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Original Article

EFFECT OF CATARACT EXTRACTION ON ANTERIOR CHAMBER ANGLE IN PATIENTS WITH PRIMARY NARROW ANGLE GLAUCOMA USING ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY

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Abstract

Background: *In glaucoma patients, anterior chamber angle anatomy in perspective of ocular biometry may be the key element to intraocular pressure (IOP) reduction. The wide variety of features that may be utilized to diagnose and track persons with this spectrum of disorders is the result of substantial research in the field as well as the continuous advancement of anterior segment optical coherence tomography technology and software. These characteristics must be investigated further in order to determine their clinical importance. The purpose of this research is to determine if surgical cataract removal is advantageous for those who have primary narrow-angle glaucoma. Anterior Segment Optical Coherence Tomography is an effective imaging modality for visually identifying the anterior segment structure, by obtaining high-resolution cross-sections of the entire anterior chamber in a single image* ***Techniques for Conducting Research:*** *A randomized, prospective design is used in this clinical investigation.* ***Methods and Cases:*** *The study included 30 patients (21 men and 9 women) with angle closure glaucoma and any level of cataract who visited the outpatient clinic at Assiut AL Azhar University Hospital. The patients' ages varied from 42.0 to 70.0 years old, with an average of 57.67.81.* ***Result:*** *When comparing IOP before and after the surgery, there was a substantial statistical difference between the two time periods. Prior to surgery, the mean was 35.13 ± 11.69SD. One week after surgery, the average was 16.67 ± 5.05SD. The average surgical result at 4 weeks was 13.80 ± 4.08SD. At 12 weeks after surgery, the mean value was 13.13 ± 4.21SD.* ***Conclusion:*** *Our findings demonstrate how AS-OCT may be utilized to evaluate the AC angle following cataract removal and peripheral iridotomy. Patients undergoing therapeutic cataract extraction to broaden a narrow angle may benefit from this type of pre- and post-operative screening. This approach is associated with the terms AS-OCT, glaucoma, and cataract.*

Keywords: *AS-OCT, Glaucoma, Cataract*

1. Introduction

Glaucoma is the major cause of permanent blindness and the second leading cause of complete blindness (after cataracts) [1, 2]. Because it records high-resolution

cross-sections of the whole anterior chamber in a single picture, Anterior Segment Optical Coherence Tomography (AS-OCT) is a valuable imaging tool for visually distinguishing the architecture of the anterior segment [3,4]. Angle measurement, morphological study of the filtering blebs, corneal thickness, iris thickness, anterior chamber depth, and lens position are all current uses of AS-OCT in patients with established or suspected glaucoma. You may use the ruler tool to take interactive measurements of several anatomical and pathologic characteristics for diagnosis and scientific inquiry. Images of the anterior portion of the eye can be used to determine the best course of action for laser treatment or surgery. As a result, AS-OCT is a valuable tool for detecting and managing glaucoma. Future glaucoma applications of this method look promising, particularly given advances in three-dimensional AS-OCT technology [5,6]. The purpose of this study is to use anterior segment OCT to look at how the anterior chamber angle changes following cataract surgery in persons with primary narrow angle glaucoma.

2. Methods and Case Studies

30 patients (21 men and 9 women) with angle closure glaucoma and any degree of cataract were examined and treated at Assiut AL Azhar University Hospital's outpatient clinic. The procedures were performed between June and December of 2021. Inclusion requirements Patients with primary angle glaucoma and cataracts of varying severity were selected from the outpatient clinic at Assiut AL Azhar University Hospital. In situations of peripheral anterior synechia, corneal illness, intraocular surgery, and laser therapy, as well as changes in pupil size caused by topical medication usage, it is best to avoid this test. A thorough eye exam, a full medical and ocular history, and the use of a gonioscope to check the retina and optic nerve, a slit lamp to examine the cornea, iris, lens, and anterior chamber, taking the patient's visual acuity and intraocular pressure, and performing a three-mirror gonioscopy are all part of the procedure. Treatment Techniques: Patients were given topical steroids and antibiotics after phacoemulsification and the implantation of a foldable intraocular lens in the capsular bag under local anesthesia. At 1, 4, and 12 weeks after surgery, patients received anterior segment OCT by measuring trabecular iris angle, at nasal (0°), and temporal (180°), and comprehensive ocular exams.

