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Original Article

# Predictability of Astigmatism Correction Following Implantation of Three Different Toric Intraocular Lenses: A Prospective Comparative Study

**Dr. Shruti[1], Dr. Nagashree B N[2], Dr. Santosh Police Patil[3]**

*[1]Consultant, Department of Ophthalmology, V.E. Hospital, Bidar, Karnataka, India.*
*[2]Assistant Professor, Department of Ophthalmology, Shridevi Institute of Medical Sciences and Research Hospital, Tumkur, Karnataka, India.*
*[3]Megur Eye Care Centre, Bidar, Karnataka, India.*

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**Corresponding Author:**

**Dr. Nagashree B N**
Assistant Professor, Department of Ophthalmology, Shridevi Institute of Medical Sciences and Research Hospital, Tumkur, Karnataka, India.

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## ABSTRACT

**Background:** Toric intraocular lens (IOL) implantation during phacoemulsification is the current standard for simultaneous correction of cataract and pre-existing corneal astigmatism. Multiple toric IOL platforms are now marketed at widely differing price points in India, yet head-to-head comparative data across affordable brands remain limited.

**Aims:** To evaluate and compare the predictability of astigmatism correction, rotational stability, and visual outcomes after implantation of AcrySof IQ Toric, Biotech Eyecryl Toric, and Acriol EC 40 Toric intraocular lenses at a tertiary care centre in Bidar, Karnataka.

**Materials and Methods:** A prospective, comparative interventional study was conducted on 120 eyes of 120 patients with visually significant cataract and pre-existing corneal astigmatism (against-the-rule >0.75 D or with-the-rule >1.25 D). Patients were allocated on the basis of affordability to receive one of three toric IOLs (n=40 per group). Standard phacoemulsification through a 2.8 mm clear corneal incision was performed and the IOL aligned to the steep meridian. All patients were assessed at day 1, day 5, day 45, and 3 months for uncorrected distance visual acuity (UDVA), refraction, keratometry, and IOL axis alignment. Data were analysed using descriptive statistics and the chi-square test, with $p<0.05$ taken as significant.

**Results:** Postoperatively at 3 months, residual refractive astigmatism ≤0.5 D was achieved in 35/40 (87.5%) eyes with AcrySof IQ, 24/40 (60.0%) eyes with Eyecryl, and 28/40 (70.0%) eyes with Acriol EC ($p=0.014$). IOL rotation of less than 10° was documented in 38 (95.0%), 32 (80.0%), and 34 (85.0%) eyes respectively; rotation greater than 30° occurred only in the Eyecryl group (3 eyes, 7.5%). Refractive surprise was observed in 5 (4.2%) eyes overall, predominantly in the Acriol EC group. Mean UDVA at 3 months was 0.10 ± 0.09 logMAR in the AcrySof IQ group compared with 0.18 ± 0.13 and 0.20 ± 0.14 logMAR in the Eyecryl and Acriol EC groups ($p<0.05$).

**Conclusion:** All three toric IOLs delivered clinically acceptable astigmatism correction, but the AcrySof IQ Toric provided the most predictable refractive outcome and the tightest rotational stability. Choice of IOL in resource-limited practice should balance affordability against these small but consistent differences in predictability.

***Keywords****: Toric intraocular lens; phacoemulsification; corneal astigmatism; rotational stability; residual astigmatism; AcrySof IQ; Eyecryl; Acriol EC.*

## INTRODUCTION

Cataract remains the leading cause of reversible blindness worldwide, and pre-existing corneal astigmatism is one of the most important determinants of the quality of vision that can be achieved after otherwise uncomplicated cataract surgery. Contemporary population-based studies from Asia have consistently shown that a substantial proportion of cataract-surgery candidates carry clinically meaningful corneal astigmatism. In a hospital-based series of 5662 consecutive eyes undergoing cataract surgery in Northern China, Wu and colleagues reported a mean corneal astigmatism of 0.98 ± 0.76 D, with 22.15% of eyes showing astigmatism between 1.00 and 1.49 D and a further 10.28% falling between 1.50 and 1.99 D; approximately one in three eyes therefore had ≥1.00 D of pre-existing corneal astigmatism.[1] Indian data mirror these findings: in a prospective series of 1000 eyes from a rural Indian teaching hospital, Joshi and Jadhav documented a mean corneal astigmatism of 0.89 ± 0.63 D, with 32.5% of eyes carrying ≥1.00 D of astigmatism and against-the-rule (ATR) astigmatism predominating at 44.6%.[2] These epidemiological data underline that pre-existing corneal astigmatism is not a niche problem but a routine surgical consideration.

