Clinical Ophthalmology

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ORIGINAL RESEARCH

Refractive Outcomes of a Low-Addition Refractive, Rotationally Asymmetric Bifocal IOL and Its Toric Version: A Comparative Cohort Study of 316 Eyes

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Purpose: To analyze and compare functional and refractive postoperative outcomes of a low-addition refractive bifocal intraocular lenses (IOL) and its toric version at 1 month.

Settings: Desgenettes Military Hospital, Lyon.

Design: Single-center retrospective study.

Methods: This study included 316 eyes of patients who underwent bilateral phacoemulsification with implantation of either the standard IOL, the Comfort LS-313 MF15 (n=245, group 1) or its toric version, the Comfort LS-313 MF15T (n=71, group 2). Patients were evaluated at 7 days and 1 month postoperatively to measure uncorrected and corrected distance (UDVA and CDVA), uncorrected intermediate (UIVA), and near (UNVA) visual acuity at 4 meters, 60 cm and 40 cm. Spectacle independence and photic phenomena were assessed using a modified McAlinden questionnaire.

Results: At one month, both groups had similar mean UDVA (0.004 vs 0.02 logMAR; $p=0.063$). UIVA (0.12 vs 0.17 logMAR; $p=0.783$) and UNVA (0.34 vs 0.3 logMAR; $p=0.292$) were also comparable. CDVA was excellent (−0.009 vs −0.02 logMAR; $p=0.348$). The toric IOL significantly reduced residual astigmatism ($p<0.01$), with a mean of 0.23±0.34 D. Photic phenomena were minimal (score: 2.17), with no severe effects. Twenty-five patients responded to the questionnaire, 56% of them reported total or high spectacle independence.

Conclusion: The low-addition refractive bifocal IOL and its toric version provide effective refractive correction, ensuring excellent UDVA and satisfactory UIVA. The toric model yields comparable outcomes to the non-toric version, with the added benefit of improved control of preoperative astigmatism. The refractive performance of the toric model remained consistent regardless of the axis of implantation and the position of the low addition segment. These findings demonstrate satisfactory functional outcomes, though validation in larger prospective studies with objective optical quality assessments is needed.

Plain Language Summary: This study compared two versions of a low-addition refractive bifocal intraocular lens: the standard IOL and its astigmatism-correcting toric version—to see how well they perform in real-world use. While it was already known that low-add bifocal lenses help with intermediate tasks like computer work, and that toric lenses are needed to correct astigmatic eyes for the best outcomes, this research provides the first direct head-to-head comparison under standardized conditions. The findings show that the toric lens effectively and stably corrects astigmatism and improves vision at multiple distances regardless of the IOL orientation in the eye, without reducing overall vision quality. Both lens types delivered strong results within one month after surgery: clear distance vision for activities like driving, good intermediate vision for screens and countertops, and satisfactory near vision when using both eyes together—all with minimal visual disturbances. For patients with astigmatism, this means the toric version offers the same visual benefits as the standard lens while also correcting corneal astigmatism providing reliable all-distance vision without compromise.

https://doi.org/10.2147/OPTH.S583057
Received: 20 November 2025
Accepted: 12 March 2026
Published: 1 May 2026

Keywords: intraocular lenses, toric intraocular lenses, astigmatism, refraction, ocular, visual acuity, refractive rotationally asymmetric, low-addition refractive bifocal

Introduction

Cataract surgery has evolved into a true refractive procedure through the use of premium intraocular lenses (IOLs) which address cataracts but also correct a range of refractive errors, including myopia, hyperopia, astigmatism, and presbyopia. As patient expectations have shifted toward greater spectacle independence, IOLs designed to extend functional vision at intermediate and near distances have gained prominence.

Range of Field (RoF) IOLs encompass three types: multifocal lenses, including bifocal and trifocal designs, that provide distinct focal points; Extended Depth of Focus (EDOF) lenses that enhance intermediate vision with minimal visual disturbances such as halos and glare; and more recently, enhanced monofocal lenses, that modestly expand functional vision compared to conventional monofocals without significantly compromising optical quality. With numerous lens options available, brand-specific labels and technical differences often complicate direct comparisons. Consequently, focusing on functional performance rather than optical design has become essential in clinical decision-making.

A functional classification system for IOLs has been proposed,[1,2] based on effective RoF and quality of vision from intermediate to near. This system classifies lenses according to clinical outcomes, providing a practical guide for IOL selection.

The Comfort LS-313 MF15 (Teleon Surgical B.V., Spankeren, The Netherlands) is a low-addition refractive rotationally asymmetric bifocal IOL, classified as an extended partial RoF category according to the ESCRS classification. Its inferior segment features a +1.50 D addition that enhances intermediate visual function while preserving distance vision. Unlike diffractive optics, this refractive design is associated with good contrast sensitivity and minimal visual disturbances. The toric version, Comfort LS-313 MF15T, incorporates cylindrical correction for corneal astigmatism.

Correcting astigmatism is crucial for achieving optimal refractive results,[3] as approximately 20% of patients undergoing surgery for age-related cataract have corneal astigmatism of 1.5 D or more.[4] In such cases, precise rotational alignment of toric IOLs is essential. Given the IOL's inferiorly positioned near segment, questions arise regarding whether alignment along different meridians (particularly in against-the-rule astigmatism) might influence visual performance.

