ANALYSIS OF CORNEAL POWER AND TORICITY MEASURED BY A SWEPT SOURCE OPTICAL COHERENCE TOMOGRAPHY-BASED BIOMETER

Gamal Mohamed Omar Khedr, Hazem Wahid Kandil, Youstina Nashaat Latif Sultan
Department of Ophthalmology, Faculty of Medicine, Alexandria University

Introduction

In refractive cataract surgery, accurate intraocular lens (IOL) power calculation is crucial for achieving desired refractive outcomes.

Factors such as measurement errors of axial length (AL), corneal power, and pseudophakic anterior chamber depth (ACD) affect refractive status. Optical biometry has gained popularity due to its non-invasiveness and inter-operator reproducibility.

Devices like IOLMaster 700, Argos, and OA-2000 use swept-source optical coherence tomography (SS-OCT) for accurate measurements.

Total corneal astigmatism is a critical element in correcting astigmatism during cataract surgery. Newer technologies like slit-scanning technology, Scheimpflug devices, and optical coherence tomography are used for measuring the posterior corneal surface.

The IOLMaster 700 is the first swept-source OCT biometry device, enabling high-speed and high-resolution imaging of the cornea and better corneal thickness measurement than scanning-slit topography. It combines unique telecentric keratometry measurement of the anterior corneal surface with measurement of the posterior corneal surface in order to calculate Total Keratometry (TK).

Aim of the Work

To describe and analyze the total, anterior and posterior corneal astigmatism measurements obtained from the IOLMaster 700 and assess how they compare to measurements by other devices.

Patients and Methods

This study reviewed patients scheduled for cataract surgery who had corneal power measurements for intraocular lens power calculation using the IOLMaster 700.

Two hundred eyes were enrolled, with criteria including clear cornea, no corneal or other ocular disease, no previous ocular trauma or surgery, and good-quality IOLMaster 700 scans.

Four categories of corneal astigmatism were identified: CAStdK, CAant, CApost, and CATotK. Data were analyzed and presented, including mean, SD, and range of astigmatism, distribution of magnitude up to 0.25 D, 0.50 D, 0.75 D, and 1.00 D, anterior versus posterior corneal astigmatism, total corneal astigmatism (CATotK) versus other categories, and total versus standard corneal stigmatism.

The study also evaluated the correlation of magnitude and orientation of astigmatism, total versus standard corneal stigmatism, and differences in the location of the steep meridian between CATotK and CAStdK. The findings provide valuable insights into the factors affecting corneal astigmatism and the need for further research.

Results

Table 1: Comparison of the axis of keratometry of the studied sample

Steep meridian	Anterior K		Posterior K		Total K		Standard K		Test of significance (p)
	No.	%	No.	%	No.	%	No.	%	
Axis 1									
Vertically			20	10.0	121	60.5	107	53.5	χ^2= 130.937, p< 0.001*
Obliquely			52	26.0	35	17.5	37	18.5	
Horizontally			128	64.0	44	22.0	56	28.0	
Axis 2									
Vertically			128	64.0	44	22.0	56	28.0	χ^2= 130.937, p< 0.001*
Obliquely			52	26.0	35	17.5	37	18.5	
Horizontally			20	10.0	121	60.5	107	53.5	
Δ axis									
Vertically	94	47.0	128	64.0	121	60.5	107	53.5	χ^2= 34.496, p< 0.001*
Obliquely	39	19.5	52	26.0	35	17.5	37	18.5	
Horizontally	67	33.5	20	10.0	44	22.0	56	28.0	

Table 2: Mean aggregate difference between CA_{TotK} and other categories

	CA_{TotK} - CA_{StdK}	CA_{TotK} – CA_{ant}	CA_{TotK} - CA_{post}
Arithmetic mean difference	0.25	0.26	2.44

Table 3: Mean aggregate of corneal astigmatism

	Mean aggregate
CA_{stdk} power	1.20 ± 0.06
CA_{ant} power	1.34 ± 0.07
CA_{post} power	0.25 ± 0.02
CA_{totk} power	1.28 ± 0.06

Table 4: Mean vector difference of corneal astigmatism

	CATotK - CAS_{tdK}	CA_{TotK} – Caant	CA_{TotK} - CA_{pos}t
Mean vector difference	0.25 ± 0.15	0.26 ± 0.18	2.44 ± 12.29

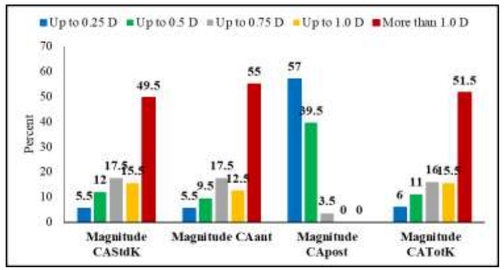

Figure 1: Distribution of magnitude of astigmatism

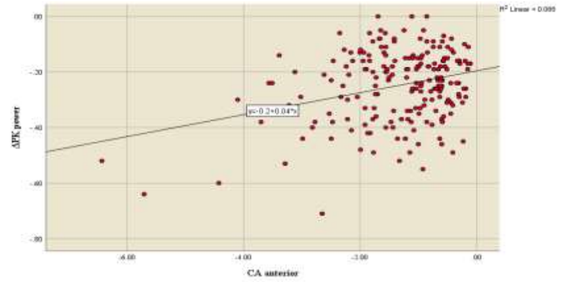

Figure 2: Correlation of CA_{ant} power and CA_{post} power

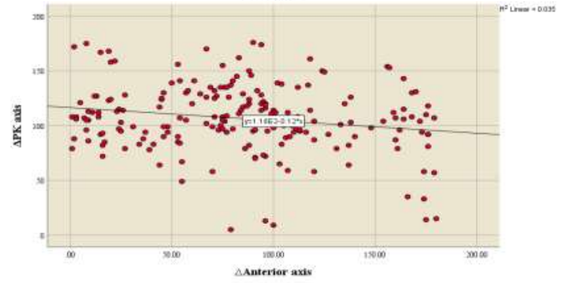

Figure 3: Correlation of CA_{ant} axis and CA_{post} axis

Conclusion

In the present study: the IOL master 700 as a Swept source optical coherence topography based biometer was found to be accurate & very effective in measuring anterior, posterior & total corneal power & astigmatism, as measuring the posterior corneal power & astigmatism by the IOL is so important to calculate the most accurate Total Keratometry (TK) & provide immediate lens calculations.

Comparing the IOL Master 700 with other devices we concluded from this study that Pentacam oculus and IOL master 700 are excellent noncontact devices for assessment and accurate measurement of anterior segment parameters of the eye. IOL master gives slightly higher K-reading than Pentacam and total corneal power (TCP) of combined placido-dual Scheimpflug imaging system. This difference may be statistically significant but we needs to know by further studies if it's practically significant or not, also IOL Master 700 total keratometry.