Even relatively small amounts of residual refractive astigmatism have well-documented effects on postoperative uncorrected visual acuity, spectacle independence, and patient satisfaction after cataract surgery. Biometric surveys extending back to the seminal paper of Hoffer, which examined 7500 cataractous eyes in 1980, first characterised the population distribution of ocular biometric variables that continue to inform intraocular lens (IOL) power calculation today.[3] Since then, several surgical approaches have been developed to manage corneal astigmatism at the time of cataract extraction, including opposite clear corneal incisions, limbal relaxing incisions, astigmatic keratotomy, and, most importantly, the implantation of toric IOLs. Toric IOLs were first introduced into clinical practice by Shimizu and colleagues in 1994, who demonstrated in 47 eyes with against-the-rule astigmatism that a posterior chamber toric silicone lens could achieve best-corrected visual acuity of 20/25 or better in 77% of eyes, provided that lens axis shift was kept below 30°.[4] Since that first-generation design, incremental improvements in optic material, haptic geometry, and cartridge-based delivery systems have translated into progressively better refractive predictability and rotational stability.
The clinical case for the toric IOL is now firmly established. In an early systematic review of 11 studies, Agresta and colleagues showed that implantation of a toric IOL produced consistent improvements in uncorrected distance visual acuity (UDVA) across four different lens platforms.[5] A more definitive assessment came from the Cochrane-based meta-analysis of Kessel and colleagues, who pooled 13 randomised controlled trials comparing toric with non-toric IOL implantation in 1413 eyes and reported high-quality evidence that toric IOL implantation was associated with better UDVA (logMAR mean difference −0.07; 95% CI −0.10 to −0.04), a significantly higher rate of spectacle independence (risk ratio 0.51; 95% CI 0.36–0.71), and lower residual astigmatism than non-toric IOLs even when relaxing incisions were used, without an increase in complication rates.[6] Long-term single-surgeon experience with early toric platforms also supports predictability: in a prospective series of 100 consecutive Staar toric IOL implantations, Till and colleagues documented a reduction in mean refractive astigmatism from 2.48 D preoperatively to 0.87 D postoperatively, with half of patients ending with ≤0.50 D of residual astigmatism.[7]

The predictability of postoperative astigmatism correction after toric IOL implantation, however, is not determined by the optic design alone. It is a function of preoperative biometry accuracy, surgical technique (in particular the precision of intra-operative axis marking), effective incision-induced astigmatism, and, most critically, the rotational stability of the lens within the capsular bag over the first postoperative weeks. Each 1° of axis misalignment is believed to reduce the cylindrical correction of the lens by approximately 3.3%, so that a rotation of 10° erodes about a third of the intended astigmatic correction, and a rotation of 30° effectively neutralises it. Contemporary comparative data illustrate how these engineering choices influence outcomes. Sun and colleagues randomised 79 eyes to a C-loop haptic AcrySof toric IOL or a plate-haptic AT TORBI 709 M IOL and reported comparable residual astigmatism at 3 months but a significantly smaller mean rotation with the plate-haptic design (2.33° ± 2.31° vs 3.85° ± 2.92°; $p<0.05$).[8] Wang and colleagues used anterior-segment OCT to correlate rotational stability with capsular bend formation and showed that the AcrySof IQ toric IOL had significantly less total misalignment than a TECNIS toric IOL at every follow-up point (approximately 3.55° vs 6.96° at day 1; $p<0.05$), attributable to earlier capsular adhesion around the AcrySof optic.[9]