To our knowledge, no prior study has directly compared the refractive and visual performance of the low-addition refractive bifocal IOL with its toric counterpart, in a standardized, single-center cohort. This study therefore aims to analyze and compare their functional and refractive outcomes one month postoperatively. Primary outcomes include uncorrected and corrected distance visual acuity (UDVA and CDVA) assessed to determine whether the partially extended RoF design compromises distance vision. Secondary outcomes include uncorrected intermediate (UIVA) and near visual acuity (UNVA), assessed both monocularly and binocularly in consecutive patients eligible for cataract surgery.

Materials and Methods

This retrospective study was conducted at a single center and included adult patients who underwent bilateral cataract surgery with implantation of the standard IOL (Group 1) and its toric version, the toric IOL (Group 2). All participants provided written consent for the use of their anonymised data in clinical research and underwent surgery consecutively between July 2020 and May 2023, performed by a team of five surgeons at the Desgenettes Military Hospital in Lyon.

The toric version of the IOL was chosen for patients with total corneal astigmatism of 0.75D or greater for against-the-rule (ATR) or oblique astigmatism, and 1.00D or greater for with-the-rule (WTR) astigmatism. These decisions were based on total keratometry (TK) measurements obtained using the IOL Master 700® (Carl Zeiss Meditec AG, Jena). The regularity of corneal astigmatism was evaluated through corneal topography performed with the OCT Anterion® (Sanotek, Heidelberg).

All patients were evaluated 7 days and 1 month after the surgical procedure. The evaluation criteria were assessed by a reference orthoptist from the department, and included UDVA, UNVA, and UIVA. These measurements were taken using the Monoyer scale at distances of 4 meters, 40 centimeters, and 60 centimeters, respectively.

Cases were excluded if they had conditions that could lead to decreased visual acuity unrelated to cataracts. This included issues such as diabetic macular edema, optic neuropathy, and corneal pathology.

To evaluate the presence and severity of photic phenomena, as well as the participants' independence from glasses, we employed a modified McAlinden questionnaire.[5] The photic phenomena score was determined by summing the points from items 1 to 9 in the questionnaire. Scores varied from 0 to 27, with severity classified as follows: absent (0), mild (1–4), moderate (5–9), intermediate (10–18), and severe (19–27).

We evaluated independence from glasses using items 14 and 15 of the questionnaire. The scores, ranging from 0 to 15, were classified into five levels: total independence (0), high independence (1–3), intermediate independence (4–6), low independence (7–12), and dependence (13–15).

All participants provided written consent for the use of their anonymized data in clinical research. The data were collected anonymously, with each participant assigned a unique number in the sequence of data collection.

The study adhered to Good Clinical Practice (GCP), International Council for Harmonisation (ICH) Guidelines, the Declaration of Helsinki, and all applicable country-specific regulations governing clinical research, in accordance with the most stringent requirements to ensure greater protection for participants. This study was approved by the Ethics Committee of the French Society of Ophthalmology (IRB 00008855 Société Française d'Ophtalmologie IRB#1).

IOL

The study IOL is a low-addition refractive bifocal IOL. It features a segmented, asymmetric refractive profile with a +1.50 D addition located in the inferior optical zone. The IOL has an optical diameter of 6.0 mm and a total length of 11.0 mm. The lens material is hydrophilic acrylic with a hydrophobic surface treatment. Spherical corrections are available from 0 D to +36.00 D in 0.5 D increments, with 1 D increments available beyond this range.

The toric version shares the same platform as the standard IOL but incorporates a posterior aspheric toric surface. The implant features neutral asphericity. It is custom-made, offering spherical corrections between +10.00 D and +30.00 D in 0.5 D increments, along with toric corrections ranging from T0 (+0.75 D) to T6 (+5.25 D).

Surgical Technique

Phacoemulsification was performed through a 2.2 mm clear corneal incision at the 120° meridian, flanked by two paracenteses at 90° on either side for bimanual irrigation/aspiration.

The toric IOL was aligned in its final position using Z-align digital guidance (Carl Zeiss Meditec AG). This alignment method was applied to all included eyes, based on 100% conjunctival recognition.

Preoperative and Postoperative Examinations

All patients underwent a comprehensive preoperative evaluation, which included autorefraction, keratometry and tonometry (using Tonoref III Nidek), anterior segment optical coherence tomography (AS-OCT) with Anterion (Sanotek, Heidelberg), and optical biometry using interferometry (IOL Master 700, Carl Zeiss Meditec AG, Jena).

The power of the implant was determined using the IOLMaster 700, with the SRK/T formula targeting emmetropia. For hyperopic patients, a multiformula approach (Hoffer Q, Holladay II, Barrett Universal II, or Haigis) was employed, and the IOL power corresponding to the greatest concordance among the formulas was selected for implantation. Calculations for toric implants were performed on the manufacturer's website (https://www.teleon-toric.com/GB/EasyCalculator.aspx#btns_bottom), utilizing the TK value obtained from the IOL Master 700®. This approach was deliberately chosen to evaluate clinical outcomes under real-world conditions, reflecting the standard calculation methodology recommended for this implant in routine practice.

A slit-lamp examination, a dilated fundus examination, and a macular OCT were also performed systematically according to the service protocol.

The presence and significance of photic phenomena as well as independence from glasses were assessed using a modified McAlinden questionnaire.[5] This questionnaire was available in the waiting room as part of routine best-practice assessments.

Statistical Analysis

Statistical analysis was performed using SPSS (IBM Corp., Armonk, NY, USA). Due to the retrospective nature of the study, the sample size was determined by the number of cases available at the study time frame and it was larger than many similar studies.[6–12] Descriptive statistics, in the form of mean ± standard deviation, were used to summarize the visual and refractive changes. A linear mixed model was used to compare visual acuity preoperatively versus postoperatively and to determine the effect of asphericity on postoperative UDVA and UNVA, to account for inter-eye correlation. The Shapiro–Wilk test was used to determine normality. A generalized linear mixed model was used to compare composite criteria. A $p<0.05$ was considered statistically significant.

