Lens Position of the AcrySof Angle Supported Phakic Intraocular Lens in Myopic Patients

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Abstract

Background: Myopia is a common finding in the population; it can be treated in several ways. Phakic IOLs is one among other available options of treatment. Angle-supported phakic IOLs rest in the angle of the anterior chamber and vault above the pupil. They have caused severe endothelial cell loss in the past due to their forward movement and their contact with the corneal endothelium.

Objectives: To assess the position of the AcrySof angle-supported phakic IOL in the anterior chamber angle with the Scheimpflug image and its stability over time.

Patients and Methods: Thirty-two eyes were included in this study. They all had moderate to high myopia. The patients were selected from the outpatient clinic of Kasr Al Aini Hospital Cairo University between June 2010 and May 2011. After a full review of the patient’s medical and ophthalmic history, all patients received complete ophthalmological examination. Surgery was then done followed by Scheimpflug imaging at 3 and 6 months postoperatively.

Results: The anterior chamber depth remained stable over time. The position of the IOL in the anterior chamber also remained stable over time indicating IOL stability.

Conclusion: The AcrySof angle-supported pIOL maintained safe distances between the anterior surface of the pIOL and corneal endothelium and between the posterior surface of the pIOL and crystalline lens. Larger patient samples with lower values of preoperative anterior chamber depth and longer follow-up are needed to draw definitive conclusions.

Key Words: Myopia – AcrySof – Phakic IOL – Pentacam.

Introduction

OVER the past years, implantation of phakic intraocular lenses (pIOLs) was introduced as an alternative to keratorefractive surgical procedures for the correction of refractive errors, especially in patients with severe ametropia. Studies of pIOL implantation have shown the treatment efficacy and potential advantages: Faster visual recovery, stability of refractive correction, potential reversibility, better visual quality, and preserved accommodation [1-3]. Since the first pIOL implants for the correction of myopia, introduced by Fechner, Worst, and Baikoff almost 20 years ago, a number of different pIOLs made of rigid or foldable material have been designed and implanted [4]. A recently released pIOL, the AcrySof angle-supported lens (Alcon Laboratories Inc., Ft Worth, Texas) made of foldable hydrophobic acrylate, which gives the IOL and the haptics significant foldability. This would theoretically reduce damage to angle structures and decrease forward movement of the IOL with pupillary movement [5-8].

Aim of work:
The aim of this study was to evaluate the position of the AcrySof Cachet angle-supported pIOL for the correction of moderate to high myopia in patients by studying its presumed location over a period of follow-up of 6 months.

Material and Methods

The study included 19 adult patients (32 myopic eyes), with good general, ocular and mental health, suffering from stable moderate to high myopia (ranging between -6.0 to -16.0 diopters of myopia) in the intended operated eyes.

The consent was for the intervention and included the advantages of surgery, the risks of possible complications and the periodical follow-up for at least 6 months after surgery.

The patients were selected from the outpatient clinic of Kasr Al-Aini Hospital Cairo University between June 2010 and May 2011.

Inclusion criteria:
Patients had to be motivated to be spectacle independent and should have had realistic expectations and willingness to participate in an evaluating trial for a relatively new pIOL. Patients should
also have had tried other methods of correction of myopia before surgery and proved intolerant to either glasses cosmetically or to contact lenses.
- Best spectacle corrected visual acuity (BSCVA) of 6/12 or better.
- Myopia more than -10.0D.
- Myopia of less than -10.0D when keratorefractive procedures are not suitable e.g. corneas thinner than 500um.
- Anterior chamber depth of 2.8mm or more measured from the corneal endothelium to the anterior lens capsule using the pentacam.
- A pupil (under mesopic light conditions) smaller than 6.0mm in diameter using the pentacam.

Exclusion criteria:
- Astigmatism >2.0D.
- Abnormal cornea such as corneal opacity or corneal dystrophy.
- Abnormal pupil, fixed pupil or pupil greater than 7.0mm in mesopic light.
- Anterior segment pathology such as any form of cataract, pseudoexfoliation, pigment dispersion and severe iris atrophy.
- History and/or any clinical signs of previous attack of uveitis.
- Glaucoma or any Intraocular pressure (IOP) greater than 21 mmHg.
- Posterior segment pathology.
- Patient has undergone any previous intraocular surgery.

Preoperative evaluation:
After a full review of the patient's medical and ophthalmic history, all patients received complete ophthalmological examination including:
- Measurement of best spectacle corrected visual acuity using Snellen's visual acuity chart.
- Patients were manually refracted to their best correction using trial lenses and cycloplegic refraction.
- Slit lamp examination of the anterior segment.
- IOP measurement using Goldmann's applanation tonometry
- Gonioscopy of the anterior chamber angle using Goldmann's three mirror goniolens to exclude angle recession, angle trauma or anatomic anomalies.
- Fundus examination by indirect ophthalmoscopy and fundus biomicroscopy using the 90D lens.
- Scheimpflug imaging was performed preoperatively using the pentacam (WaveLight, Erlangen, Germany) to assess the distance between the corneal endothelium and the anterior surface of the crystalline lens, which represented the measured anterior chamber depth.

Surgical technique:
The anterior chamber was then accessed using a 2.60mm microkeratome knife. The incision was usually placed in the direction of the steepest axis.

Injection of the IOL was then started at the mid pupillary plan after loading in the P cartridge and on the injector system. After pausing for the leading haptics to unfold, injection was continued and as soon as the leading haptics reached the opposite angle the injector was slowly withdrawn out of the eye while continuing injection to avoid excessive compression in the distal angle.

Trailing haptics were left outside the incision and then tucked one at a time into the anterior chamber using a kuglen hook instrument.

