Optimized Visual Outcome After Asymmetrical Multifocal IOL Rotation

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ABSTRACT

PURPOSE: To report improved visual outcome after rotation of an asymmetrical multifocal intraocular lens (IOL).

METHODS: Case report.

RESULTS: A 58-year-old patient underwent bilateral phacoemulsification with asymmetrical multifocal IOL implantation. Postoperative uncorrected distance visual acuity (UDVA) was 0.0 logMAR (20/20 Snellen) and uncorrected near visual acuity was 0.0 logMAR (20/20 Snellen) in both eyes. Quality of vision questionnaire scores for day and night were 5 and 7, respectively. The center of the multifocal IOL in the dominant eye was initially found to be 0.2 mm superotemporally displaced, increasing the percentage area of 'near-add' compared to 'distance-add' within the physiological pupil. Rotation of this IOL 120° clockwise greatly improved the IOL centration within the pupil center and resulted in an immediate improvement in UDVA to -0.1 logMAR (20/16 Snellen) and quality of vision questionnaire scores to 8 and 9, respectively.

CONCLUSIONS: Assessment of the centration of an asymmetrical multifocal IOL is important, particularly if there are dysphotoptic or other visual complaints.

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The aim of multifocal intraocular lens (IOL) use is to restore distance, intermediate, and near visual function following cataract surgery. The new generation of refractive radially asymmetrical multifocal IOLs aim to alleviate the occurrence of optical side effects. The SBL-3 (Lenstec Barbados, Inc., Christ Church, Barbados) is a bi-aspheric asymmetrical refractive multifocal IOL with a +3.00 D add in the inferior anterior optic (**Figure 1**). A transition zone separates the distance and the near-add sections of the lens and the near segment occupies 42% of the total lens optic.

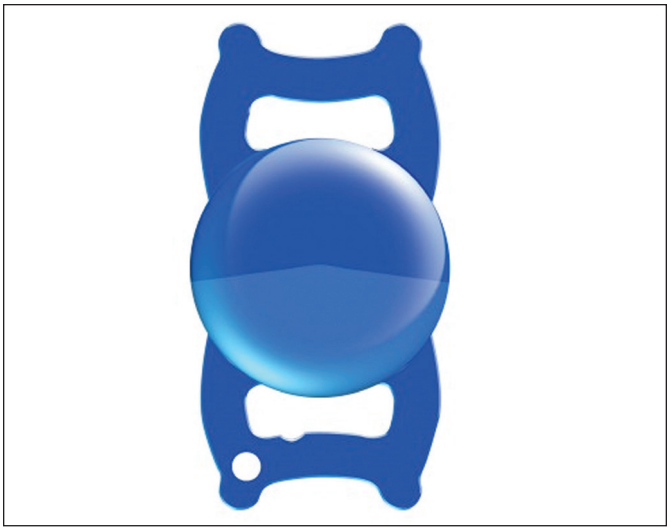

Figure 1. Lenstec SBL-3 asymmetrical multifocal intraocular lens (Lenstec Barbados, Inc., Christ Church, Barbados).

We report a case in which a patient underwent bilateral implantation of an asymmetrical multifocal IOL. To our knowledge, this is the first report of decentration of a new radially asymmetric multifocal IOL and alleviation of the decentration by rotation.

CASE REPORT

A 58-year-old man presented at the ophthalmology clinic with gradually decreased visual acuity because of bilateral cataract. Cataract extraction with asymmetrical multifocal IOL implantation was performed in both eyes. The near-add was placed inferonasally in both eyes by an experienced surgeon (JEM). Standard sutureless on-steep axis corneal phacoemulsification (2.8-mm incision) was performed with a uniform capsulorhexis of 5.2 mm.

One month after this uneventful cataract surgery, the patient complained that he was experiencing difficulty with vision in supermarkets and while driving during the day. On assessment, the uncorrected distance visual acuity (UDVA) in both eyes was 0.0 logMAR (20/20 Snellen). Uncorrected near visual acuity (UNVA) also improved in both eyes to 0.0 logMAR (20/20 Snellen). Quality of vision questionnaire scores for day and night were still low at 5 and 7, respectively (prior to cataract extraction: -4 and 3, respectively). Slit-lamp anterior segment and fundus examinations were unremarkable and the near-add of the multifocal IOL was confirmed to be oriented inferonasally in both eyes. Preoperative biometric data are given in **Table A** (available in the online version of this article).