Results

A total of 316 eyes were implanted between July 2020 and May 2023. The preoperative clinical characteristics of each group are summarized in Table 1. There were no significant differences between groups in terms of age, preoperative refraction, or calculated IOL power. The only differing factor was corneal astigmatism, which justified the indication for toric implantation.

In Group 2, the majority of toric lenses used were T0 (+0.75) and T1 (+1.50), accounting for 75% of the implants (34% and 41%, respectively). This distribution is illustrated in Figure 1.

All Eyes (n=316)

For the entire cohort, the mean UDVA was 0.01 ± 0.09 logMAR, the mean UIVA was 0.12 ± 0.11 logMAR, and the mean UNVA was 0.33 ± 0.18 logMAR (Parinaud 3.5).[13] The mean postoperative subjective spherical equivalent was −0.06 ± 0.26 D, and the average monocular addition required to read 0.1 logMAR (Parinaud 2) was 1.48 ± 0.63 D.

Table 1 Comparison of Baseline and Intraoperative Data Between the Standard IOL Group and the Toric IOL Group

	Standard IOL	**Toric IOL**	**P value**
Eyes (n)	245	71	
Baseline UDVA (logMAR)	0.50±0.37 (n=78)	0.57±0.33 (n=23)	0.239
Baseline CDVA (logMAR)	0.22±0.21 (n=196)	0.23±0.23 (n=65)	0.826
Baseline CNVA (logMAR)	0.18±0.14 (n=192)	0.20±0.20 (n=58)	0.949
Baseline objective SE (D)	−0.61±2.87 (n=199)	−0.82±2.64 (n=65)	0.149
Baseline subjective SE (D)	−0.36±2.45 (n=197)	−0.81±2.56 (n=65)	0.932
Baseline objective cylinder (D)	−0.87±0.55 (n=198)	−1.47±0.95 (n=65)	<0.001*
Baseline subjective cylinder (D)	−0.61±0.58 (n=195)	−1.17±0.91 (n=65)	<0.001*
Axial length (mm)	23.55±0.81	23.54±0.84 (n=71)	0.202
Total keratometry astigmatism (D)	−0.52±0.29 (n=219)	−1.20±0.54 (n=66)	<0.001*
IOL spherical power (D)	20.13±2.20	19.82±2.39 (n=71)	0.924
IOL toric power (D)	–	1.51±0.78 (n=66)	–
Target SE (D)	0.06±0.17 (n=244)	0.07±0.12 (n=70)	0.538
Predicted postoperative Residual astigmatism (D)	–	0.08±0.21 (n=66)	–

Notes: Data are presented as number (%) or mean±standard deviation. P values calculated using a linear mixed model. Asterisks (*) indicate statistical significance ($p<0.05$).

Abbreviations: n, number; SE, spherical equivalent; UDVA, uncorrected distance visual acuity; CDVA, corrected distance visual acuity; CNVA, corrected near visual acuity; IOL, intraocular lens; D, diopter.

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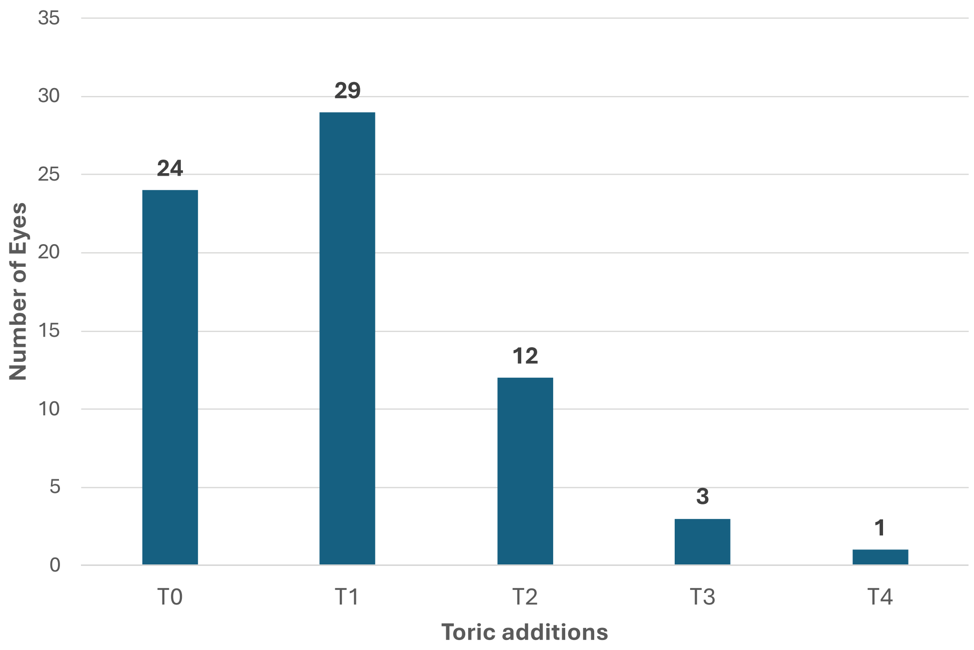

Figure 1 Frequency of toric additions used in Group 2 (Toric IOL, n=71).
Abbreviation: IOL, intraocular lens.

