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Original Article

ANTERIOR CHAMBER CHANGES AFTER IMPLANTABLE COLLAMER LENS IMPLANTATION IN HIGH MYOPIA

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Abstract

Background: *Global acclaim has been accorded to the Vision Implantable Collamer Lens, a posterior chamber phakic intraocular lens used to cure extreme myopia.* ***Goals & Aims:*** *of this research is to use Pentacam and specular microscopy to assess the changes to the eye's anterior chamber (AC) and endothelial cell count after the placement of an implanted Collamer lens (ICL) in individuals with wide myopia. Procedures and cases forty eyes were employed in this prospective, non-comparative, non-randomized follow-up research, which also made use of Al-Azhr University's eye care facilities in Assiut.* ***Results:*** *Between preoperative, 30 days after surgery, and 3 months after surgery, there were no discernible differences, 6 months after surgery. Preoperative, 30 days postoperative, three months postoperative, and 6 month postoperative observations all showed a substantial reduction in IOP (mmhg). After ICL implantation, the ACA and CACD are markedly lowered.* ***Conclusion:*** *The ACA and CACD are dramatically decreased after ICL implantation. Those modifications must be taken into consideration when deciding whether a case is eligible for ICL installation. ICL implantation has no impact on pupil size or corneal angles, which may ensure satisfactory vision after surgery.*

Keywords: *Collamer, Implantable, Lens, Implantation, Myopia. Anterior chamber*.

1. Introduction

High myopia has been diagnosed and treated with the posterior chamber phakic intraocular lens (IOL) known as the Visian Implantable Collamer Lens [1]. Although it has been said to be a secure, successful, & reversible method, individuals must be informed of any potential side effects, including lens opacification, endothelial cell loss, risen intraocular pressure (IOP), inflammation, and others [2]. In order to select the best refractive surgery, the anterior segment characteristics are crucial. Important criteria for determining if a patient is a candidate for ICL surgery and choosing a right length of ICL are the central anterior chamber depth (CACD) & white to white (WTW) [3]. The CACD value must be more than 2.80 mm for ICL surgery to be safe. For calculating the postoperative safety of operation, the central vault the space among the front area of the lens & the rear surface of the ICL is useful. A large vault elevates the likelihood of glaucoma, while a small vault raises the chance of anterior subcapsular cataracts [4]. In around 2 seconds, the

Pentacam creates a virtual three dimensional illustration of the anterior section. The central anterior chamber depth and other anterior segment properties may be evaluated and quantified using software (CACD), 0° to 360° cross-sectional images of the anterior chamber volume (ACV), pupil diameter (PD), and anterior chamber angle (ACA) [5]. The aim of the research was to use the Pentacam and specular microscopy to examine how high myopia patients' anterior chambers (AC) and endothelial cell counts changed after receiving an implantable Collamer lens (ICL).

