Cataract Surgery in Keratoconus: An Interesting Case

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A 52 year old male patient presented with complaints of diminished vision in both the eyes, the left eye since many years. He had never used glasses in the past and had not had a complete eye checkup too. As regards the left eye, he vaguely remembered being told that his left eye was very weak and that nothing could be done for it.

Vision in the Right eye was 6/36 P&Left eye was 6 feet finger counting , with both the eyes having nuclear grade 2-3 cataract. Intraocular pressure & fundi were normal in both the eyes.

Corneal topography (Figure I), Pentacam (Figure 2 & Figure 3) & Biometry with IOL master 700 (Figure 4 & 5, Figure 8) was performed for both the eyes.

Figure 1 : Corneal topography on Atlas Topographer

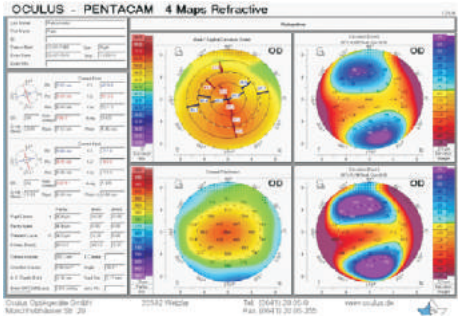

Figure 2 : Pentacam 4 map refractive map of the Right eye

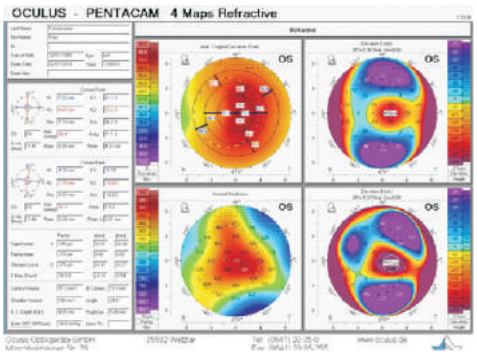

Figure 3 : Pentacam 4 map refractive map of the Left eye

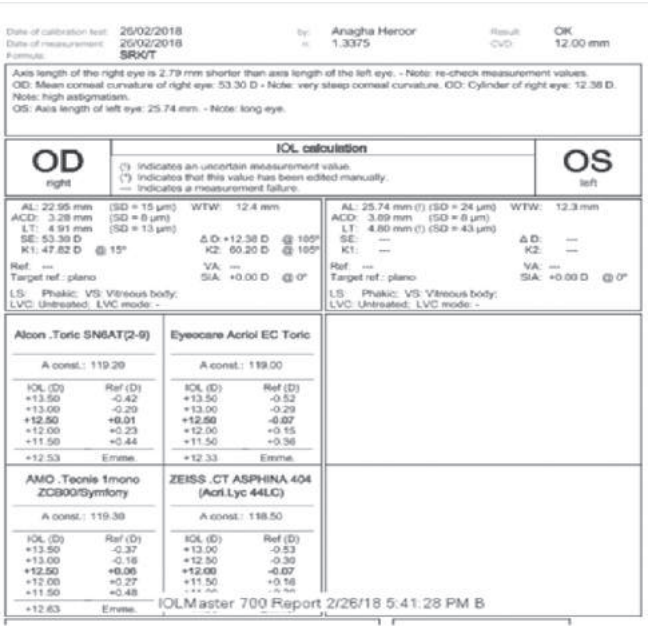

Figure 4 : IOL Master 700 report Right eye

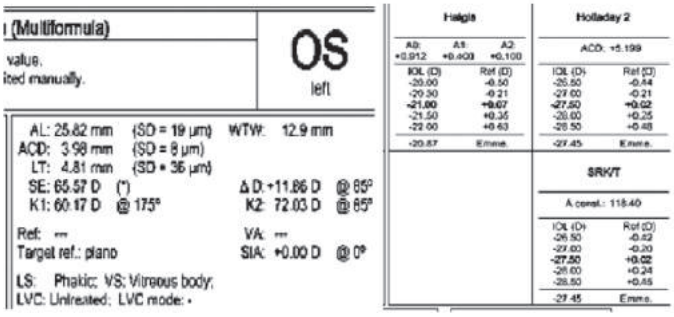

Figure 5 : IOL Master 700 report left eye

The keratometry readings in both the eyes in various instruments were as follows.

Instrument	RE K1	Re K2	LE K1	LE K2
Auto K	59.50 X 103	47.25 X 13	Not recordable	Not recordable
Topography	58.21@106	47.67@16	72.5@89	61.15 @179
Pentacam 4 map	57.3@106	47.8@16	72.2@89	61.2@179
IOL Master	60.2@105	47.8@15	Not recordable	Not recordable
Axial length	22.95 mm		25.82 mm	
ACD	3.28 mm		3.98 mm	
Lens thickness	4.91 mm		4.81mm	

The Right eye, being the better eye, was operated first. As the astigmatism was very high, it was decided to use a toric Intraocular lens.