Visual Acuity by Subgroup (Figures 2–4/Table 2)

Group 1 implanted with the standard IOL comprised 245 eyes (78%), while Group 2 implanted with the toric IOL comprised 71 eyes (22%).

The CDVA was comparable in both groups. In Group 1, the mean logMAR CDVA was −0.009±0.06 (n=102), while in Group 2, it was −0.02 ± 0.04 (n = 43) (p = 0.260) (Figure 2).

The UDVA was comparable between the two groups. In Group 1, the mean logMAR UDVA was 0.004 ± 0.10 (n = 245), while in Group 2, it was 0.02 ± 0.07 (n = 71) (p = 0.238). Thus, the average UDVA was close to 0 logMAR (10/10) in both groups. Additionally, there was no significant difference observed between the groups for UIVA (0.12 ± 0.10 logMAR versus 0.17 ± 0.18 logMAR, respectively, p = 0.365) and UNVA (0.34 ± 0.18 logMAR versus 0.30 ± 0.17 logMAR, respectively, p = 0.076). Therefore, the mean UNVA was approximately 0.3 logMAR (Parinaud 3.5) in both groups, while the average binocular UNVA was approximately 0.2 logMAR (Parinaud 3) in both groups (p = 1.0). Figures 3 and 4 illustrate the standard graphs for standard IOL (group 1) and toric IOL (group 2), respectively. Notably, 82% of group 1 and 68% of group 2 demonstrated postoperative UDVA of 0 logMAR. Furthermore, postoperative UDVA was equivalent to or surpassed preoperative CDVA in 98% and 95% of eyes in group 1 and 2, respectively.

Refractive Outcomes (Figures 3 and 4)

Table 2 presents the refractive outcomes one month postoperatively. No statistically significant refractive differences were observed between the two groups. The subjective spherical equivalent and spherical values were comparable in both cohorts (−0.06 ± 0.26 D vs −0.08 ± 0.25 D, p = 0.932 and 0.01 ± 0.23 D vs 0.00 ± 0.25 D, p=0.722, respectively). The average addition required to achieve a UNVA of 0.1 logMAR was approximately 1.5 D in both groups (p = 0.275). As demonstrated in Figures 3 and 4, 92% of group 1 and 87% of group 2 exhibited postoperative subjective spherical equivalent within 0.5 D of the intended target, and 93% and 82%, respectively, presented postoperative subjective astigmatism of ≤0.5 D.

Composite Criteria (Table 3)

The composite criterion "monocular UDVA ≤ 0.1 and UNVA ≤0.3" was observed equivalently in both groups (p = 0.966; Group 1 = 51.6%; Group 2 = 52.4%) (Table 3).

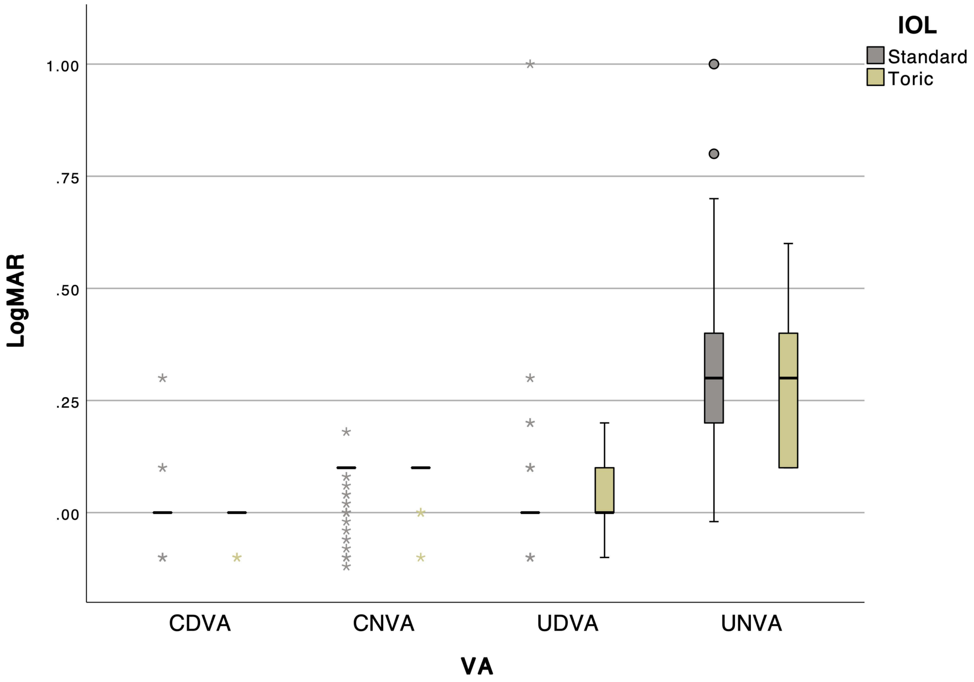

Figure 2 Visual outcomes (corrected and uncorrected near and distance visual acuities): Standard & Toric IOLs at 1 month.
Abbreviation: IOL, intraocular lens.

Results of Toric IOLs

The mean postoperative residual vector astigmatism was 0.23 ± 0.34 D, compared to 1.17 ± 0.91 D preoperatively (p<0.001), indicating a significant reduction in astigmatism. Figure 5 illustrates the refractive outcomes achieved relative to the refractive target, demonstrating a realignment of values around the desired goal.