2. Patients and Methods

This was a Viewpoint, non-comparative, nonrandomized follow up study of 40 eyes at ophthalmology department of Al-Azhar University (Assiut), eye care centers. *Inclusion criteria:* Age ranged 18 to 35 years, clear corneal appearance on slit lamp, normal lens, IOP & fundus and spherical error from -8 to -20 D and Astigmatism up to -6 D. *Exclusion criteria:* IOP above 20 mmHg, anterior chamber depth under 2.80 mm, and a history of eye trauma or surgery, cataracts, glaucoma, diabetes mellitus, other autoimmune disorders affecting the eyes, and a young age of under 18 years. *Clinical evaluation*: All subjects underwent thorough ocular exams prior to surgery as well as at 1, 3, and 6 months afterward. Slit-lamp biomicroscopy, fundus examinations, uncomeasures of manifest and cycloplegic refraction using cyclopentolate eye drops, UDVA and CDVA for distance vision using the Snellen chart, both corrected and uncorrected, among the tests conducted were intraocular pressure using an Air puff tonometer. Central corneal thickness, central AC depth, central AC depth, and central AC angle, K readings and endothelial cell count will be recorded. *Investigation*: Corneal topography was measured using ascheimpflug camera pentacam (OCULAZER) and specular microscopy (NIDEK). *Operative method*: Immediate preoperative counseling before starting the treatment, the patient was counseled about what is expected during the procedure. *Preoperative medication*: Surgery was performed under topical anathesia; strile drape was placed over the skin and eyelashes. *Operative details*: Mydriatic medications were infused four times, spaced by 10-minute intervals, before the operation. After using topical anaesthesia, a temporal corneal incision of 3 mm was performed. While in the AC, a viscoelastic substance was placed. Buffered salt solution was used to entirely remove the viscoelastic substance. No limbal relaxing incision or astigmatic keratotomy was performed. In the two weeks following surgery, Tobramycin, dexamethasone, and moxifloxacin eye drops were used topically. *Postoperative measurement*: Imaging of the anterior chamber utilising a spinning Scheimpflug camera Pentacam and specular microscopy at one to three and 6 months following operation. A number of readings were taken, including the K values, the endothelial cell count, the central corneal thickness (CCT), the central AC depth (CACD), the AC angle (ACA), IOP, and the AC volume (ACV). *Ethical consideration*: Before beginning this investigation, the Al Azhar Assuit Faculty of Medicine ethical committee gave its clearance. Each participant was notified of the research aim before any data were collected those who agreed to participate in the study gave their verbal and written consent. The privacy of the data was ensured. The data was gathered, altered, coded, and entered using the social science statistical software Using IBM SPSS 20. When it was found that the distribution of the since quantitative data was parametric, the mean, standard deviation, and ranges were used to present the data. While quantitative data were presented as percentages and figures.

3. Results

According to this tab. (1), there were 14 males and 26 women patients, whose ages varied from 15 to 34 years old (mean: 22.85 years), and whose mean refractive error (D) was -15.11 4.28. In tab. (2) 1 month post-operative the Mean ACV (mm3) Were 141.67 ± 32.80, the Mean ACA Were 27.31 ± 2.26, the Mean CACD (mm) Were 2.90 ± 0.22, the CCT ranged From 466 to 650 with mean 506.93 ± 45.42, the K (D) ranged From 40.8 to 48 with mean 44.59 ± 2.17, the IOP (mmhg) ranged From 10 to 20 with mean 12.66 ± 2.80 and the Mean Vault (mm) Were 0.62 ± 0.07. Endothelial cell count were 2800 ± 20.54. In tab. (3) 3 month post-operative the Mean ACV (mm3) Were 142.98 ± 18.94, the Mean ACA Were 27.79 ± 3.25, the Mean CACD (mm) Were 2.96 ± 0.23, the CCT ranged From 440 to 610 with mean 509.88 ± 37.53, the K (D) ranged From 40.8 to 47.1 with mean 44.55 ± 2.15, the IOP (mmhg) ranged From 12 to 22 with mean 12.89 ± 1.99 and the Mean Vault (mm) Were 0.53 ± 0.09. Endothelial cell count were 2795 ± 21.78. Table (4) demonstrates that there were statistically significant differences. found between Preoperative, 1 month postoperative, 3 month postoperative and 6 month post-operative Regarding ACV (mm3). Table (5) demonstrates that there was a major discrepancy. in terms of statistics found between preoperative, 1 month post-operative, 3 month post-operative and 6 month post-operative Regarding ACA. Table (6) demonstrates that there was a major discrepancy in terms of statistics found between preoperative, 1 month post-operative, 3 month post-operative and 6 month post-operative Regarding CACD (mm). After surgery, there was no significant difference in IOP from before to one month after, three months after, or six months after (mmhg). According to the previous table, there was a very substantial difference in terms of statistics between 1 month post-operative, 3 month post-operative and 6 month post-operative Regarding Vault (mm), fig. (1).