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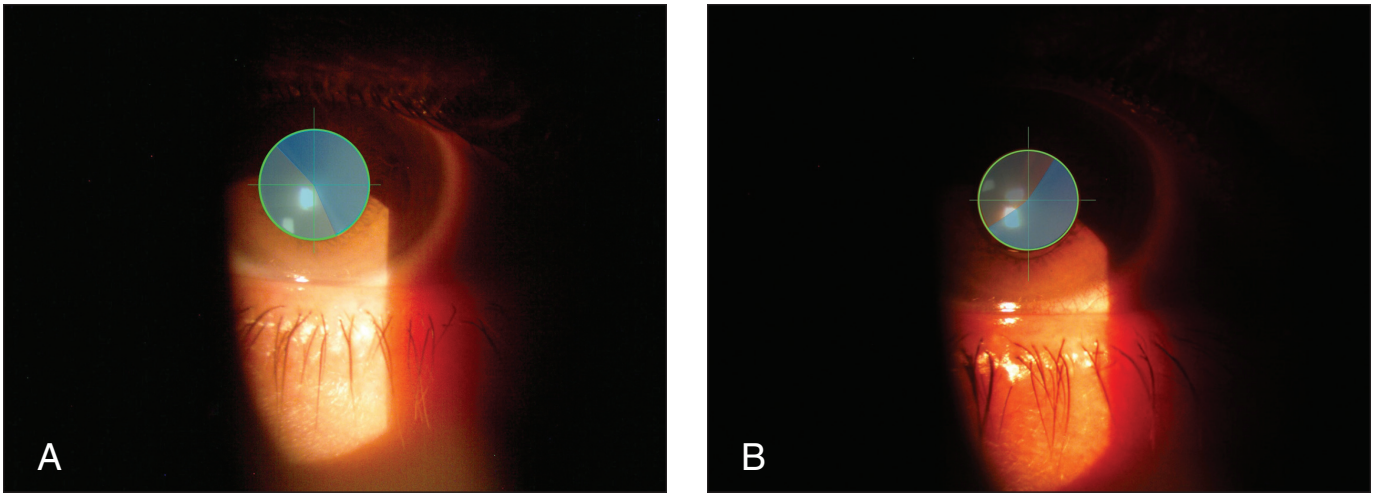

Figure 2. (A) Pupil (left eye) under pharmacologically dilated conditions before rotation of the multifocal intraocular lens with inferonasally positioned near-add. (B) Pupil (right eye) under pharmacologically dilated conditions after rotation of the multifocal intraocular lens with superotemporally positioned near-add.

On assessing the pupil of the dominant eye under photopic conditions using a slit lamp, it was observed that the near-add surface had high exposure in the dominant eye. Digital retro-illumination photographs were taken of dilated and undilated pupil. Adobe PS suite (Adobe Systems, Inc., San Jose, CA) was used to determine surface area exposure, decentration, capsular dimension changes, and pupil shift. After the risk and benefits were explained to the patient, the inferonasally placed (near-add) asymmetrical multifocal IOL in the dominant right eye was rotated 120° clockwise to a more superotemporally positioned near-add (**Figure 2**) 1 month after cataract operation, ensuring that a more normal degree of distance-add was now present within the physiological pupil.

Three months following IOL rotation surgery, the UDVA in both eyes was -0.1 logMAR (20/16 Snellen). UNVA in both eyes was -0.1 logMAR (20/16 Snellen) (**Table B**, available in the online version of this article). The patient was happy with driving and seeing in the supermarket during the day. This improvement in satisfaction of visual performance was reflected in the quality of vision questionnaire scores, with day and night scores of 8 and 9 (1 month after rotation). Three months after rotation, the quality of vision score was 9 for day and 9 for night. The final position of the multifocal IOL near-add was inferonasal in the left eye and superotemporal in the right eye (**Figure 2**).

DISCUSSION

The SBL-3 multifocal IOL is a relatively new lens. The recent case series of bilateral implantation on 53 eyes published by Venter et al. reported a good range of distance, intermediate, and near visual acuity in patients.[1] The rotation of asymmetrical multifocal IOL on its axis was compared before by de Wit et al.,[2] who found that the placement of the near-add in the superior or inferior position in the Mplus IOL (Lentis Barbados, Inc.) had no significant overall difference in the mean subjective or objective outcomes.