Table 2 Comparison Between Standard vs Toric at 1 Month

	LS-313 MF15 Standard IOL	LS-313 MF15T Toric IOL	P value
Visual Outcomes			
UDVA (logMAR)	0.004±0.10 (n=245)	0.02±0.07 (n=71)	0.238
CDVA (logMAR)	−0.009±0.06 (n=102)	−0.02±0.04 (n=43)	0.260
UNVA (logMAR)	0.34±0.18 (n=221)	0.30±0.17 (n=63)	0.076
CNVA (logMAR)	0.08±0.05 (n=233)	0.08±0.04 (n=68)	0.224
UIVA (logMAR)	0.12±0.10 (n=43)	0.17±0.18 (n=6)	0.365
Bilateral UNVA (logMAR)	0.22±0.14 (n=86)	0.21±0.19 (n=19)	1.000
Refractive Outcomes			
Subjective SE (D)	−0.06±0.26 (n=240)	−0.08±0.25 (n=71)	0.932
Objective SE (D)	−0.54±0.45 (n=242)	−0.52±0.47 (n=71)	0.330
Subjective sphere (D)	0.01±0.23 (n=240)	0.00±0.25 (n=71)	0.722
Objective sphere (D)	−0.19±0.58 (n=240)	−0.17±0.51 (n=71)	0.395

(*Continued*)

Table 2 (Continued).

	LS-313 MF15 Standard IOL	LS-313 MF15T Toric IOL	P value
Subjective cylinder (D)	−0.14±0.27 (n=240)	−0.23±0.34 (n=71)	0.026*
Objective cylinder (D)	−0.66±0.44 (n=240)	−0.73±0.42 (n=71)	0.292
Near add (D)	1.47±0.62 (n=239)	1.52±0.68 (n=71)	0.275

Notes: Data are presented as number (%) or mean±standard deviation. P values calculated using a linear mixed model. Asterisks (*) indicate statistical significance ($p<0.05$).

Abbreviations: n, number; SE, spherical equivalent; UDVA, uncorrected distance visual acuity; CDVA, corrected distance visual acuity; CNVA, corrected near visual acuity; IOL, intraocular lens; D, diopter.

Regarding toric IOL alignment, no significant association was observed between the orientation of the implanted lens and final visual acuity. The position of the additional segment was determined according to the calculated implantation axis provided by the toric calculator, based on the astigmatism to be corrected. As a result, the so-called "inferior" segment did not necessarily correspond to an anatomically inferior position. Regardless of whether the segment was oriented inferiorly, temporally, or obliquely, no significant differences in visual acuity outcomes were identified.

