BIOMETRIC CHARACTERISTICS OF EYES IMPLANTED WITH PHAKIC INTRAOCULAR LENSES

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INTRODUCTION

The most prevalent eye condition affecting people of all ages is refractive errors. Since 43% of visual impairments are caused by refractive errors, numerous research and publications from the WHO suggest that refractive errors are the primary cause of visual impairment and the second leading cause of visual loss globally.
Refractive surgeries are becoming more popular as the days go, due to the advances in technologies as, excimer laser, femtosecond laser, and newer treatment modalities. Refractive errors can now be corrected by either refractive corneal surgery in the form of excimer laser, or refractive lens surgery in the form of refractive lens exchange (RLE), which is similar to cataract surgery, and phakic intraocular lenses, which are the focus of our discussion. The Visian implantable collamer lens (ICL) released by STAAR® Surgical was inspired by Dr. Fyodorov who designed the first posterior chamber phakic intraocular lens in 1986. Collamer is the trademark material for this lens, which is a copolymer of hydroxyethyl methacrylate and porcine collagen. Several Variables are needed in order to calculate the ICL power using the online calculator provided by STAAR Surgical which includes, 1) pre-operative manifest spherical and cycloplegic refraction, 2) Keratometric power, 3) Corneal thickness, 4) Horizontal white to white, and 5) Central AC depth.

AIM OF THE WORK

The aim of the study was to report on the phakic ICL vault and biometric characteristics of the anterior segment of eyes implanted with phakic ICLs.

PATIENTS AND METHODS

All patients operated upon for phakic ICLs for a myopic refractive error from January 2018 to December 2022 and presented to Alexandria Main University Hospital for routine follow up were included in the study.
A cohort of patients needed to complete at least 90 eyes was be randomly assigned for study inclusion based on sample size calculation.
Inclusion criteria for our study includedpatients between the age of 18 and 38 that had undergone phakic ICL implantation for a myopic refractive error. Sample size was calculated using IBM SPSS statistics power analysis software (version 28.0.1.0).

Data that was extracted from the patients' charts included (subject to data availability):
- Patient's demographic characteristics.
- Pre-operative clinical data, including – but not limited to – refraction, keratometry, Scheimpflug Imaging, white-to-white data, best corrected visual acuity.
Operative data including type and brand of implanted ICL, implantation orientation (horizontal vs. vertical), as well as any intraoperative or early postoperative complications.
Thorough ophthalmic examination was ensued and included:
- Uncorrected visual acuity and best corrected visual acuity.
- Manifest refraction.
- Anterior segment examination by slit -amp.
- IOP measurement using Goldman applanation tonometer.
- Fundus examination using slit lamp indirect ophthalmoscopy.
- IOL Master® (Carl Zeiss Jena, Germany) was used to obtain biometric measurements of the anterior segment of the eye, including central corneal thickness (CCT), White-to-white (WTW) distance, and anterior chamber depth (ACD).
Ultrasound Bio-microscopy of the study eyes was performed using AvisioQuantel® device (Quantel Medical Company, France) with the clearscan® attachment to image the anterior segment.
Data were tabulated and statistical analysis was performed using Microsoft EXCEL (Microsoft Inc, USA). Quantitative variables were described as mean, standard deviation and range. Student t test was used to compare between groups and the Pearson correlation coefficient was used to study correlation between quantitative variables with statistical significance set at 0.05 level.

RESULTS

Table 1: Comparing Sulcus to Sulcus measurements per mode of implantation.

Among all eyes			
Term	**Horizontal**	**Vertical**	**p-value**
Sulcus to Sulcus (mm)	11.7 (1)	12 (0.9)	U: 0.0021**
Vertical implantation only			
Sulcus to Sulcus (mm)	11.6 (0.7)	12 (0.6)	t: 0.0043**
Horizontal implantation only			
Sulcus to Sulcus (mm)	11.7 (0.7)	11.9 (0.6)	t: 0.2653
α = 0.05. p < 0.05*, p < 0.01, p < 0.001***			
P-values obtained from two-sample t-test (t) or Mann-Whitney test (U)			

Table 2: Comparing ICL Vault measurements per mode of implantation.

Among all eyes			
Term	**Horizontal implantation**	**Vertical implantation**	**p-value**
ICL Vault (in microns)	440 (270)	340 (220)	U: <0.001***
Vertical measurement only			
Term	Horizontal implantation	Vertical implantation	p-value
ICL Vault (in microns)	440 (270)	315 (187.5)	U: 0.0045**
Horizontal measurement only			
Term	Horizontal implantation	Vertical implantation	p-value
ICL Vault (in microns)	445 (247.5)	365 (232.5)	U: 0.0046**
α = 0.05. p < 0.05*, p < 0.01, p < 0.001***			
P-values obtained from two-sample t-test (t) or Mann-Whitney test (U)			

CONCLUSION

1. Sulcus to Sulcus diameter was found significantly larger in the vertical meridian compared to horizontal although few showed the opposite.
2. ICL vaulting is significantly lower when ICL is implanted along the vertical meridian
3. BCVA was found significantly better when ICL is implanted vertical and requires further studies.
4. Cataractous changes postoperatively were found significantly more when ICL is implanted along the Horizontal meridian, but whether it was iatrogenic induced or developed post-operatively warrants further investigation.
5. IOP appeared to be not affected with the ICL implantation in both meridians.
6. ICL surgery is considered a safe, effective, and predictable surgery whether implanted in vertical or horizontal merdian if accurate measurements are performed preoperatively.