Comparison of intraocular lens formulas in eyes with previous myopic laser refractive surgery using total keratometry

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Background

Patients who have undergone prior myopic corneal refractive surgery still present a challenging conundrum for accurate intraocular lens power (IOL) calculations.[1] After myopic refractive surgery, the relationship between the anterior and posterior corneal curvatures is altered, which changes the standard keratometric index used in conventional keratometry (K), hence resulting in overestimation of the corneal power. Secondly, a flatter K post-myopic refractive surgery estimates an erroneously anterior effective lens position. These errors result in an underestimation of IOL power and produces a hyperopic refractive surprise.[3]

A recent advancement in technology is promising in addressing keratometry measurement errors, where the IOLMaster 700 version 1.70 (Carl Zeiss Meditec AG, Jena, Germany) has enabled the measurement of total corneal power (total keratometry) by using telecentric keratometry and swept source optical coherence tomography.

Our aim is to compare and evaluate the accuracy of using standard versus total keratometry with no-history IOL formulas in patients undergoing cataract surgery after previous myopic refractive surgery in a large-scale study.

Methods

This study conducted a retrospective review of 517 consecutive eyes that had previous myopic refractive surgery (Laser Assisted In-situ Keratomileusis (LASIK) or Photo-Refractive Keratectomy (PRK)) and underwent an uneventful cataract surgery at the Singapore National Eye Centre, Singapore and Tan Tock Seng Hospital, Singapore between June 2017 to April 2022, and between March 2015 and January 2023 respectively.

Refractive prediction accuracy was compared for current no-history IOL formulas.

Results

Table 1: Comparison of IOL formulas (n = 517)

IOL formula	Mean error (D) ± SD	MAE (D)	MedAE (D)	RMSE (D)
EVO TK	-0.057 ± 0.574	0.425	0.311	0.577
EVO	-0.059 ± 0.592	0.447	0.336	0.594
Barrett True-K TK	-0.150 ± 0.597	0.463	0.345	0.615
Barrett True-K	-0.207 ± 0.609	0.496	0.395	0.643
Haigis TK	0.156 ± 0.643	0.496	0.373	0.661
PEARL-DGS	-0.252 ± 0.642	0.542	0.432	0.689
ASCRS Ave	-0.369 ± 0.619	0.579	0.486	0.721
Hoffer QST	0.071 ± 0.732	0.567	0.466	0.735
Shammas-PL	-0.447 ± 0.661	0.648	0.550	0.798
Haigis-L	-0.454 ± 0.678	0.661	0.563	0.815

Abbreviations: SD, Standard Deviation; MAE, Mean Absolute Error; MedAE, Median Absolute Error; RMSE, Root Mean Square Error

Figure 1: Percentage of eyes with absolute prediction errors within 0.25/0.50/0.75/1.00D.

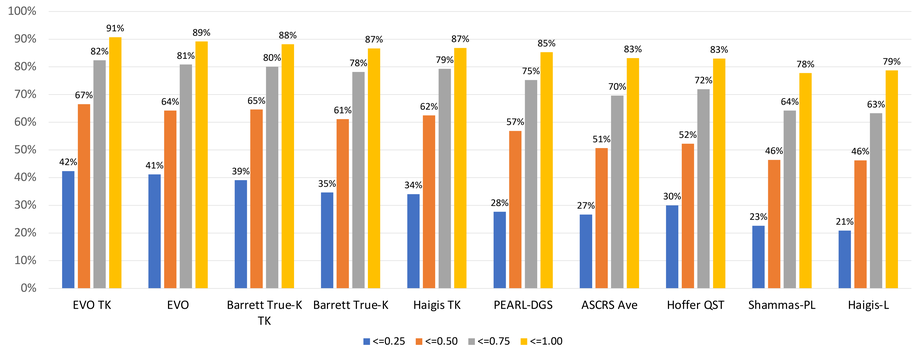


Table 3: Accuracy of IOL formulas for different axial length subgroups

	≤26mm (n = 161)			>26mm to ≤29mm (n=288)			>29mm (n = 68)		
	Mean Error	RSME	≤0.50D	Mean Error	RSME	≤0.50D	Mean Error	RSME	≤0.50D
EVO TK	-0.029	0.520	75%	-0.086	0.573	65%	0.000	0.706	53%
EVO	-0.044	0.514	73%	-0.081	0.607	63%	-0.001	0.704	51%
Barrett True-K TK	-0.175	0.556	70%	-0.139	0.600	65%	-0.134	0.788	53%
Barrett True-K	-0.275	0.593	64%	-0.159	0.626	61%	-0.248	0.807	53%
Haigis TK	-0.052	0.559	73%	0.154	0.621	63%	0.654	0.976	38%
PEARL-DGS	-0.416	0.690	55%	-0.265	0.674	59%	0.190	0.750	54%
ASCRS Ave	-0.487	0.724	50%	-0.341	0.710	52%	-0.210	0.755	46%
Hoffer QST	-0.042	0.604	65%	-0.027	0.687	52%	0.756	1.113	25%
Shammas-PL	-0.580	0.823	43%	-0.449	0.791	47%	-0.128	0.765	50%
Haigis-L	-0.607	0.819	41%	-0.416	0.794	49%	-0.253	0.890	46%

Conclusions

Our study found that EVO TK, followed by EVO, then Barrett True-K TK performed the best. Patients with an axial length (AL) of <26.0mm would achieve similar target refraction outcomes to that of a normal eye, but patients with a longer AL, especially >29.0mm, would only be able to achieve within 0.50D of target refraction around 50% of the time. Our findings have clinical implications on the way we counsel and treat post-myopic laser refractive surgery patients to achieve an optimal refractive outcome post-cataract surgery.

References

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