The SRK T formula gave a 12.5 D power for the Alcon toric, Tecnis Toric & the IO care toric Intraocular lenses, but they could not correct the astigmatism completely. The Barett calculator showed a residual astigmatism of 7.09 D cylinder even with a T9 IOL with a 9 D power.(Figure 6) Hence, it was decided to use a customised Ultima Smart Toric IOL from the care group (Figure 7), which needs to be placed in the 0-180 axis, with a cylinder power of 18 D at the IOL plane and an anticipated residual astigmatism of 0.14 D @ 104 degrees and an incision at 180 degrees.

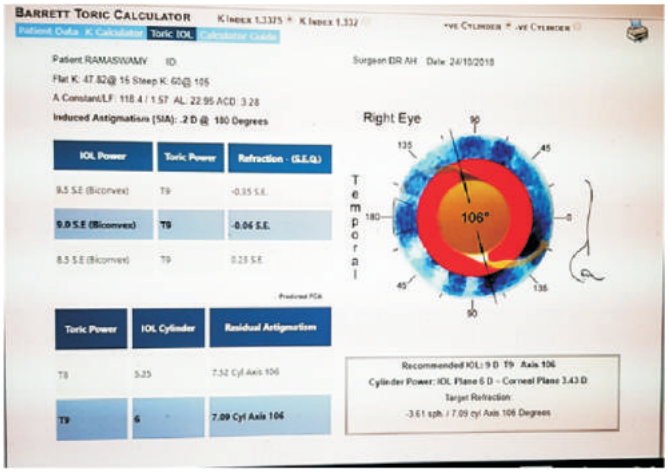

Figure 6 : Barrett toric calculator Right eye

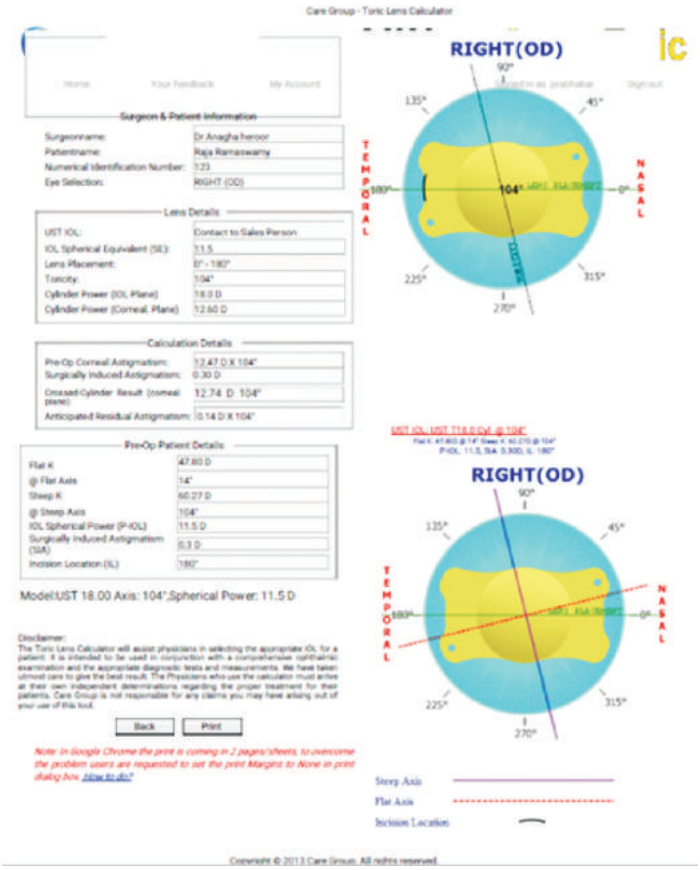

Figure 7 : Ultima smart toric calculation Right eye

We went ahead with the Right eye surgery with an excellent result. The patient improved to 6/9p with -1.0 D cyl @ 105.

The left eye was the bigger challenge.The patient had poor vision in the left eye since childhood though he was never diagnosed or treated. He hadno hopes at all and very low expectations, and he didn't want any other surgery except the cataract surgery. Hence, we just gave it a try as there was nothing to lose, so , under very severe guarded prognosis, we went ahead.