3. Statistical Analysis

SPSS Inc.'s Statistical Package for the Social Sciences, version 20 (Chicago, Illinois, USA) was used for the study. The mean and standard deviation were used to characterize quantitative variables. Qualitative elements were quantified and proportionally stated. The Student test was used to compare the statistical significance of two groups on parametric quantitative variables. When there were less than five observations in each category, the chi-square (X2) test or Fisher's exact test was used to compare the qualitative variables. To investigate the relationship between two normally distributed data, Pearson correlation coefficients were utilized. When the variable's distribution is not normal, the significance criterion is set at P 0.05.

4. Results

The following were the results of the 30 patients: According to the demographic statistics, there were 21 men (about 70 %) and 9 women (30%) among the cases

evaluated. Participants in 15 of the cases studied (50.0%) were 60 or older. The ages ranged from 42.0 to 70.0, with a mean of 57.67± 8.11 SD, fig. (1) and tab. (1). There was a statistically significant change in UCVA (LogMAR) between the two time points studied (preoperative and postoperative). Prior to surgery, the average was 1.13± 0.21 SD. One week following surgery, the average was 0.58 ±0.25 SD. Four weeks following surgery, the mean was 0.50± 0.20 SD. Twelve weeks after surgery, the mean was 0.47± 0.14 SD, fig. (2) and tab. (2). There was a substantial change in CDVA (LogMAR) between the two time periods studied (preoperative and postoperative). Prior to surgery, the mean value was 0.92 ±0.39 SD. One week after surgery, the mean value was 0.52 ±0.21 SD. After 4 weeks, the results showed a mean SD of 0.47± 0.17. Twelve weeks after surgery, the average was 0.46 ± 0.15 SD. In tab. (3) and fig. (3), the IOP data demonstrated a significantly significant difference between the preoperative and postoperative time periods. The average IOP before to surgery was 35.13 ±11.69 SD. One week after surgery, the average was 16.67 ±5.05 SD. Four weeks after surgery, the mean was 13.80± 4.08 SD. The average time between surgeries was 13.13 ±4.21SD. Figure (4) and tab. (4) show the timing angle measurement. The preoperative and postoperative time periods, as well as the angle between them, were shown to be statistically distinct. The pre-op mean was 20.30±2.49 standard deviations away. After one week, the average was 35.63 ±6.99. The average four weeks after surgery was 37.67 ±6.32 standard deviation. The mean score 12 weeks after surgery was 39.07, with a standard deviation of 5.63. Figure (5), tab. (5), and Illustration 1:4 Measurements of the nasal angle before and after surgery indicated a significant difference. The pre-op means were 20.17 ±2.42 SD. One week after surgery, the average was 35.77 ±6.97. The average score four weeks after surgery was 37.40 ±6.30 SD. At 12 weeks after surgery, the mean score was 38.93 ±5.50 SD, fig. (6); tab. (6) and figs. (1-4).

Table 1: Distribution of the studied cases according to demographic data (n=30)

Demographic Data	No.	%
Gender		
▪ *Male*	21	70.0
▪ *Female*	9	30.0
Age (years)		
<60	15	50.0
≥60	15	50.0
Min. – Max.	42.0 – 70.0	
Mean ± SD.	57.67 ± 8.11	
Median (IQR)	58.50 (55.0 – 61.0)	

IQR: Inter quartile range; SD: Standard deviation

Table 2: Comparison between the different studied periods according to UCVA and CDVA (LogMAR) (n=30)

UCVA (LogMAR)	Preoperative	Postoperative			Fr	p
		1 Week	4 Weeks	12 Weeks		
Min. – Max.	1.0 – 1.50	0.20 – 1.0	0.20 – 1.0	0.20 – 0.70	78.164*	<0.001*
Mean ± SD.	1.13 ± 0.21	0.58 ± 0.25	0.50 ± 0.20	0.47 ± 0.14		
Median (IQR)	1.0 (1.0–1.30)	0.50 (0.50–0.80)	0.50 (0.30–0.50)	0.50 (0.30–0.50)		
p_1		0.001*	0.001*	0.001*		
CDVA (LogMAR)						
Min. – Max.	0.50 – 1.50	0.20 – 0.80	0.20 – 0.80	0.20 – 0.70	64.688*	<0.001*
Mean ± SD.	0.92 ± 0.39	0.52 ± 0.21	0.47 ± 0.17	0.46 ± 0.15		
Median (IQR)	1.0 (0.50–1.30)	0.50 (0.30–0.80)	0.50 (0.30–0.50)	0.50 (0.30–0.50)		
p_1		0.001*	0.001*	0.001*		