Head-to-head comparisons that are directly relevant to Indian practice have recently emerged. Korpole and colleagues, in a real-world South Indian series of 143 eyes, found that the Eyecryl toric and Alcon AcrySof IQ toric IOLs produced comparable postoperative UDVA and residual astigmatism at 1 month (0.36 ± 0.42 D vs 0.50 ± 0.51 D; $p=0.87$).[10] Thulasidas and colleagues, in a single-centre study of 108 eyes, similarly showed that both Eyecryl and Tecnis toric IOLs achieved logMAR UDVA within 0.09 at 3 months, although the Tecnis platform delivered marginally lower residual astigmatism (−0.16 ± 0.27 D vs −0.29 ± 0.34 D; $p=0.038$).[11] A comparative study of toric IOL implantation versus

opposite clear corneal incisions from Sankara Eye Hospital showed that although both techniques were effective, the toric IOL group achieved a mean residual refractive cylinder of only 0.05 ± 0.15 D compared with 0.60 ± 0.38 D in the incision group at 6 weeks (p=0.007).[12] The extended-depth-of-focus platform has also matured, with Pastor-Pascual and colleagues demonstrating a mean IOL rotation of only 0.74° ± 1.13° and a rotation of less than 5° in every eye implanted with the AcrySof IQ Vivity toric IOL,[13] and Lee reporting bilateral outcomes with 86.7% of eyes rotating less than 5°.[14] Finally, the largest single-centre Indian dataset to date, from the Aravind Eye Hospital in Madurai, showed that hydrophilic and hydrophobic acrylic single-piece toric IOLs had comparable surgical repositioning rates (1.8% vs 1.5%; p=0.59), providing important reassurance that hydrophilic platforms—typically the more affordable option in the Indian market—are not inherently inferior in real-world use.[15]

In this context, the present study was designed to compare, in a single centre and by a single surgical team, the predictability of astigmatism correction following implantation of three toric IOL platforms that are in widespread use at Indian tertiary care centres: AcrySof IQ Toric, Biotech Eyecryl Toric, and Acriol EC 40 Toric. The choice of these three IOLs reflects the spectrum of affordability that governs day-to-day decision-making in an Indian ophthalmology practice and generates locally relevant evidence that can guide surgeon–patient counselling.

## AIMS AND OBJECTIVES

The study was undertaken with the following objectives:

(i) To evaluate the visual and refractive outcomes—including uncorrected distance visual acuity and residual refractive astigmatism—following cataract surgery with implantation of AcrySof IQ Toric, Biotech Eyecryl Toric, and Acriol EC 40 Toric intraocular lenses.

(ii) To compare the rotational stability of the three toric IOL platforms at 3 months postoperatively.

(iii) To document the frequency and clinical characteristics of refractive surprise across the three groups.

## MATERIALS AND METHODS

### Study Design and Setting

This was a prospective, comparative interventional study conducted in the Department of Ophthalmology at V.E. Hospital, Bidar, in collaboration with Megur Eye Care Centre, Bidar, Karnataka, India, between the years 2022 and 2024.

### Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee prior to enrolment of the first participant. Written informed consent was obtained from every participant after explanation of the study procedures in the local language. The study adhered to the tenets of the Declaration of Helsinki.

### Sample Size and Group Allocation

One hundred and twenty eyes of 120 consecutive patients meeting the eligibility criteria were enrolled and allocated to one of three toric IOL groups (40 eyes per group) on the basis of patient affordability: AcrySof IQ Toric (Alcon Laboratories, Fort Worth, TX, USA), Biotech Eyecryl Toric (Biotech Vision Care, Ahmedabad, India), or Acriol EC 40 Toric (Medicontur, Zsámbék, Hungary). Where more than one platform was affordable to a given patient, the surgeon proceeded with the next sequential group in the enrolment log to preserve balance across arms.

### Inclusion Criteria

Adult patients with a visually significant senile cataract and one of the following forms of pre-existing corneal astigmatism were included: against-the-rule (ATR) astigmatism greater than 0.75 D (steep axis at 180° ± 30°), or with-the-rule (WTR) astigmatism greater than 1.25 D (steep axis at 90° ± 30°).

