

# Pupil influence on the quality of vision in rotationally asymmetric multifocal IOLs with surface-embedded near segment



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**Purpose:** To evaluate the influences of preoperative pupil parameters on the visual outcomes of the SBL-3, a rotationally asymmetric multifocal intraocular lens (IOL) with a surface-embedded near segment.

**Setting:** Cathedral Eye Clinic, Belfast, Northern Ireland, United Kingdom.

**Design:** Retrospective comparative case series.

**Methods:** Postoperatively, patients divided into 4 groups according to their pupil size as follows: Group A: 2.50 to 2.99 mm, Group B: 3.00 to 3.50 mm, Group C: 3.51 to 4.00 mm, and Group D: 4.01 to 4.50 mm. The uncorrected distance (UDVA), intermediate (UIVA), and near (UNVA) visual acuities, IOL centration and tilt, and quality of vision (QoV) questionnaires were compared between the 4 groups for 18 months postoperatively.

**Results:** The study comprised 90 patients (180 eyes). The mean preoperative pupil (photopic and mesopic) diameter was

4.3 mm  $\pm$  0.3 (SD) and 5.6  $\pm$  1.4 mm, respectively, which decreased to 3.8  $\pm$  0.7 mm and 4.9  $\pm$  1.2 mm, respectively, at 18 months. Eighteen months postoperatively, both photopic and mesopic pupil groups had a statistically significant reduction in size from preoperative levels. No significant differences in UDVA, UIVA, and UNVA were found between the groups ( $P > .001$ ). Significant differences in the QoV questionnaire day scores and night scores were found between the 4 groups ( $P < .001$ ).

**Conclusions:** The rotationally asymmetric multifocal IOL provided excellent optical performance during 18-months follow-up. The preoperative photopic pupil is an important parameter for consideration of this type of IOL because smaller pupils have a significant negative subjective impact on QoV.

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The aim of multifocal intraocular lens (IOL) use is to restore distance, intermediate, and near visual function after cataract extraction or refractive lens exchange.<sup>1,2</sup> Various methods have been implemented to achieve some degree of pseudoaccommodation, such as aiming for myopic astigmatism,<sup>3</sup> targeting 1 eye for myopia (monovision),<sup>4</sup> or multifocal IOL implantation.<sup>5</sup>

The new generation of refractive rotationally asymmetric multifocal IOLs aims to alleviate the occurrence of optical side effects.<sup>2,6</sup> Asymmetric multifocal IOLs, such as the SBL-3 (Lenstec, Inc.), in general provide both far and near vision by splitting light to 2 or more focal points.<sup>6</sup> The SBL-3 is an asymmetric multifocal IOL with a +3.0 diopter (D) near portion and a seamless transition zone between the distance section and the near section (Figure 1). It

is crucial that ophthalmologists help elderly patients retain the ability to see a range of distances, enabling multiple daily-life scenarios including driving.<sup>7</sup> Anecdotal evidence from patients and a case report by Pazo et al.<sup>8</sup> of bilateral implantation of asymmetric multifocal IOLs suggests that because of the asymmetric design of the IOL, patients can have a reduced quality of vision (QoV) while driving and in bright supermarket lighting conditions.<sup>9</sup> The center of the pupil has a tendency to move slightly nasally when constricting.<sup>10</sup> Therefore, a small photopic pupil can alter the amount of incident light directed to either the distance or near section. The visual performance and subjective experience of multifocal IOLs is dependent on pupil size.<sup>11–13</sup> A case report by Pazo et al.<sup>8</sup> and Montés-Micó et al.<sup>13</sup> highlights that a variation in pupil size affects the relative

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