***Fr**: Friedman test, Sig. bet. periods was done using Post Hoc Test (Dunn's);**p:** p value for comparing between the different studied periods; **p_1:** p value for comparing between preoperative and each other period; ***:** Statistically significant at $p \leq 0.05$*

Table 3: Comparison between the different studied periods according to IOP (n=30)

IOP (mm Hg)	Preoperative	Postoperative			Fr	P
		1 Week	4 Weeks	12 Weeks		
Min. – Max.	24.0 – 30.0	10.0 – 27.0	8.0 – 20.0	8.0 – 20.0	86.681*	<0.001*
Mean ± SD.	27.23± 2.28	16.67 ± 5.05	13.80 ± 4.08	13.13 ± 4.21		
Median (IQR)	27.0 (25.0–29.5)	16.50(12.0–21.0)	14.0 (10.0–18.0)	13.0 (9.0–16.0)		
p_1		**0.002***	**<0.001***	**<0.001***		

***Fr**: Friedman test, Sig. bet. periods was done using Post Hoc Test (Dunn's);**p:** p value for comparing between the different studied periods; **p_1:** p value for comparing between preoperative and each other period; ***:** Statistically significant at $p \leq 0.05$*

Table 4: Comparison between the different studied periods according to angle temporal and angle nasal (Degree) (n=30)

Angle temporal (AT) (Degree)	Preoperative	Postoperative			F	P
		1 Week	4 Weeks	12 Weeks		
Min. – Max.	18.0 – 26.0	29.0 – 51.0	31.0 – 51.0	33.0 – 51.0	318.550*	<0.001*
Mean ± SD.	20.30 ± 2.49	35.63 ± 6.99	37.67 ± 6.32	39.07 ± 5.63		
Median (IQR)	19.0 (19.0–21.0)	32.0 (31.0–41.0)	34.0 (33.0–43.0)	36.0 (35.0–43.0)		
p_1		**<0.001***	**<0.001***	**<0.001***		
Angle Nasal (AN) (Degree)						
Min. – Max.	18.0 – 26.0	29.0 – 51.0	30.0 – 51.0	33.0 – 51.0	81.409*	<0.001*
Mean ± SD.	20.17 ± 2.42	35.77 ± 6.97	37.40 ± 6.30	38.93 ± 5.50		
Median (IQR)	19.0 (19.0–20.0)	32.0 (31.0–43.0)	34.0 (33.0–43.0)	36.0 (35.0–43.0)		
p_1		**<0.001***	**<0.001***	**<0.001***		

***F:** F test (ANOVA) with repeated measures, Sig. bet. periods was done using Post Hoc Test (adjusted Bonferroni); **p:** p value for comparing between the different studied periods; **p_1:** p value for comparing bet`ween Preoperative and each other period; ***:** Statistically significant at $p \leq 0.05$*

