87 eyes) and narrow-angle eyes (63 eyes) based on anterior chaber angle findings. Anterior chamber angle parameters, including angle opening distance, angle recess area, trabecular iris space area, and trabecular iris angle, were measured using ASOCT. Measurements were made of each group's serial changes prior to, and one day, one week, and one month following cataract surgery.

Following cataract surgery, all angle metrics in both groups showed a significant difference from the preoperative values at every examination period (p<0.01).All angle parameters increased immediately following cataract surgery. The degree of angle widening in narrow-angle eyes was, however, less than in open-angle eyes, indicating that the angle closure was impacted by variables other than the lens.

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