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Case Report

Monovision in a case of bilateral high hyperopia by refractive lens exchange with customised foldable IOL

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ABSTRACT

This case report describes about the feasibility of monovision in a case of bilateral high hyperopia for achieving spectacle independence following refractive lens exchange (RLE) A 19-year male presented with diminution of vision (DOV) since 15 years oculus uterque (OU). On examination, unaided distance visual acuity (UDVA) was 20/1000 in OU and corrected distance visual acuity (CDVA) was 20/125, N18 with a refraction of +12.25DS/+1.25DC (DS: Dioptre sphere, DC: Dioptre cylinder) @140 degrees in oculus dexter (OD) and +12.75DS/+1.50DC @25 degrees in oculus sinister (OS). Primary diagnosis was high hyperopia. Refractive lens exchange with a monofocal intraocular lens (IOL) and monovision by targeting dominant OS to emmetropia and non-dominant OD to myopia of -2.00D was planned for the patient. The IOL power was calculated by multiple formulae and we decided to implant +46.0D in OD and +47.0D in OS calculated using personalized A-constant. At post-op day 15, no complications were noted, UDVA in OD was 20/250 and in OS was 20/200 and CDVA was 20/125 OU, uncorrected near visual acuity (UNVA) was N18 OU with a refraction of -2.00DS/-2.50DC @95 degrees in OD and +0.25DS/ -1.75DC @125 degrees in OS (Monovision) which was stable even at 6 months follow up RLE in high hyperopia requires meticulous planning and biometry to give good results. Monovision can be planned in such a case to deliver spectacle independence. It can thus be a valuable tool in the armament of refractive surgeon.

Keywords: Refractive lens exchange, High hyperopia, Pseudophakic monovision

INTRODUCTION

In patients with severe anisometropia, bilateral high ametropia or lesser residual stromal bed thickness for kerato-refractive procedures, phakic intraocular lens (IOL) implantation or refractive lens exchange (RLE) are preferred options for refractive surgery.[1] RLE or intraocular surgery in patients with high hyperopia can be surgically challenging, mainly due to a shallow anterior chamber, increased risk of choroidal effusion, choroidal detachment and macular oedema.[2]

PATIENT CONSENT STATEMENT

The patient agreed and consented to the surgical procedure (RLE with monovision) having been explained in vernacular language about the advantages and disadvantages of the surgery and the likely complications associated. Informed written consent has been taken and a copy of it has been uploaded. IRB/Ethics Committee approval was taken for this case report.

CASE REPORT

A 19-year-old male presented with diminution of vision in oculus uterque (OU) for 15 years. Unaided distance visual acuity (UDVA) was 20/1000 OU improving to 20/125 and uncorrected near visual acuity (UNVA) was N24, improving to N18, with refraction of +12.25 DS/+1.25 DC @140° in oculus dexter (OD) and +12.75 DS/+1.50 DC @25° in oculus sinister (OS). Measurement of visual acuity was done using ETDRS charts (Precision Vision, La Sella, IL, USA). OS was dominant. Intraocular pressures recorded with non-contact tonometry (NCT) (Tomey NCT, NishiKu, Nagoya, Japan) was 12 mm Hg in both the eyes. Gonioscopy revealed open angles in both eyes.

On examination, the patient had deep set eyes, orthophoria on cover test, extraocular movements were full and free and nanophthalmos (Axial length by optical biometry: IOL Master 700 [Carl Zeiss Meditec, Jena, Germany] [no financial interest] OD – 17.16 mm, OS – 17.06 mm), with a well-dilating pupil in both eyes (8 mm). Dilated fundus examination revealed hyperopic disc OU and few areas of white without pressure temporally and no treatable lesion. Corneal topography (Pentacam HR, Oculus, Wetzlar, Germany) revealed K1: 48.76 D @39°, K2: 50.63 D @129° in OD and K1: 49.16 @126°, K2: 50.44 D @36° in OS. Anterior chamber depth was 3.26 mm OU. White to

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white measurement was 12.1 mm OD and 11.9 mm in OS, measured using Scheimpflug technology (Pentacam HR, Oculus, Wetzlar, Germany) (no financial interest).

Based on these findings, the available treatment options were – (1) RLE with a Monofocal/Trifocal/Toric IOL, (2) toric implantable Collamer lens (ICL), (3) piggyback IOL and (4) non-surgical intervention-contact lenses.

