INTRAOCULAR LENS POWER CALCULATION AFTER RADIAL KERATOTOMY

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INTRODUCTION

Surgeons have long been aware of the difficulties that radial keratotomy (RK) poses for IOL calculations when patients later present for cataract surgery. Challenges are in peri-operative planning, surgical execution and refractive expectations.

Firstly, RK alter the basic assumptions on which the biometry for IOL calculations is based – namely the perfectly spherical nature of cornea affecting the normal corneal curvature and anterior: posterior relationship. Secondly, the optical zone is often less than 3.0mm, so standard keratometry measures the region representing the inflection point between the incised cornea and the indirectly flattened central zone leading to overestimation of corneal power and a risk of hyperopic refractive error when standard formulae are used. Furthermore, post-RK corneas are frequently irregular with multiple steep and flat areas, making determination of the net steep and flat meridians challenging.

AIM OF THE WORK

This study aims at comparing different intraocular lens (IOL) power calculation formulas in patients who have undergone cataract surgery after radial keratotomy (RK).

PATIENTS AND METHODS

This study was a retrospective study tracking the intra-ocular lens (IOL) power calculation results of 30 eyes of patients who have undergone cataract surgery with IOL implantation after having previous radial keratotomy (RK).

Axial length, keratometric reading and anterior chamber depth were revised from records and used as input for the formulas to be evaluated. The 9 formulas included were SRK/T, Haigis, Hoffer Q, Holladay 1, Holladay 2, SRK II, Barrett universal II, Holladay –DK and Barrett true K. The achieved spherical equivalent outcome was compared with the target outcome for each eye with each formula. This was done through calculating the refractive prediction error for each formula for each eye by subtracting the predicted refraction based on implanted IOL power from the actual postoperative refraction.

Following this, the mean arithmetic error was calculated and the predictability of the formulas were calculated by percentage for each formula at ± 0.50 D, ±1.00 D, and ±2.00 D.

RESULTS

Table 1: Descriptive analysis of the studied cases according to Mean Error and Absolute Error (n=30)

	Mean Error			Absolute Error		
	Min. – Max.	**Mean ± SD.**	**Median (IQR)**	**Min. – Max.**	**Mean ± SD.**	**Median (IQR)**
SRK T	-0.13 – 4.40	1.77 ± 1.02	1.80 (1.09–2.39)	0.13 – 4.40	1.78 ± 1.01	1.80 (1.09–2.39)
SRK II	-1.48 – 5.50	2.18 ± 1.43	2.02 (1.22–2.92)	0.51 – 5.50	2.28 ± 1.27	2.02 (1.48–2.92)
Haigis	-0.93 – 2.58	0.38 ± 0.77	0.26 (-0.06–0.87)	0.04 – 2.58	0.65 ± 0.56	0.56 (0.21–0.93)
Hoffer Q	-0.59 – 2.78	0.58 ± 0.71	0.52 (0.04–0.95)	0.04 – 2.78	0.70 ± 0.59	0.60 (0.27–0.95)
Barrett universal	-0.36 – 3.59	1.24 ± 0.85	1.31 (0.73–1.74)	0.22 – 3.59	1.29 ± 0.78	1.31 (0.73–1.74)
Holladay 1	-0.01 – 3.78	1.51 ± 1.0	1.40 (0.80–2.12)	0.0 – 3.78	1.51 ± 1.0	1.40 (0.80–2.12)
Holladay 2	-0.29 – 3.82	1.16 ± 0.83	1.18 (0.56–1.64)	0.05 – 3.82	1.18 ± 0.80	1.18 (0.56–1.64)
Barrett true-K	-0.39 – 3.02	0.71 ± 0.71	0.70 (0.19–1.15)	0.03 – 3.02	0.76 ± 0.65	0.70 (0.24–1.15)
Holladay-DK	-0.81–2.32	0.38 ± 0.82	0.18 (-0.17–0.96)	0.04 – 2.32	0.65 ± 0.61	0.41 (0.17–0.96)

Table 2: Distribution of the studied cases according to percentage of patients at ±0.5, ± 1.0, and ± 2.0 (n=30)