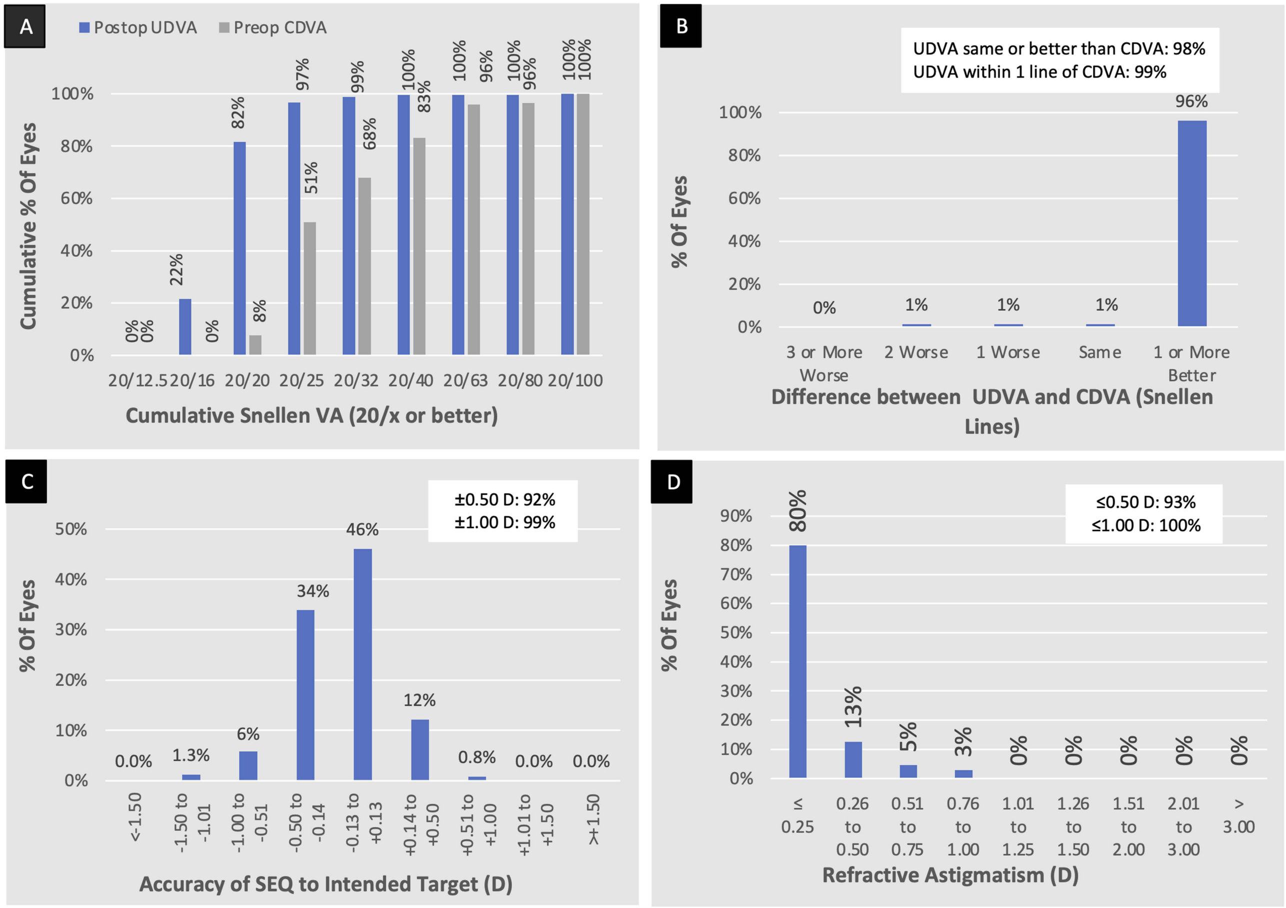

Figure 3 Standard graphs of Group 1 (Standard IOL) at 1 month postoperatively. n=245 eyes. (**A**) Cumulative Snellen Postoperative UDVA vs Preoperative CDVA. (**B**) The difference between postoperative UDVA and preoperative CDVA in Snellen lines. (**C**) The accuracy of subjective spherical equivalent to the intended target. (**D**) Subjective astigmatism.

Abbreviations: UDVA, uncorrected distance visual acuity; CDVA, corrected distance visual acuity.

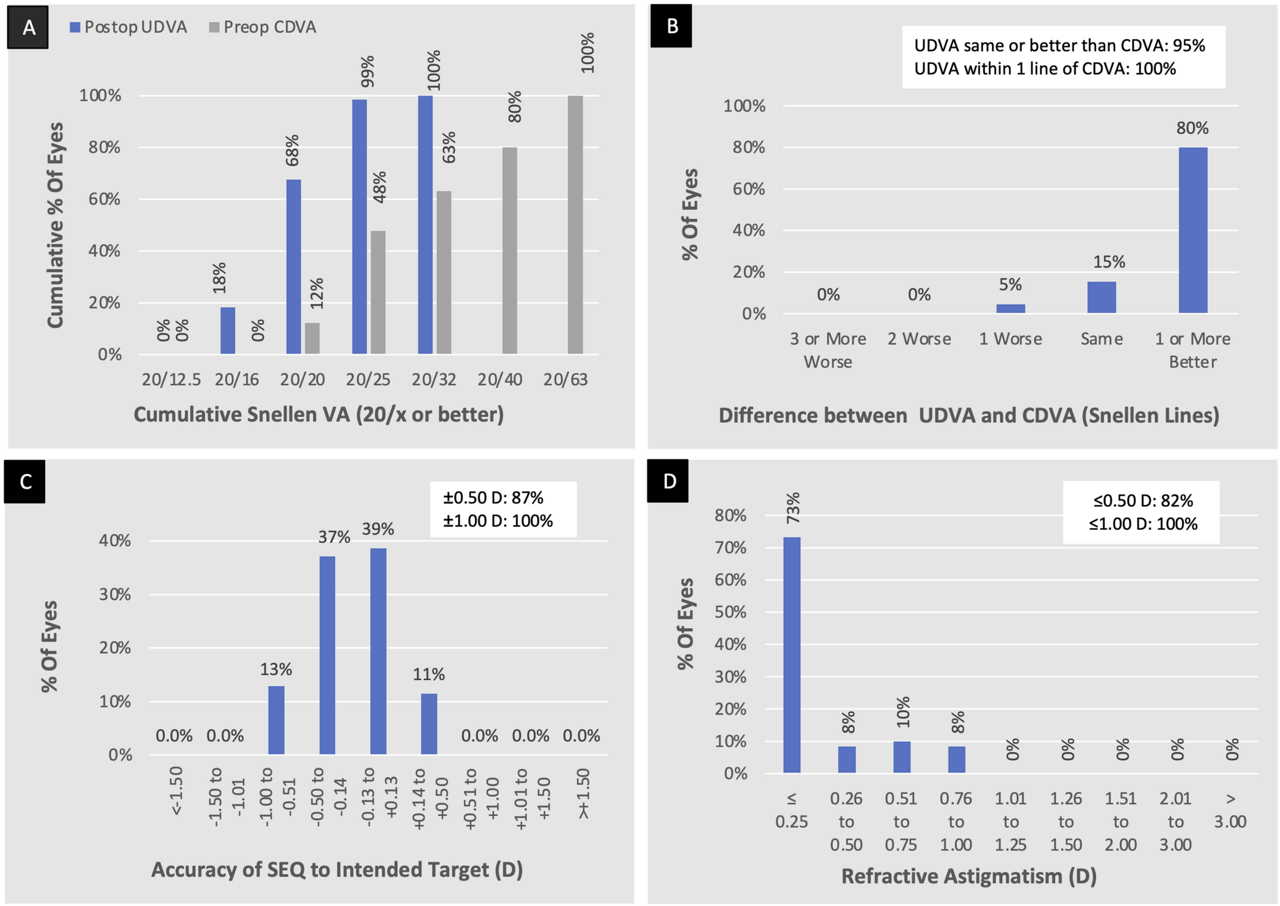

Figure 4 Standard graphs of Group 2 (Toric IOL) at 1 month postoperatively. n=71 eyes. (**A**) Cumulative Snellen Postoperative UDVA vs Preoperative CDVA. (**B**) The difference between postoperative UDVA and preoperative CDVA in Snellen lines. (**C**) The accuracy of subjective spherical equivalent to the intended target. (**D**) Subjective astigmatism.
Abbreviations: UDVA, uncorrected distance visual acuity; CDVA, corrected distance visual acuity.

Asphericity of the Cornea and Refractive Outcomes

In a secondary analysis, we examined the potential effect of preoperative corneal asphericity on UDVA and UNVA. The preoperative corneal asphericity was −0.2 ± 0.12 (min: −0.54; max: 0.3). No significant correlation was observed between these variables, indicating that preoperative corneal asphericity does not influence visual outcomes.