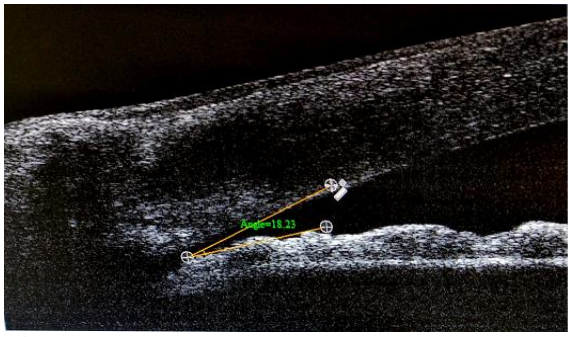

Figure 1: preoperative AS-OCT angle view in patient I

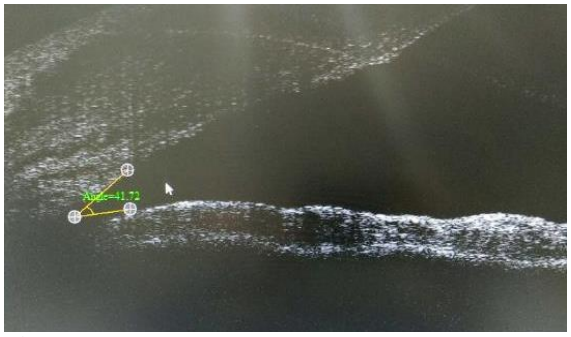

Figure 2: postoperative AS-OCT angle view in patient I

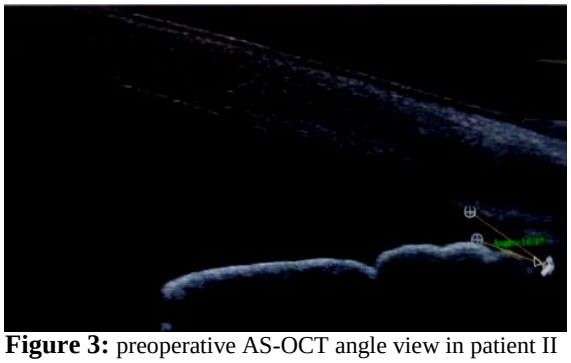

Figure 3: preoperative AS-OCT angle view in patient II

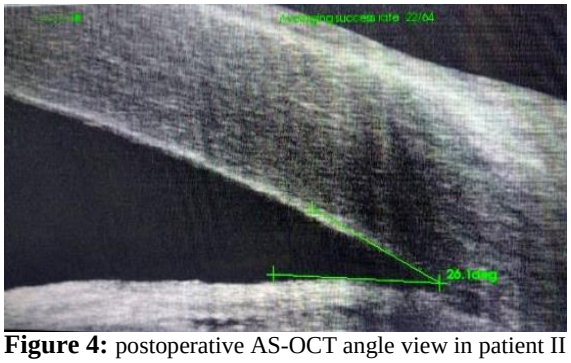

Figure 4: postoperative AS-OCT angle view in patient II

5. Discussion

Out of the 30 participants, nine (30.0%) were female and 21 (70.0%) were male. Participants were under the age of 60 in 15 of the 15 cases studied (50.0%). The ages ranged from 42.0 to 70.0, with a mean of 57.67 8.11 SD. Twenty patients (66.7%) had left eyes and ten (33.3%) had right eyes in a research that used ant-

erior segment optical coherence tomography to determine the anterior chamber angle following phaco. Sulastiwaty R. et al. [7] discovered that 50% of patients had the left eye and 50% had the right eye when they investigated the efficacy and safety of cataract extraction in decreasing intraocular pressure in glaucoma patients. We showed that the two time periods (preoperative and postoperative) in this study's comparison of UCVA (as measured by LogMAR) differed significantly. Prior to surgery, the average was 1.13 (0.21 SD). One week following surgery, the average was 0.58 ±0.25 SD. Four weeks following surgery, the mean was 0.50 ±0.20 SD. Twelve weeks after surgery, the mean was 0.47 ±0.14 SD. Sulastiwaty R. et al.'s study [7] found that patients' visual acuity improved considerably after surgery. Individuals noticed an average drop in their vision of 0.75 ±0.49 logMAR to 0.08 ±0.09 after one month of treatment. Cataract removal enhanced UCVA, according to Altan et al. [8]. The average preoperative UCVA had a decimal point of (P =.22). Pre-op norms were 0.1 ±0.1 (1.1 logMAR), but post-op norms were 0.6 ±0.2 (0.2 logMAR). We discovered a substantial change in CDVA (LogMAR) between the preoperative and postoperative periods after completing a research. Prior to surgery, the mean value was 0.92 by 0.39 SD. One week after surgery, the mean value was 0.52 by 0.21 SD. After 4 weeks, the results showed a mean SD of 0.47± 0.17. Twelve weeks after surgery, the average was 0.46 by 0.15 SD. Postoperative visual acuity was much better than preoperative readings, with a mean of 0.17 ±0.1 before surgery and 0.9 ±0.08 one month later (p 0.001). According to Altan et al. [8], BCVA increased after cataract extraction. Before surgery, the average BCVA was 0.30 (0.60 logMAR). A regression study found averages of 0.9 ±0.2 (0.07 logMAR) following surgery. According to Sulastiwaty R. et al. [7], one month following cataract surgery, the BCVA mean corrected visual acuity increased from 0.54 ±0.41 to 0.91 ±0.16. In our investigation, we obtained significant statistical support for a difference in IOP between the pre- and postoperative periods. The average BMI before to surgery was 35.13 (11.69 SD). One week after surgery, the average was 16.67 ±5.05 SD. Four weeks after surgery, the mean was 13.80 4.08 SD. The average time between surgeries was 13.13 (SD = 4.21) weeks. The intraocular pressures were 15.06 ±3.42 and 10.52 ±2.32mmHg, respectively, before and one month after surgery in a research by Heba Said et al. [9] to examine Anterior Segment Optical Coherence Tomography Changes after Phacoemulsification (P-value 0.001; extremely significant). Sulastiwaty R. et al. [7] discovered that intraocular pressure reduced considerably following cataract surgery. During the first week following surgery, patients' mean IOP dropped by 3.33 mmHg, from 21.33 ±6.15 to 18 ±6.0 mmHg. The average IOP was 3.22 mmHg lower after one month of treatment (18.11 ±5.57 mmHg; p= 0.02), while the control group's IOP only marginally dropped (15.2 ±2.8 mmHg). Patients with cataracts and primary angle closure glaucoma had a substantial drop in intraocular pressure (IOP) one month after phacoemulsification, according to research by Hazem Helmy et al. [10]. This IOP level maintained for the first 30 months after surgery, declined significantly for the next 6 months, and then slowly climbed over the next 6 years. Following cataract surgery, IOP is typically reduced. The average IOP drop in these investigations ranged between 1.1 and 13.5 mmHg. Abd ElHakam et al. [11] shown that in all patients, postoperative intraocular pressure (IOP) was consistently and considerably lowered. The average IOP was 34.3±3.5 before surgery and dropped to 17.3±0.95 thereafter, showing a considerable improvement (P0.001). In both glaucoma and non-glaucoma patients, intraocular pressure (IOP) is significantly reduced following phacoemulsification cataract surgery with