Absolute Error	**±0.5**	**±1**	**±2**
	No. (%)	**No. (%)**	**No. (%)**
SRK T	3^{b} (10.0%)	7^{c} (23.3%)	18^{ab} (60.0%)
SRK II	0^{b} (0.0%)	5^{c} (16.7%)	15^{b} (50.0%)
Haigis	14^{ab} (46.7%)	24^{a} (80.0%)	29^{a} (96.7%)
Hoffer Q	14^{ab} (46.7%)	23^{a} (76.7%)	29^{a} (96.7%)
Barrett universal	5^{b} (16.7%)	11^{c} (36.7%)	25^{a} (83.3%)
Holladay 1	6^{b} (20.0%)	10^{c} (33.3%)	22^{ab} (73.3%)
Holladay 2	6^{b} (20.0%)	12^{bc} (40.0%)	27^{a} (90.0%)
Barrett true-K	14^{ab} (46.7%)	21^{ab} (70%)	29^{a} (96.7%)
Holladay-DK	17^{a} (56.7%)	23^{a} (76.7%)	29^{a} (96.7%)
Fr (p)	62.795*(<0.001*)	97.751*(<0.001*)	73.818*(<0.001*)

Fr: Friedman test, Sig. bet. periods was done using Post Hoc Test (Dunn's)
p: p value for comparing between **the different studied Absolute Error parameters**
*: Statistically significant at $p \leq 0.05$
Means with **Common letters** are not significant (i.e. Means with **Different letters** are significant)

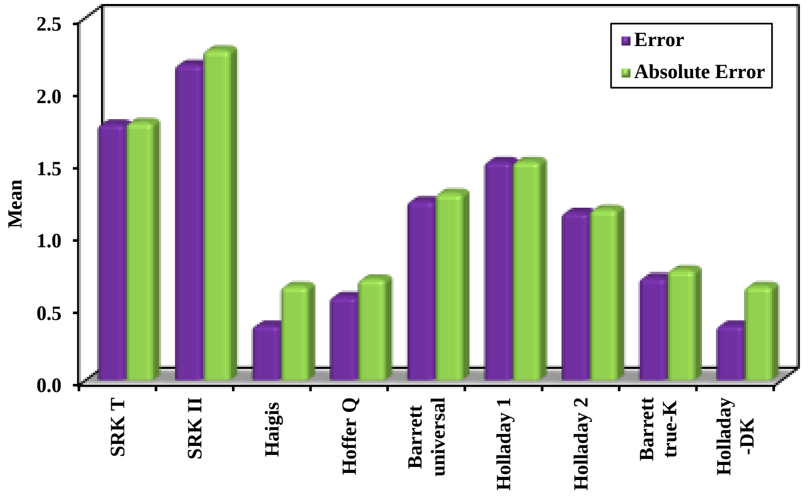

Figure 1: Descriptive analysis of the studied cases according to error and absolute error (n=30)

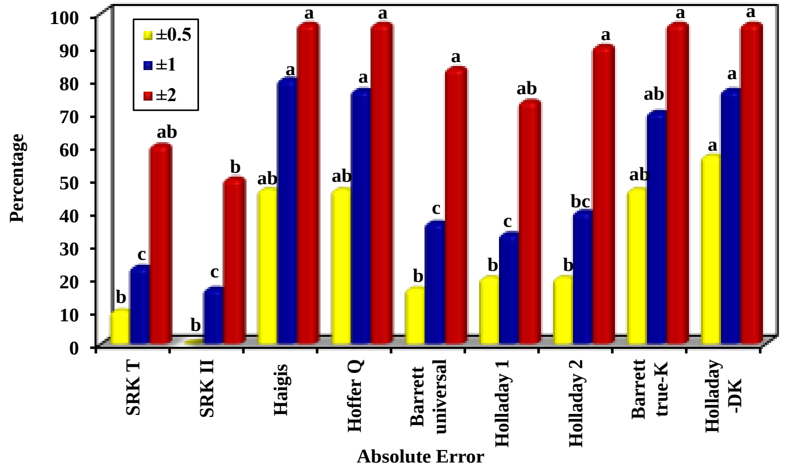

Figure 2: Distribution of the studied cases according to percentage (n=30)

CONCLUSION

Holladay-DK results had more than half the cases within ±0.5 (56.7%). There was no significant difference between the holladay - DK results and the Haigis, Hoffer Q and Barrett true k results. All 4 formulas showed close results even at the ± 2 D were all were within 96.7% of cases. However, the 4 formulas results were significant to the other 5 forumlas studied.

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