The patient had been using spectacles; his refraction was stable over past 1 year and had a history of contact lens intolerance. RLE with a monofocal IOL and monovision by targeting dominant OS to emmetropia and non-dominant OD to myopia of −2.00 D was planned for the patient. IOL power calculations were done using optical biometry (IOL Master 700-Carl Zeiss Meditec, Jena, Germany). Formulae used were – Barrett TK Univeral II, Haigis, Hoffer Q and SRK-T [Table 1] which gave variable refractive outcomes. The IOL power calculated by Barrett TK Universal II, Hoffer Q was more predictable in hyperopic eyes,[3] and hence, we decided to use the above formulae. The IOL power was +46.0 D in OD and +47.0 D in OS calculated using personalised A constant of 118.0. A customised foldable hydrophilic acrylic IOL was used. OS was operated first followed by OD. IV Mannitol 100 mL infusion was given 30 min before surgery. The surgical area was cleaned with povidone iodine (5%) and draped. Under topical anaesthesia with 4% lignocaine drops, a 2.8 mm clear corneal triplanar temporal main incision was made followed by injection of 1% intracameral lignocaine. Two side ports of 1.2 mm incision size were made at 12'0 clock and 6'0 clock. A 5 mm central, circular capsulorrhexis was made to ensure good overlap of the IOL optic. Clear lens aspiration was done with a thorough cortical clean up. The main wound was extended slightly to 3.0 mm to prevent barrel burst/sudden ejection of the IOLs as shooter injector was provided with IOL. The IOL was then injected into the capsular bag. Viscoelastic removal followed by wound hydration was done. The procedure was uneventful for both the eyes. Postoperatively, the patient was started on eyedrops prednisolone acetate 1% tapering doses for 6 weeks, homatropine for 2 days, nepafenac for 1 month and 0.5% carboxy methyl-cellulose lubricating drops. At post-operative day 15, no complications were noted, and anterior segment OCT (MS-39, CSO, Firenze, Italy) and clinical photography (Haag Streit, model BX 900, Rosengarten, Germany) were done. UDVA in OD was 20/250 and in OS was 20/200 and corrected distance visual acuity (CDVA) was 20/125, with a refraction of −2.00 DS/−2.50 DC @95° in OD and +0.25 DS/−1.75 DC @125° in OS. UNVA was N18 in both eyes. Binocularly, the patient maintained a CDVA of 20/125 through the 6 months' follow-up period [Table 2].

DISCUSSION

Our patient had severe visual impairment due to ametropic amblyopia and aberrations induced by the use of thick

Table 1: Different formulae with IOL powers, predicted residual refraction obtained using IOL Master 700 (Carl Zeiss Meditec, Germany).

IOL calculation formulae	Right eye		Left eye	
	IOL power	Residual refraction	IOL power	Residual refraction
Barrett TK Universal II	+46.00	−1.92	+47.00	−0.04
Hoffer Q	+47.00	−1.91	+45.00	+0.07
Haigis	+46.50	−2.19	+44.00	+0.13
SRK-T	+42.50	−2.19	+40.00	+0.11

IOL: Intraocular lens

Table 2: Pre-operative and post-operative visual acuity and refraction.

Parameters	Right eye			Left eye		
	Pre-operative	POD-15	POD-6 months	Pre-operative	POD-15	POD-6 months
Sph (D)	+12.25	−2.00	−2.25	+12.75	+0.25	+0.50
Cyl (D)	+1.25	−2.50	−2.25	+1.50	−1.75	−1.75
Axis	140	95	90	25	125	120
UDVA	20/1000	20/250	20/250	20/1000	20/200	20/250
CDVA	20/125	20/125	20/125	20/125	20/125	20/125
UNVA	N24	N18	N18	N24	N18	N18
CNVA	N18	N18	N18	N18	N18	N18
K1	48.76	48.70	48.68	49.16	49.13	49.11
K2	50.63	50.59	50.57	50.44	50.42	50.40

Sph: Sphere, Cyl: Cylinder, UDVA: Uncorrected distance visual acuity, CDVA: Corrected distance visual acuity, UNVA: Uncorrected near visual acuity, CNVA: Corrected near visual acuity, K: Keratometry, POD: Post-op day

spectacle lenses. Toric ICL was not considered despite adequate ACD (3.26 mm) as they are known to cause pigment dispersion and angle closure glaucoma.[4] We could not implant a multifocal/trifocal/toric IOL in our patient due to high hyperopia and non-availability of hydrophobic foldable IOLs in such powers. In addition, there is risk of inter-lenticular opacification/red rock syndrome, associated with piggyback IOLs.[5] Several studies were done by Siganos *et al*.,[6] Fink *et al*.,[7] have reported satisfactory outcomes with RLE in hyperopia. On retrospective analysis, the predicted refraction and IOL power calculation were inaccurate with SRK-T, and Haigis formulae and would have resulted in a hyperopic shift, whereas Barrett TK Universal II and Hoffer Q were more reliable in terms of post-operative refraction. Monovision was aimed at achieving spectacle independence to improve the quality of life of the patient.

CONCLUSION

RLE needs to be performed with high precision, and accuracy and be minimally invasive to treat the presence of high refractive error in the absence of cataract when all other modalities of treatment are exhausted. The patient had a history of contact lens intolerance and was not willing to ICL due to the costs involved. Since the majority of the high hyperopes are amblyopic, the patient expectations need to be addressed accordingly. Many patients desiring spectacle independence can accept monovision and thus can be a valuable tool in the armament of refractive surgeons for correction of high hyperopia using RLE.

Value statement

What was known earlier?

- RLE can be used to treat hyperopia
- Various formulae have been proposed for hyperopic eyes but varied refractive results.

What does this paper add?

- Monovision can be planned to achieve spectacle independence in a case of bilateral high hyperopia with customised IOLs following RLE.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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