Safety

No adverse effects related to the implant were reported, particularly no early opacification of the implant or the posterior capsule, and no inflammatory complications. No patient underwent explantation, and no surgery was planned for misalignment.

Table 3 Composite Criteria: Standard vs Toric IOLs

	LS-313 MF15 Standard IOL	LS-313 MF15T Toric IOL	P value
Percentage of cases with logMAR UDVA ≤0.1	237/245 (96.7%)	70/71 (98.6%)	0.839
Percentage of cases with postoperative logMAR UDVA ≤0.1 and UNVA ≤ 0.3	114/221 (51.6%)	33/63 (52.4%)	0.966

Note: P values were calculated using a generalized linear mixed model.

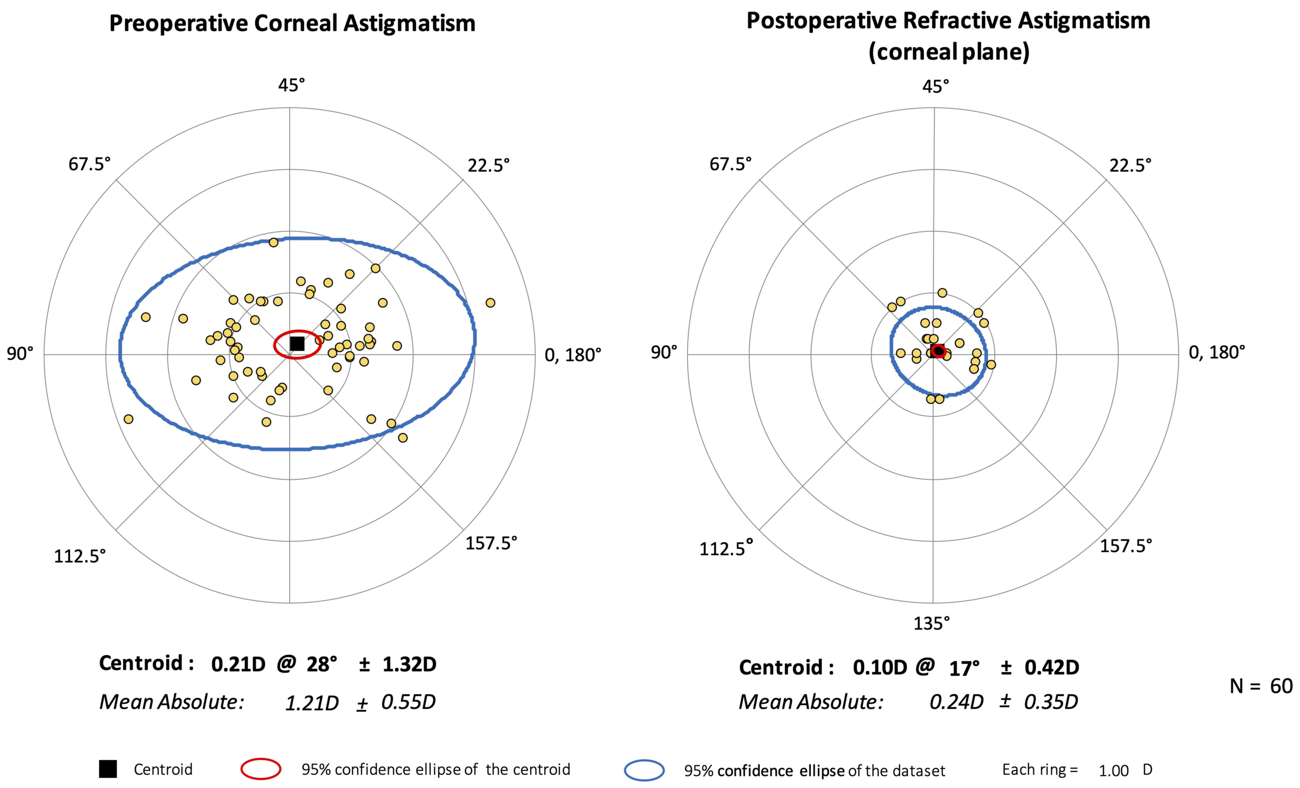

Figure 5 Double-angle vector plot showing preoperative corneal astigmatism versus subjective postoperative refractive astigmatism of Group 2 eyes. Adjusted scale for each ring: 1D. Text shown in bold are highlighted for emphasis and do not denote a separate statistical parameter.
Abbreviation: D, diopter.

Questionnaire

Twenty-five patients (50 eyes included) responded to the questionnaire assessing independence from glasses and photic phenomena. No patients reported severe photic phenomena, and 44% of respondents indicated that they experienced no photic phenomena one month after the intervention. The mean score for photic phenomena, on a scale of 0 to 27, was 2.17 ± 2.52 (mild photic phenomena).

Concerning independence from glasses, 56% of patients reported complete or high independence from glasses. The mean score for independence from glasses, on a scale of 0 to 15, was 4.39 ± 3.93.

Discussion

This study provides the first comparative evaluation of the refractive and visual performance of the standard implants and their toric version in daily practice.

It is important to note that the UDVA at one month postoperatively was high in both groups, highlighting the absence of compromise in distant vision associated with this partial extended RoF IOL. In fact, the UDVA is comparable to that observed following traditional monofocal lens implantation.[14]

The toric correction is also effective, comparable to that of non-toric implants, (Tables 2 and 3) thereby expanding the indications for this implant. This highlights the interest in considering a toric implant, without apprehension, even in cases of low astigmatism, to improve the final refractive outcome.