In the left eye, the Auto k and the IOL master 700 could not measure the K readings. Hence, the topography K readings were taken which were comparable to the pentacam readings in the EKR report at the 4.5 mm zone (Figure 4)and the 4 map report. The graph in the EKR report also showed a wide variability in the K readings from almost 50 D to 77 D which indicated a poor prognosis. The corneal wavefront showed a horizontal coma of 5.3 microns.

The topography readings were fed in the IOL master 700 and the IOL power was calculated, which gave an axial length of 25.82 mm. We wanted to confirm the axial length on the

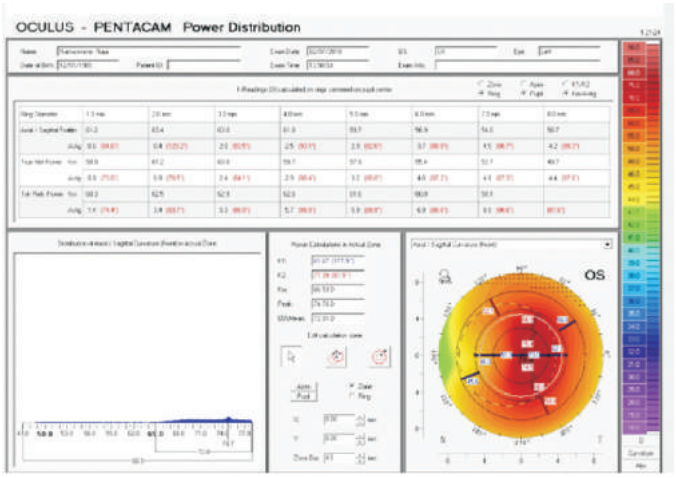

Figure 8 : Pentacam Power distribution map Left eye

immersion biometry which also showed a comparable reading of 25.7 mm. However, the ultrasound Ascan biometer did not accept a K reading of more than 68 D. Hence , K1 and K2 readings entered were reduced by 4 D each. It gave an IOL power of -20.5 D with the SRK T formula and an A constant of 118.7 (Figure 9). The IOL master , gave an IOL power of -20.5 D with the Haigis and -27 D with the SRK T and the Holladay II formulae for the Ultima lens that we were planning to use.

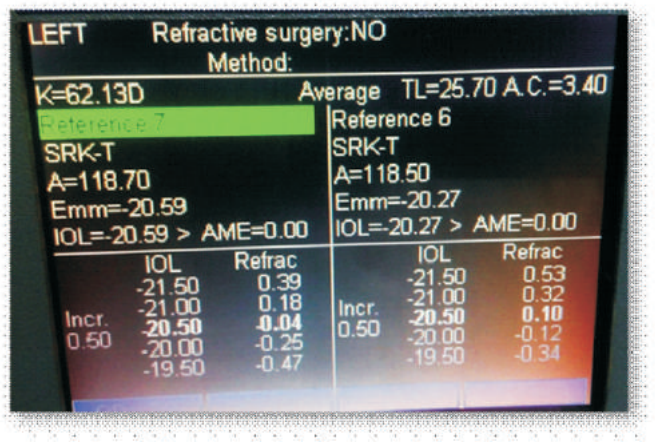

Figure 9 : Immersion Biometry Left eye

The Barrett Universal II (not more than 55D K), the Barrett Toric calculator (not more than 60 D K)& the Hill RBF calculator(not more than 52 D K and not less than -5 D IOL power) refused to accept such high K readings.

It was decided to use a customised Ultima smart toric IOL again in the left eye with a spherical IOL power of -20 D and +17 D cylinder @ 85 degrees at the IOL plane with an anticipated residual astigmatism of 0.21 D @ 85 degrees, with incision at 0 degrees & IOL aligned in the 0-180 degrees axis (Figure 10). The next day postop, the vision improved to 6/60 with a cylinder of -5.0 D cyl @ 140 degrees with an anti-clockwise rotation of 15 degrees. Hence, the patient was taken up the same day for an IOL rotation without using any viscoelastics and the IOL was aligned to the 0-180 degree axis. The vision improved to 6/36 with a manifest refraction of -2.0 D cyl at 160 degrees.