Table 1: The distribution of the patients under study by gender, age, and refractive index (D)

		No.= 40
Sex	Female	26 (65.0%)
	Male	14 (35.0%)
Age	Mean ± SD	22.85 ± 6.20
	Range	18 – 34
Refraction (D)	Mean ± SD	-15.11 ± 4.28
	Range	-23.6 – -8

Table 2: Division of the research cases according to ACV (mm3), ACA, CACD (mm), CCT, K (D), IOP (mmhg) and Vault (mm) endothelial cell count 1month post-operative

1 month post-operative	No.= 40	
	Mean ± SD	Range
ACV (mm3)	141.67 ± 32.80	110 – 205
ACA	27.31 ± 2.26	23.2 – 31.6
CACD (mm)	2.90 ± 0.22	2.5 – 3.4
CCT	506.93 ± 45.42	466 – 650
K (D)	44.59 ± 2.17	40.8 – 48
IOP (mmhg)	12.66 ± 2.80	10 – 20
Vault (mm)	0.62 ± 0.07	0.51 – 0.79
Endothelial cell count	2800 ± 20.54	2750 - 2830

Table 3: Scattering of the research examples based on ACV (mm3), ACA, CACD (mm), CCT, K (D), IOP (mmhg) and Vault (mm) endothelial cell count 3month post-operative

3 month post-operative	No.= 40	
	Mean ± SD	Range
ACV (mm3)	142.98 ± 18.94	130.4 – 215
ACA	27.79 ± 3.25	23.3 – 37.4
CACD (mm)	2.96 ± 0.23	2.5 – 3.3
CCT	509.88 ± 37.53	440 – 610
K (D)	44.55 ± 2.15	40.8 – 47.1
IOP (mmhg)	12.89 ± 1.99	12 – 22
Vault (mm)	0.53 ± 0.09	0.41 – 0.66
Endothelial cell count	2795 ± 21.78	2750 – 2830

Table 4: Compares preoperative, one month after surgery, three months after surgery, and six months after surgery. Concerning ACV (mm3)

ACV (mm3)	Pre-operative	1 month post-operative	3 month post-operative	6 month Post -operative	Test value*	P-value	Sig.
Mean ± SD	192.60 ± 35.90	141.67 ± 32.80	142.98 ± 18.94	142.46 ± 11.07	5126.284	0.000	HS
Range	140 – 276	110 – 205	130.4 – 215	125 – 160			
Test value€	–	6.263	8.842	8.327	–	–	–
P-value	–	0.000	0.000	0.000	–	–	–
Sig.	–	HS	HS	HS	–	–	–

P-value > 0.05 *indicates non significance (NS),* ***P-value 0.05*** *indicates significance (S),* ***P-value 0.01*** *indicates very significance (HS) highly significant (HS) at 0.01; repeated-measures analysis Paired t-test for ANOVA€*

Table 5: Comparison between Preoperative, 1 month post-operative, 3 month post-operative and 6 month post-operative Regarding ACA

ACV (mm3)	Pre-operative	1 month post-operative	3 month post-operative	6 month Post -operative	Test value*	P-value	Sig.
Mean ± SD	36.11 ± 1.98	27.31 ± 2.26	27.79 ± 3.25	25.40 ± 3.21	12456.225	0.000	HS
Range	31 – 40	23.2 – 31.6	23.3 – 37.4	20 – 30.5			
Test value€		24.202	14.547	17.569	–	–	–
P-value		0.000	0.000	0.000	–	–	–
Sig.		HS	HS	HS	–	–	–

****:*** *Repeated Measure ANOVA,* ***€:*** *Paired t-test*

Table 6: Comparison between Preoperative, 1 month post-operative, 3 month post-operative and 6 month post-operative Regarding CACD (mm).

ACV (mm3)	Pre-operative	1 month post-operative	3 month post-operative	6 month Post -operative	Test value*	P-value	Sig.
Mean ± SD	3.58 ± 0.25	2.90 ± 0.22	2.96 ± 0.23	2.96 ± 0.23	14592.007	0.000	HS
Range	3.1 – 3.9	2.5 – 3.4	2.5 – 3.3	2.5 – 3.3			
Test value€	–	14.506	12.450	12.450	–	–	–
P-value	–	0.000	0.000	0.000	–	–	–
Sig.	–	HS	HS	HS	–	–	–

Significant (HS) *: Repeated Measure ANOVA, €: Paired t-test

Table 7: Taking IOP readings before surgery, at one month after, three months after, and six months after can provide a useful comparison (mmhg).