### Exclusion Criteria

Patients with irregular corneal astigmatism (including manifest or subclinical keratoconus), a poorly dilating pupil, pre-existing zonular weakness, previous retinal surgery, previous glaucoma filtration surgery, high myopia (axial length >26.0 mm), high hypermetropia (axial length <21.5 mm), or those unwilling to participate were excluded from the study.

### Preoperative Evaluation

All patients underwent a comprehensive preoperative work-up including slit-lamp biomicroscopy, Goldmann applanation tonometry, dilated fundus examination, subjective refraction, elevation-based corneal topography, automated keratometry, and A-scan biometry for axial length. The steep and flat keratometry values and the corresponding axes were entered into the manufacturer's online toric IOL calculator. The SRK/T formula was used for IOL spherical-equivalent power calculation, targeting postoperative emmetropia.

**Surgical Technique**
All surgeries were performed by a single experienced surgeon under topical anaesthesia. The horizontal corneal reference meridian was marked with ink at the slit-lamp with the patient upright to avoid cyclotorsional error. On the operating table, the intended toric IOL alignment axis was then marked from the horizontal reference. A temporal 2.8 mm clear corneal incision was fashioned, followed by continuous curvilinear capsulorhexis, hydrodissection, and phacoemulsification of the nucleus using a stop-and-chop technique. After thorough cortical clean-up, the toric IOL was injected into the capsular bag through the primary incision. The lens was rotated to within 10° of the calculated axis, the ophthalmic viscosurgical device (OVD) was removed from both anterior chamber and behind the optic, and the lens was then fine-tuned to the exact intended axis. The corneal wound was hydrated and confirmed to be watertight. Alignment was rechecked after OVD removal to detect early rotation.

**Postoperative Assessment and Follow-up**
Patients were reviewed on postoperative day 1, day 5, day 45, and at 3 months. At each visit, uncorrected and best-corrected distance visual acuity were measured using the Snellen chart and expressed in logMAR for analysis; subjective refraction, keratometry, and IOL axis alignment on the slit-lamp under maximal mydriasis were also documented. Rotational stability was quantified as the absolute difference in degrees between the achieved postoperative axis and the intended axis at 3 months, and was categorised as <10°, 10°–30°, or >30°.

**Definitions**
Predictable astigmatic correction was defined a priori as a postoperative residual refractive cylinder of 0.50 D or less at 3 months. Refractive surprise was defined as a postoperative manifest spherical equivalent that deviated by more than 1.00 D from the predicted target refraction.

**Statistical Analysis**
Data were entered into Microsoft Excel and analysed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation and categorical variables as frequencies and percentages. Between-group comparisons for categorical outcomes were performed using the chi-square test or Fisher's exact test, and for continuous outcomes using the one-way ANOVA with post-hoc Tukey correction. A two-sided p value of less than 0.05 was taken as statistically significant.

**RESULTS**
One hundred and twenty eyes of 120 patients completed the 3-month follow-up and were included in the final analysis. There were 62 male (51.7%) and 58 female (48.3%) patients, and the three groups were comparable at baseline.

**Baseline Characteristics**
The mean age of the cohort was 63.4 ± 8.7 years. Preoperative corneal astigmatism ranged from 0.80 D to 3.75 D, with a mean of 1.58 ± 0.62 D. There were no clinically meaningful differences in age, gender distribution, or preoperative astigmatism among the three groups. Baseline characteristics are summarised in Table 1.