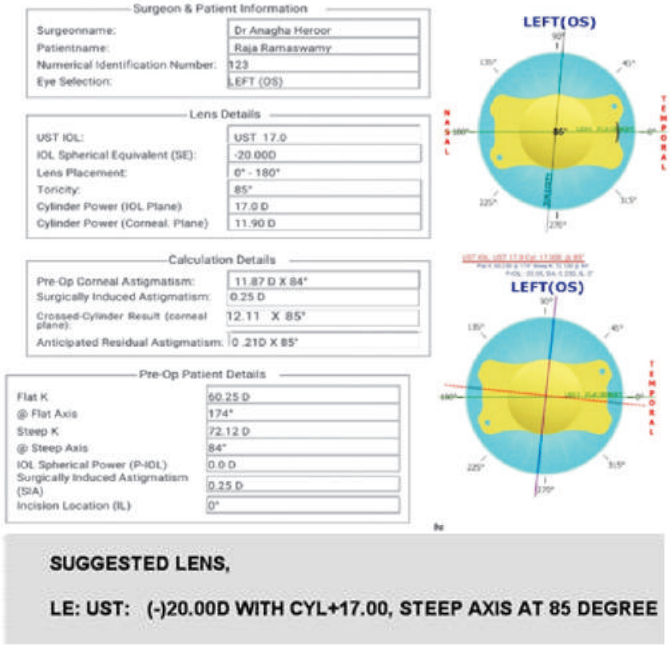

Figure 10 : Customised Ultima Smart Toric calculation Left eye

The total eye aberrometry done 1 month later showed the following readings

RE RMS HOA 0.57 microns

LE RMS HOA 1.07 microns.

The patient was extremely happy with the result. We were pleased that inspite of having very high astigmatism and an advanced keratoconus especially in the left eye, we were able to atleast debulk the astigmatism and give the patient a good visual outcome with fairly good functional vision.

Discussion:

There are usually 3 reasons for wrong IOL power calculations in keratoconus -index of refraction error, instrument error&formula error. Calculating the corneal power with the standard keratometric index (n =1.3375) can lead to erroneous results as the B/A ratio is disrupted. The very steep & asymmetric corneal curvature causes an error in the K reading & a variability in the K reading in different instruments.

In general, all formulas produced a positive mean Predicted error (PE), meaning that a hyperopic refractive outcome is likely to occur inmost keratoconus patients. In Stage

I & stage II of keratoconus (Krumeich classification), the SRK T formula was found to give the least error. Even in cases of stage I , most formulas achieved a percentage of eyes with a Predicted Error within +/-0.5 D close to 40%, a value that is much lower than that reported for normal eyes. In eyes with stage III keratoconus, almost all the formulae were unpredictable, with mean PEs and median absolute error higher than 2.5 D.[1]

All formulas tend to have a hyperopic surprise. The Barrett Universal II formula was the mostaccurate for mild to moderate disease.[2] Pentacam keratometry may help avoid hyperopic outcomes.

Overall, these results suggestgreat caution when targeting any refractive outcome ineyes with keratoconus, especially when the preoperativeK value is higher than 48 D.

References:

1. Kamiya K,Kono Y, Takahashi M, Shoji N Comparison of Simulated Keratometry and Total Refractive Power for Keratoconus According to the Stage of Amsler–Krumeich Classification Sci Rep. 2018; 8: 12436.e text here
2. Iijima K, Kamiya K, Iida Y, Shoji N Comparison of Predictability Using Barrett Universal II and SRK/T Formulas according to Keratometry J Ophthalmol. 2020; 2020: 7625725

Ophthalmic News (Compiled from OBN Ophthalmic Breaking News)

Biodegradable Glaucoma Implant Study From PolyActiva

The latest announcement about glaucoma treatment study has come recently from a clinical-stage Australian ophthalmology biopharmaceutical company, PolyActiva Pty Ltd. According to the announcement, the company has completed its Phase I clinical study for its lead candidate, the Latanoprost FASR Ocular Implant.

The implant device was well tolerated in all 8 patients without any significant safety findings and the study also showed that the implant persists for the entire 6-month treatment period after which the implant biodegrades completely over six weeks. This biodegradation profile should enable repeat dosing with the implant.

The Latanoprost FASR Ocular Implant is designed to substitute for daily drop therapy by providing sustained treatment from a single implant administration over six months to treat glaucoma.

PolyActiva has now initiated a Phase II dose-ranging study at nine clinical trial sites in Australia. The study is designed to identify the minimum effective dose of latanoprost free acid and confirm the safety of the implant.

High-dose Sirolimus appears Safe, effective for Noninfectious Uveitis of Posterior Segment

This trial evaluated intravitreal sirolimus for noninfectious uveitis of the posterior segment. Researchers randomized 416 patients to receive sirolimus (44 µg or 440 µg) on days 1, 60 and 120 of treatment. By 5 months, corticosteroids were tapered successfully in approximately 69% of both groups. The 440-µg arm had better inflammation control, as measured by vitreous haze, compared with the 44-µg arm. Both doses were well tolerated and had minimal impact on IOP. Approximately 80% of sirolimus-treated patients maintained or improved BCVA by more than 5 letters. A higher 880-µg arm was terminated as it appeared to offer comparable benefits to the 440-µg dose. *Ophthalmology, October 2020*