ACV (mm3)	Pre-operative	1 month post-operative	3 month post-operative			6 month Post -operative	Test value*	P-value	Sig.
Mean ± SD			12.04 ± 3.28	12.66± 2.80	12.89± 1.99	12.93 ± 3.52	2661.060	0.068	NS
Range			8 – 19	10 – 20	12 – 22	10 – 25			
Test value€			–	-1.106	-1.344	-1.030	–	–	–
P-value			–	0.276	0.187	0.310	–	–	–
Sig.			–	NS	NS	NS	–	–	–

Statistically **: Repeated Measures ANOVA, €: Paired t-test*

Table 8: Comparison between 1 month post-operative, 3 month post-operative and 6 month post-operative regarding vault (mm).

Vault (mm)	Pre-operative	1 month post-operative	3 month Post -operative	6 month Post -operative	Test value*	P-value	Sig.
Mean ± SD	–	0.62 ± 0.07	0.53 ± 0.09	0.44 ± 0.10	2600.985	0.000	HS
Range	–	0.51 – 0.79	0.41 – 0.66	0.3 – 0.6			

Significant (HS) **: Repeated Measure ANOVA*

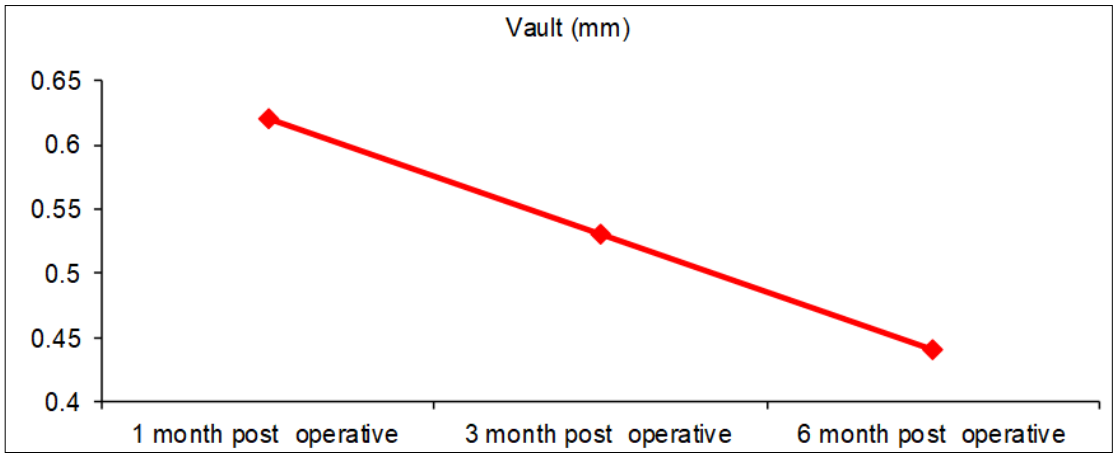

Figure 1: Shows the difference between 1 month post-operative, 3 month post-operative and 6 month post-operative Regarding Vault (mm)