**Table 1. Baseline demographic and refractive characteristics of the three toric IOL groups.**

| Variable | AcrySof IQ (n=40) | Eyecryl (n=40) | Acriol EC (n=40) | Total (n=120) |
|---|---|---|---|---|
| Male, n (%) | 21 (52.5) | 23 (57.5) | 18 (45.0) | 62 (51.7) |
| Female, n (%) | 19 (47.5) | 17 (42.5) | 22 (55.0) | 58 (48.3) |
| Mean age (years) | 62.9 ± 8.4 | 63.7 ± 9.1 | 63.6 ± 8.7 | 63.4 ± 8.7 |
| Mean preop keratometric astigmatism (D) | 1.61 ± 0.58 | 1.55 ± 0.63 | 1.58 ± 0.66 | 1.58 ± 0.62 |
| ATR astigmatism, n (%) | 24 (60.0) | 22 (55.0) | 25 (62.5) | 71 (59.2) |
| WTR astigmatism, n (%) | 16 (40.0) | 18 (45.0) | 15 (37.5) | 49 (40.8) |

**Distribution of Postoperative Residual Astigmatism**
At 3 months postoperatively, the proportion of eyes achieving zero residual refractive astigmatism was 19 (47.5%) in the AcrySof IQ group, 10 (25.0%) in the Eyecryl group, and 18 (45.0%) in the Acriol EC group. Residual astigmatism greater than 1.0 D was documented in no eyes with AcrySof IQ, 6 (15.0%) with Eyecryl, and 1 (2.5%) with Acriol EC. Overall, residual astigmatism of ≤0.5 D was achieved in 35 (87.5%) AcrySof IQ eyes, 24 (60.0%) Eyecryl eyes, and 28 (70.0%) Acriol EC eyes, a difference that reached statistical significance ($\chi^2$=8.5, p=0.014). The distribution of postoperative residual astigmatism across the three groups is presented in Table 2 and Figure 1.

**Table 2. Distribution of postoperative residual refractive astigmatism at 3 months (n=40 per group).**

| Residual astigmatism | AcrySof IQ | Eyecryl | Acriol EC |
|---|---|---|---|
| 0 D (no correction needed) | 19 (47.5%) | 10 (25.0%) | 18 (45.0%) |
| −0.5 D | 16 (40.0%) | 14 (35.0%) | 10 (25.0%) |
| >−0.5 to −1.0 D | 5 (12.5%) | 10 (25.0%) | 11 (27.5%) |
| >−1.0 D | 0 (0%) | 6 (15.0%) | 1 (2.5%) |
| Eyes with ≤0.5 D residual | 35 (87.5%) | 24 (60.0%) | 28 (70.0%) |

Figure 1. Distribution of postoperative residual astigmatism across three toric IOL groups (n=40 per group)

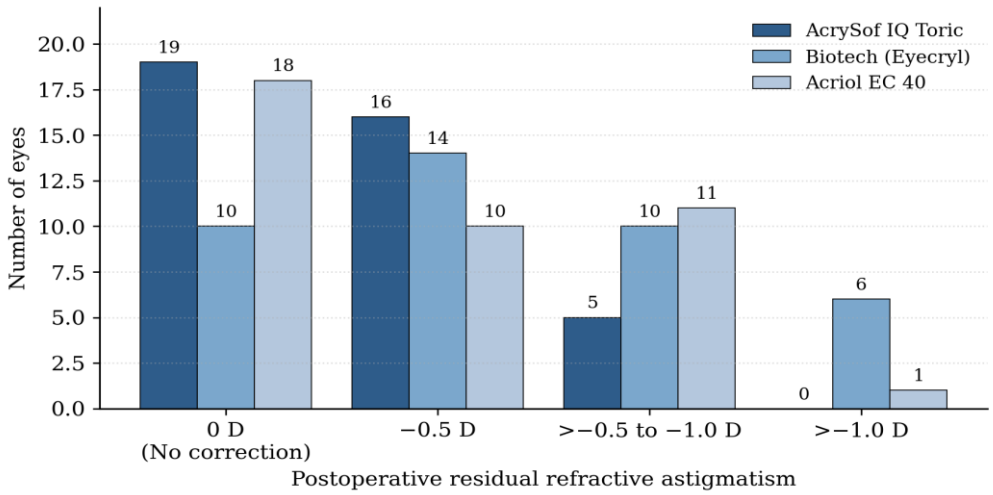


***Figure 1. Distribution of postoperative residual refractive astigmatism across the three toric IOL groups at 3 months.***