IOL implantation. The current study found that mean IOP reductions might range from 2 to 7 mmHg. Several studies have found that the average decline in intraocular pressure (IOP) ranges from 1.1 to 13.5 mmHg. The IOP reduction attained with phacoemulsification and IOL implantation appears to benefit narrow angle eyes more than wide angle eyes. It is unknown how the IOP falls during cataract surgery. In theory, cataract surgery might deepen the AC and broaden the ACA by correcting the physical source of the limiting angle. If the drainage angle is raised, water should be able to reach the filtering part of the trabecular meshwork more easily. In this thesis, we discovered that the Temporal Angle, as well as the Preoperative and Postoperative periods, differed significantly. The pre-op mean was 20.30 ±2.49 standard deviations away. After one week, the average was 35.63 ±6.99. The average four weeks after surgery was 37.67 (6.32 standard deviation). The mean score 12 weeks after surgery was 39.07, with a standard deviation of 5.63. Altan C. et al. [8] employed changes in AS-OCT angle measurements in the nasal and temporal quadrants between pre-operative and postoperative periods to show restoring preoperative condition. Angle measurements increased statistically substantially between before and after surgery (26.0 9.0) (P 0001). At both follow-up visits, R. Kucumen et al. [12] observed a widening of the temporal iridocorneal angle. After one week, the average angle was 14.35 degrees, which is roughly 55% wider than before surgery, and 14.97 degrees after one month, which is approximately 57.4% wider than before surgery. The temporal anterior chamber angle (ACA) was 22.58 degrees (meanSD) before to surgery and 33.14 degrees (meanSD) one month afterwards (P0.001). We discovered a significant variation in the nasal angle between the two time periods (pre- and post-surgery) in this thesis. The pre-op means were 20.17± 2.42 SD. One week after surgery, the average was 35.77± 6.97. The average score four weeks after surgery was 37.40 ±6.30 SD. At 12 weeks after surgery, the mean score was 38.93± 5.50 SD. The nasal quadrant angle was evaluated postoperatively, and the postoperative results (34.2 ±7.2) were significantly larger than the preoperative values (24.5 7.7) (P.0001). This was proven by Tai MC. et al. [12]. R. Kucumen et al. [12] discovered that the nasal iridocorneal angle was larger at both post-surgery follow-up sessions. After one week, the average angle was 14.57 degrees, which is approximately 56.5% wider than it was before surgery. After one month, the average angle was 15.61 degrees, or approximately 60.6% wider.

6. Conclusion

Cataract removal benefits patients with primary narrow angle glaucoma by expanding the ACA and lowering intraocular pressure. AS-OCT, according to our findings, is a good approach for detecting the AC angle after peripheral iridotomy and cataract surgery. This method can be used to examine individuals undergoing therapeutic cataract extraction to broaden a narrow angle.

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