4. Discussion

Previous research compared different postoperative imaging modalities for the anterior segment, explored for changes in anterior segment features, and evaluated the effectiveness and security of ICL as a refractive procedure. But none of these researches compared the findings from the superior section data before and after surgery using the Pentacam [6]. This study's objective was to assess the variations to the eye's anterior chamber (AC) and endothelial cell amount following the transplantation of an implanted Collamer lens (ICL) in patients with extreme myopia using Pentacam and specular microscop. Our study's results show that there were 14 men and 26 female patients, whose ages varied from between 18 and 34 years (mean 22.85 years), and whose mean refractive error (D) was -15.11± 4.28. Regarding the comparison of preoperative, one month after surgery, three months after surgery, and six months after surgery findings that we found there was a striking drop in measures of ACV (mm3) between the preoperative and postoperative findings, which was highly statistically significant. On the other hand, within the scope of a typical follow-up of 4:28 months, Zhu et al. [7]. investigated the AC volume (ACV) (Pentacam imaging) following ICL transplantation in 45 eyes of 26 patients with great myopia before surgery and after surgery. From 198.33+ 33.08 mm3 before surgery to 118.65+ 17.70 mm3 after surgery, the mean ACV was determined to be dramatically decreased (a drop of 40%). They discovered a good association between postoperative ACV and ACA and came to the conclusion that the ACV is a delicate metric that is useful in conjunction with vault and ACD in preoperative evaluation and postoperative monitoring of ICL patients. At one and three months postoperatively, there were no statistically significant variations across ACAs in our sample (p= 0.966). As a result, three months after surgery, the initial constriction of the ACA persisted steady. This was also the case in the researchs by Fernandez-Vigo et al. [8] and Chung et al. [9] where there were no significant variations in ACA from 1 month following surgery to the end of follow-up, which was a mean of 1 year. While comparing preoperative, 1 month postoperative, three month postoperative, and sex month postoperative in our study we reported a very statistically significant difference between preoperative and one month CACD (mm). Postoperative, 3 month postoperative and 6 month postoperative Regarding CACD (mm). As the CACD is studies postoperatively from the rear

surface of the cornea to the anterior surface of the ICL, the ICL vaulting was the primary cause of this drop. These findings concur with those of Ju et al., [10] they discovered that the mean ACD, as determined by AS-OCT, was 3.28± 0.14 mm prior to surgery and 2.45± 0.22 mm three months afterwards. In their investigation, ACD shown a quantitatively significant decrease of 25.4% (p 0.01) Using Scheimpflug CT scanning to assess ACV, ACD, ACA width (AC AW), and vault, Yan et al. [11] have reported the two years outcome of Visian ICL with a central whole (ICL V4c) implantation for treating excessive myopia in 61 eyes of 32 patients. Pre-operative values for the ACV, ACD, and ACAW were 193.28±29.15 mm3, 3.15± 0.23 mm, and 36.51±6.54°; postoperative values were 112.48±17.01 mm3, 2.99± 0.23 mm, and 22.54±5.27° (P= 0.0008, 0.008, and 0.0003, respectively). There was no statistically significant variation between preoperative, 1 month postoperative, 3 month after surgery, and 6 month after surgery regarding IOP (mmhg), according to the comparison between preoperative, 30 days postoperative, 3 month postoperative, and 6 month post-operative (mmhg). IOP increased from the typical (11-12mmHg) to (17-19mmHg) in 17.5% (7 eyes) of our patients throughout the course of the follow-up period of six months. This situation was quite similar to that in the Almalki et al. [12] research from 2016, when they discovered high IOP in 10.8% of subjects. Our cases' CCT results were non-significant; this was due to excellent IOP management and little to no endothelial stress during surgery. This was in line with research done by Eissa et al. [13] to assess the effects of ACA following ICL implantation. In order to correct myopia, they enlisted 54 eyes from 27 patients who were having V4C phakic posterior chamber Collamer lenses implanted. They discovered a significant rise in IOP, which persisted at 6 and 18 months. Regarding the comparison of the first, third, and sixth months following surgery we discovered that there was a very statistically significant difference between Vault (mm) after one month, three months, and six months after surgery. Concerning Vault (mm). Bianchi, [14], reported no variation in vault dimensions among the third and sixth months, which is in contrast to our findings after surgery. Vasavada et al., [15] discovered, however, that the IPCL vault shrank with time, with a considerable decrease at three years after surgery as opposed to 1 postoperative month.

5. Conclusion

Significant reductions in ACA and CACD are seen after ICL implantation. These modifications must be taken into account when determining whether or not a patient is a good candidate for ICL implantation. Implantation of an ICL has a negligible influence on pupil size and corneal curvature, which may ensure acceptable vision quality following surgery. In 17.5% of our patients, there is a postoperative rise in IOP that stays within the physiological range.

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