**Rotational Stability**

IOL rotation of less than 10° from the intended axis, considered clinically negligible, was documented in 38 (95.0%) eyes with AcrySof IQ, 32 (80.0%) eyes with Eyecryl, and 34 (85.0%) eyes with Acriol EC. Rotation between 10° and 30° was observed in 2 (5.0%), 5 (12.5%), and 6 (15.0%) eyes respectively, and rotation greater than 30°—which typically warrants surgical repositioning—occurred only in the Eyecryl group (3 eyes; 7.5%). None of the three eyes with rotation greater than 30° were repositioned during the 3-month follow-up; conservative management was preferred as best-corrected acuity remained functional. Data on rotational stability are presented in Table 3 and Figure 2.

**Table 3. Rotational stability of the three toric IOLs at 3 months (n=40 per group).**

| IOL rotation from intended axis | AcrySof IQ | Eyecryl | Acriol EC |
|---|---|---|---|
| <10° (clinically negligible) | 38 (95.0%) | 32 (80.0%) | 34 (85.0%) |
| 10°–30° | 2 (5.0%) | 5 (12.5%) | 6 (15.0%) |
| >30° (repositioning indicated) | 0 (0%) | 3 (7.5%) | 0 (0%) |

Figure 2. Rotational stability of the three toric IOLs at 3 months postoperatively (n=40 per group)

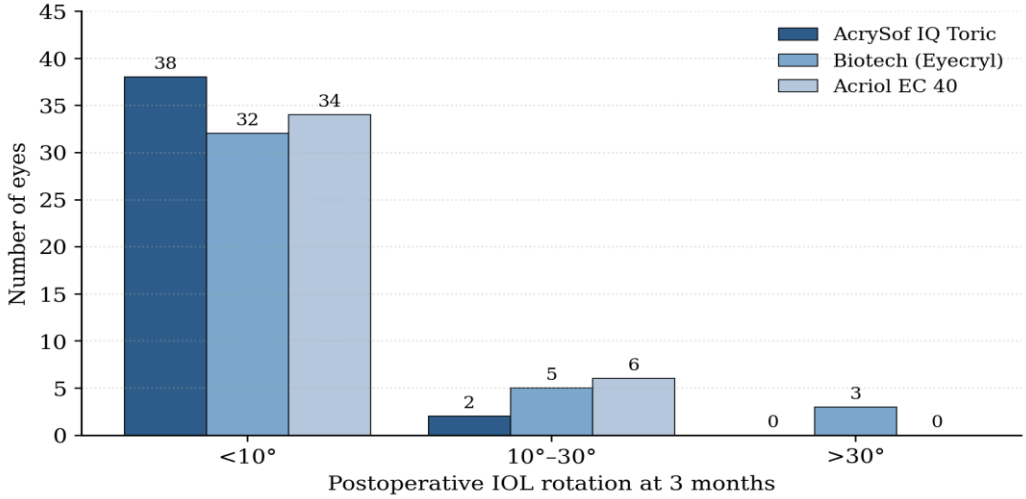


***Figure 2. Rotational stability of the three toric IOLs at 3 months postoperatively.***

**Uncorrected Distance Visual Acuity**

The distribution of uncorrected distance visual acuity at 3 months is presented in Table 4. UDVA of 6/9 (0.18 logMAR) or better was achieved in 38 (95.0%) AcrySof IQ eyes, 30 (75.0%) Eyecryl eyes, and 32 (80.0%) Acriol EC eyes. The mean UDVA at 3 months was 0.10 ± 0.09 logMAR in the AcrySof IQ group compared with 0.18 ± 0.13 logMAR in the Eyecryl group and 0.20 ± 0.14 logMAR in the Acriol EC group; one-way ANOVA with post-hoc Tukey correction showed the AcrySof IQ mean to be significantly lower than the other two groups ($p<0.05$), which did not differ significantly from each other.