The distribution of patients between the two groups in our study was consistent with real-world data, with approximately a quarter of patients requiring toric implantation (23% in our study).[15,16] The distribution of toric addition was also consistent with the most recent data, the majority of implants (76%) being T0 and T1 implants correcting astigmatism ranging from +0.75 D to +1.50 D.

Monocular UIVA was excellent across all implant types, with UIVA values consistently close to 0.1 logMAR. Although this partial extended RoF IOL is designed primarily for intermediate vision rather than near vision, we report in this series an equally comfortable UNVA. Binocular UNVA was further improved, enabling spectacle-free reading of a newspaper on a daily basis (0.2 logMAR/Parinaud 3).

These results align with findings reported with other Partials Extended RoF IOLs, at 6 months by Reinhard et al concerning the AT LARA and Tecnis symfony implants (in their non-toric version)[17] However, Giannuzzi et al reported superior UIVA and UNVA outcomes with the Vivity implant in a cohort of 40 patients, although these results were accompanied by poorer uncorrected distance visual acuity (UDVA).[18]

The average reading addition required to achieve comfortable, sustained monocular vision (0.1 logMAR) was approximately +1.50 D in both groups. However, this correction was not systematically prescribed, as it was generally not requested by patients, who reported satisfactory binocular vision.

In the toric group, the mean residual vector astigmatism was 0.23 D ±0.34 D. Vector analysis revealed that refractive outcomes were centered on the postoperative target, underscoring the procedure's predictability.

Preoperative astigmatism assessment followed our service protocol, which involved administering one drop of artificial tear before biometry, as described in a previous study.[19] This approach corrected keratometry errors associated with lacrimal instability, observed in approximately half the patients, and significantly reduced deviation from the postoperative refractive target.

These results further highlight the efficacy of the toric calculator provided by the manufacturer. We utilized the TK value measured by the IOL Master 700 for calculations, as the calculator lacks a nomogram for estimating TK. This approach is crucial for optimizing astigmatism correction outcomes. In a recent study, we demonstrated that the TK values obtained using the IOL Master 700 were comparable to those estimated by the Abulafia-Koch nomogram when calculating another toric implant (Vivinex Toric IOL, HOYA Corporation).[20]

Another significant finding was the consistent performance of the toric IOL regardless of its orientation during surgery. This confirms that the near portion of the lens does not need to be placed inferiorly, as previously reported by Song et al in a study of 45 patients using the Mplus LS313 version of the implant.[21]

Patients reported minimal photic phenomena, with no severe cases observed. This represents an advantage over multifocal and other diffractive implants. Notably, this evaluation was conducted early, at just one-month post-surgery, as photic effects are known to diminish over time. These findings underscore the immediate postoperative comfort experienced by patients, without evidence of the cognitive adaptation periods typically associated with multifocal implants. This is an important consideration for preoperative patient counseling.

This study has several limitations. First, the sample size of toric subgroup was small, which limits the generalizability of the findings. Secondly, as it is retrospective in nature, there is a potential for missing data on some patients. However, we had complete refractive data for distance and near vision, along with most intermediate visual acuity measurements. The relatively short follow-up period limited our ability to evaluate long-term outcomes including refractive stability, axis alignment stability, neuroadaptation, and photic phenomena; however, the observed immediate adaptation to the implant mitigates some of this limitation. Additionally, only a subset of patients completed the questionnaire provided in the waiting room, which may introduce bias in the assessment of photic phenomena and spectacle independence. Critically, objective optical quality metrics such as contrast sensitivity were not collected, as they were not standard in routine clinical practice. This limited quantitative assessment of optical performance. Additionally, toric calculations were performed using the manufacturer's online calculator, which reflects real-world clinical practice for this implant. While this approach enhances the relevance of our findings to routine care, future studies using independent calculation methods could help confirm these results. Lastly, while the study was conducted at a single center, it was performed in a facility with significant expertise in toric lens implantation, highlighting the potential of this implant.

The strengths of this study include its relatively large sample size of the total cohort, consecutive recruitment of patients eligible for cataract surgery, and consistent use of standard surgical protocols across five surgeons. To our knowledge, this is the first comparative study to report on the performance of the low-addition refractive bifocal IOL and its toric version, regardless of axis alignment.

Conclusion

In summary, this study demonstrates satisfactory functional and refractive outcomes for the low-addition refractive bifocal IOL and its toric version, achieving high levels of spectacle independence and a low incidence of photic disturbances. However, our assessment of optical quality is based on subjective patient-reported outcomes rather than objective measurements, and the limited questionnaire response rate may affect the generalizability of these findings. These results should therefore be interpreted as indirect indicators of optical performance and validated by larger prospective studies with longer follow-up periods and comprehensive objective optical quality assessments.

Abbreviations

AS-OCT, anterior segment optical coherence tomography; ATR, against-the-rule; CDVA, corrected distance visual acuity; EDOF, extended depth of focus; GCP, Good Clinical Practice; IOLs, intraocular lenses; RoF, range of field; TK, total keratometry; UNVA, uncorrected near visual acuity; UIVA, uncorrected intermediate visual acuity; UDVA, uncorrected distance visual acuity; WTR, with-the-rule.

Funding

The authors have no financial or proprietary interest in any of the materials or methods mentioned and received no funding for this study.

Disclosure

Corinne Dot is a consultant for Alcon, Hoya, Teleon, and Zeiss. The other authors have no disclosures to declare for this work.

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