Passive removal of the viscoelastic was then carried out by injection of intraocular irrigating solution (BSS) to displace the viscoelastic while slightly pressuring the posterior lip of the wound.

Post operative follow-up:
Patients were examined on the first postoperative day and one week after surgery. Subsequent examinations were done at 1,3 and 6 months.

Each visit candidates went through the following:
- Measurement of uncorrected visual acuity using Snellen's visual acuity chart.
- Manual refraction to their best correction using trial lenses and cycloplegic refraction.
- Measurement of best spectacle corrected visual acuity measured using Snellen's visual acuity chart.
- Slit lamp examination for the detection of any cataractous changes, acute/chronic inflammation or IOL deposits.
- Measurement of IOP using Goldmann's applanation tonometry.
- Scheimpflug imaging: The distance between the corneal endothelium and the anterior surface of the lens was evaluated to compare with preoperative values. In addition, the distance between
the corneal endothelium and the anterior surface of the IOL and the distance between the posterior surface of the IOL and the anterior surface of the lens were measured to evaluate IOL position in the anterior chamber and change over time.

Results

Thirty-two eyes of 19 patients were included in the statistical analysis. By the time of this analysis 32 eyes had received the angle-supported pIOL. One eye was implanted with the L12500 model, 17 eyes were implanted with the L13000, 12 eyes with the L13500 and 2 eyes with the L14000. All the eyes had completed the 6-month postoperative visit.

Patients recruited in this study had a mean age of 26.91±4.92 (standard deviation) ranging from 21 to 43 years old; 65.6% were females and 34.4% were males.

The mean preoperative mean refractive spherical equivalent (MRSE) of the operated eyes was −11.30 D ±3.37 ranging from −18.0 D to -6.0 D. The mean lens power of implanted IOLs was −12.14 D ±3.03 ranging from 16.5 D to 7.0 D.

A preoperative BSCVA of 6/12 was reached by 20 out of 32 eyes (62.5%) while BSCVA of 6/9 was reached by 9 out of 32 eyes (28.1%).

Postoperatively The BSCVA significantly improved from the pre-operative figures \( p > 0.05 \).

The anterior chamber depth remained stable over time. The position of the IOL in the anterior chamber, reflected by the distance from the corneal endothelium to the anterior surface of the IOL and the distance from the posterior surface of the IOL to the anterior capsule of the lens, also remained stable over time indicating IOL stability.

The mean anterior chamber depth pre implantation was 3.259mm, 3.209mm at 3 months and 3.225mm at 6 months. These slight changes in depth were statistically insignificant.

The IOL kept its recommended position in the anterior chamber with 2/3 of the depth above it and 1/3 below it in all eyes.

The Mean distance from the endothelium to the anterior surface of the pIOL was 2.085mm and 2.095mm at the 3 and 6 months visit respectively. On the other hand the mean distance from the posterior surface of the pIOL to the anterior surface of the natural crystalline lens was 1.004mm and 1.008mm respectively.

Discussion

Phakic IOLs have been shown to be useful in the correction of moderate to high myopia [9-11]. Implantation of pIOLs leads to better postoperative quality of vision than keratorefractive excimer laser surgery in the same myopic eyes [12].

However, questions remain about the potential long-term risks to anterior segment structures. Phakic IOLs should be well positioned with adequate stability so they do not damage the corneal endothelium and anterior lens capsule [13].

Therefore, stability of the pIOL in relationship to the intraocular structures is crucial to good performance over time because a lack of stability is directly related to complications.

This study found that the mean endothelium-pIOL distance and the mean pIOL-crystalline lens distance 6 months after implantation were 2.09 ± 0.18 and 1.0±0.15 respectively.

These are a little higher than Baumeister et al., who, evaluating the position of angle supported, Iris fixated and ciliary sulcus implanted pIOLs, found the mean endothelium-pIOL distance and the mean pIOL-crystalline lens distance 1 year after implantation for the angle supported pIOLs to be 2.04±0.16mm and 0.80±0.14mm [14]. This study’s results were also higher than Kohnen et al’s who found that the mean endothelium-pIOL distance and the mean pIOL-crystalline lens distance 1 year after implantation was 2.15 ±0.29mm and 0.86±0.22mm [8].

A factor may be that the mean preoperative anterior chamber depth was larger in our trial 3.25±0.19 than in the previous studies. This might lead to a larger central clearance distance that might secondary reduce the risk of endothelial cell injury and secondary glaucoma.
In 2012, Mastropasqua et al., found that the mean endothelium-pIOL distance was 2.38mm and the mean pIOL-crystalline lens distance was 1.04mm. The mean anterior chamber depth was 4.08mm [15]. These results correlated better with Ours.

The clearance distance between the corneal endothelium and the crystalline lens is an important factor to reduce the risk of endothelial cell damage and development of cataractar. If the distances are stable throughout time theses complications are minimized [16].

In this study we also compared the IOL position between visits to assess the variances in IOL position and we found that the overall mean differences in the 3 months and the 6 months visit were very small. This was consistent with Kohnen evaluating the lens position over time [8].

The reason for this slight change might be the accommodation caused by the fixation target on the camera, compared to the Iris fixated pIOLs which follow the iris's anteroposterior movement during accommodation.

Guell et al., who found that there was a significant decrease between the anterior surface of the pIOL and the endothelium during accommodation confirmed this phenomenon [17].

In conclusion, the angle supported pIOL showed excellent intraocular behavior, with no shortening of the distance between the pIOL and the corneal endothelium over time. Therefore, sufficient space was maintained between the pIOL and the anterior segment structures preventing the possibility of unwanted pIOL contact with ocular structures. Further evaluation for prolonged periods of time is needed before conclusions can be drawn.

References