**Table 4. Distribution of uncorrected distance visual acuity (UDVA) at 3 months.**

| UDVA (Snellen / logMAR) | AcrySof IQ | Eyecryl | Acriol EC |
|---|---|---|---|
| 6/6–6/9 (0 to 0.18) | 38 (95.0%) | 30 (75.0%) | 32 (80.0%) |
| 6/12–6/18 (0.30 to 0.48) | 2 (5.0%) | 8 (20.0%) | 7 (17.5%) |
| Worse than 6/18 (>0.48) | 0 (0%) | 2 (5.0%) | 1 (2.5%) |
| Mean UDVA (logMAR) | 0.10 ± 0.09 | 0.18 ± 0.13 | 0.20 ± 0.14 |

**Refractive Surprise and Complications**

Refractive surprise, defined as a manifest spherical-equivalent deviation of more than 1.00 D from the predicted refraction, was documented in 5 (4.2%) eyes overall: none with AcrySof IQ, 2 (5.0%) with Eyecryl, and 3 (7.5%) with Acriol EC. All eyes with refractive surprise had preoperative axial lengths outside the mid-range (<22.5 mm or >25.0 mm). No intra-operative posterior capsular rupture, dropped nucleus, or endothelial decompensation was observed in any of the 120 eyes. Details of adverse refractive outcomes are shown in Table 5.

**Table 5. Refractive surprise and adverse outcomes across the three IOL groups.**

| Adverse outcome | AcrySof IQ | Eyecryl | Acriol EC | Total |
|---|---|---|---|---|
| Refractive surprise (>1.0 D SE deviation) | 0 (0%) | 2 (5.0%) | 3 (7.5%) | 5 (4.2%) |
| IOL rotation >30° at 3 months | 0 (0%) | 3 (7.5%) | 0 (0%) | 3 (2.5%) |
| Residual astigmatism >1.0 D | 0 (0%) | 6 (15.0%) | 1 (2.5%) | 7 (5.8%) |
| UDVA worse than 6/18 at 3 months | 0 (0%) | 2 (5.0%) | 1 (2.5%) | 3 (2.5%) |

## DISCUSSION

This prospective comparative study of 120 eyes across three commonly used toric IOL platforms in an Indian training centre demonstrates that all three lenses—AcrySof IQ Toric, Biotech Eyecryl Toric, and Acriol EC 40 Toric—produce clinically acceptable astigmatic correction after phacoemulsification. However, meaningful differences in the predictability and precision of correction, in the frequency of clinically important rotation, and in the risk of refractive surprise emerged among the three groups, and these observations align closely with the contemporary international literature.

**Predictability of Astigmatism Correction**

The proportion of eyes reaching a residual refractive cylinder of ≤0.5 D at 3 months—commonly regarded as the threshold for successful astigmatism management—was 87.5% in the AcrySof IQ group, 60.0% in the Eyecryl group, and 70.0% in the Acriol EC group. Our AcrySof IQ result compares favourably with the multi-platform pooled data of the systematic review by Agresta and colleagues, who documented consistent UDVA gains with several toric IOL platforms.[5] It is also consistent with the meta-analysis of Kessel and colleagues, who reported that toric IOLs produced significantly lower residual astigmatism than non-toric IOLs even when relaxing incisions were combined (mean difference 0.37 D; 95% CI −0.55 to −0.19).[6] Our Eyecryl 60% result at ≤0.5 D is slightly lower than the 68% reported by Korpole and colleagues in a South Indian real-world series and slightly lower than the mean postoperative residual astigmatism of 0.36 ± 0.42 D that they documented at 1 month.[10] Thulasidas and colleagues, comparing Eyecryl with Tecnis toric IOLs, reported a mean residual astigmatism of −0.29 ± 0.34 D for Eyecryl at 3 months in a series of 108 eyes.[11] The relatively higher proportion of eyes with residual astigmatism >1.0 D in our Eyecryl group (15.0%) probably reflects the mixed pool of pre-existing astigmatism at our centre and the smaller subgroup sample size.