Decentration of any multifocal IOL can lead to decreased visual acuity and photopic phenomenon, which has an adverse affect on the quality of vision for the patient.[3] The effect of decentration of a multifocal IOL on visual quality can be further compounded by a large angle kappa, resulting in central optical rays potentially passing through the periphery of the multifocal IOL rather than its center.[4] The centration of any multifocal IOL with respect to the physiological pupil center can be difficult, principally because this is dictated by the position of capsular bag periphery.[5] The SBL-3 IOL is radially asymmetric and centration appears to play a crucial role for good quality of vision, as documented in our case where the superotemporal displacement of approximately 0.2 mm in the dominant eye from the center resulted in poor quality of vision. Possible factors that may have influenced this decentration with respect to the physiological pupil include capsular contraction, haptic movement, IOL rotation, or pupil shift.[3,6,7]

Pupil shift refers to a slight change in reference to the pupil's central location between mesopic, photopic, and pharmacologically dilated conditions[8] and this tendency of the pupil to shift makes it more difficult to achieve a precise positioning of the asymmetrical multifocal IOL. Closer examination of the photopic pupil of the patient's dominant eye revealed that a photopic pupil shift occurred toward the inferonasal region[9] and

thereby maximized the light exposure to the inferiorly placed near-add of the IOL, making distance vision during photopic conditions difficult for the patient.

Postoperative rotation of an asymmetrical multifocal IOL can be beneficial for some patients experiencing dysphotopsia and poor quality of vision. It is key to ensure that the dominant eye is optimized for distance viewing by maximizing the area of distance optic within the mesopic and photopic pupil. Determining where the physiological pupil center lies during surgery in an attempt to center the IOL within a pharmacologically dilated pupil is difficult. However, rotation of the IOL can result in different final positions for the center of the IOL. This is due to the asymmetric nature of the capsular bag[10] and the differences between the center of the bag and the center of the pupil. Asymmetrical multifocal IOLs are not circular and neither is the capsular bag; therefore, one can actively alter the resultant centration of the IOL by rotating it into different positions. Taking these factors into consideration, the near-add positioning should be assessed individually for optimal positioning of a multifocal IOL and potentially different positions used for the dominant and non-dominant eyes.

AUTHOR CONTRIBUTIONS

Study concept and design (TCBM, JEM); data collection (EEP, OR, RM, ZAM, TCBM, JEM); analysis and interpretation of data (EEP, OR, RM, ZAM, TCBM, JEM); writing the manuscript (EEP, OR, RM, ZAM, TCBM, JEM); critical revision of the manuscript (OR, JEM); statistical expertise (EEP, OR, RM, ZAM, TCBM, JEM); supervision (TCBM, JEM)

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TABLE A

Preoperative Biometric Data

Parameter	Right Eye	Left Eye
Axial length (mm)	23.65	23.51
K1 (D)	41.46 @ 10°	41.56 @ 155°
K2 (D)	41.87 @ 100°	41.77 @ 65°
ACD (mm)	3.00	3.05
Angle kappa	4.02°	3.75°
Photopic pupil (mm)	3.2	3.3
Mesopic pupil (mm)	4.1	3.8
Sphere (D)	1.5	1.4
Mean corneal astigmatism (D)	0.74	0.6

K = keratometry; D = diopters; ACD = anterior chamber depth

TABLE B

Preoperative and Postoperative Data

Parameter	Preoperative	Postoperative 1 Month	1 Month After Rotation	3 Months After Rotation
Visual acuity (logMAR)				
UDVA (OD)	0.5 (20/63 Snellen)	0 (20/20 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)
UDVA (OS)	0.6 (20/80 Snellen)	0 (20/20 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)
CDVA (OD)	0.2 (20/32 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)
CDVA (OS)	0.2 (20/32 Snellen)	0.04 (20/22 Snellen)	0 (20/20 Snellen)	-0.1 (20/16 Snellen)
CDVA (Bino)	0.2 (20/32 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)
UNVA (OD)	0.4 (20/50 Snellen)	0 (20/20 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)
UNVA (OS)	0.2 (20/32 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)	-0.1 (20/16 Snellen)
Quality of vision questionnaire				
Day	4	5	8	9
Night	3	7	9	9
IOL surface area exposure of near-add in photopic pupil				
OD	NA	60%	20%	20%
OS	NA	40%	NA	NA

UDVA = uncorrected distance visual acuity; OD = right eye; OS = left eye; CDVA = corrected distance visual acuity; UNVA = uncorrected near visual acuity; Bino = binocular; IOL = intraocular lens; NA = not applicable