**Rotational Stability**

The rotational stability profile of the three lenses in our series is instructive. Ninety-five percent of AcrySof IQ eyes had rotation of less than 10° at 3 months, compared with 80% in the Eyecryl group and 85% in the Acriol EC group, and rotation greater than 30° occurred only in the Eyecryl arm (3 of 40 eyes; 7.5%). These figures are broadly consistent with the direct comparison by Wang and colleagues, who used anterior-segment OCT and showed that AcrySof IQ toric IOLs

had significantly less total misalignment than TECNIS toric IOLs at every follow-up point out to 3 months ($p<0.05$), and attributed this advantage to earlier capsular bend formation around the AcrySof optic.[9] The randomised comparison by Sun and colleagues between a C-loop haptic AcrySof toric IOL and a plate-haptic AT TORBI toric IOL showed a slightly greater mean rotation for the C-loop design (3.85° ± 2.92° vs 2.33° ± 2.31°; $p<0.05$), suggesting that plate-haptic geometry may offer marginal advantages in rotational stability that could partly explain the Acriol EC performance in our series.[8] Reassuringly, the very large real-world dataset from the Aravind Eye Hospital reported by Haripriya and colleagues—which included 5529 toric IOL implantations—showed comparable surgical repositioning rates for hydrophilic and hydrophobic acrylic single-piece toric IOLs (1.8% vs 1.5%; $p=0.59$), broadly supporting our observation that all three platforms are workable in routine practice.[15] The pioneering series of Till and colleagues had already flagged that if clinically important rotation is to occur, it usually manifests within the first postoperative week and is amenable to early repositioning, an operational principle that remains relevant for the eyes with rotation >30° in our Eyecryl subgroup.[7]

**Visual Outcomes**

The 95% of AcrySof IQ eyes achieving UDVA of 6/9 or better in our study is very similar to the 96.7% of eyes achieving UDVA of 6/9 or better after toric IOL implantation reported by Priyamvada and colleagues in a comparison against opposite clear corneal incisions.[12] Newer toric extended-depth-of-focus platforms have raised the bar further: Pastor-Pascual and colleagues reported that 97.87% of eyes implanted with the AcrySof IQ Vivity toric IOL had a postoperative refractive cylinder of ≤0.50 D, with a mean IOL rotation of 0.74° ± 1.13° and no eye rotating more than 5°.[13] Lee's bilateral series with the same lens reported that 86.7% of eyes had rotation of less than 5°.[14] These modern datasets reinforce that the AcrySof platform is a benchmark for predictability, but that the differences between our lenses at 3 months are, in absolute clinical terms, small: the mean UDVA gap between AcrySof IQ (0.10 logMAR) and Eyecryl (0.18 logMAR) or Acriol EC (0.20 logMAR) is less than one Snellen line.

**Refractive Surprise**

Refractive surprise was seen in 5 eyes across the study (4.2%), predominantly in the Acriol EC group. All five eyes had axial lengths at the extremes of our biometry distribution (<22.5 mm or >25.0 mm), highlighting the well-known limitation of the SRK/T formula at extreme axial lengths, first characterised in Hoffer's landmark biometric survey of 7500 eyes.[3] The absence of refractive surprise in the AcrySof IQ arm may reflect the maturity of the Alcon online toric calculator and its incorporation of posterior corneal astigmatism adjustments, which are not uniformly available for every third-party platform. Practically, at Indian training centres where multiple lens platforms are stocked, choosing an IOL with a well-validated online calculator is a modest but meaningful safeguard against refractive surprise, especially in short and long eyes.

**Regional Relevance and Cost Considerations**

Approximately one-third of Indian cataract surgery patients carry ≥1.00 D of corneal astigmatism, as documented by Joshi and Jadhav,[2] which mirrors the international data of Wu and colleagues.[1] Even a conservative interpretation of these prevalence figures translates into an enormous unmet need in India, where cost is often the deciding factor between a toric IOL and a monofocal IOL. In this context, the more affordable Eyecryl and Acriol EC platforms remain valuable options, particularly when combined with meticulous biometry, precise intra-operative axis marking, and early identification of the small number of eyes that require repositioning.

**Strengths and Limitations**

The strengths of this study include its prospective design, the use of a single surgical team and a standardised protocol across all three IOL platforms, and the availability of complete follow-up data for every enrolled eye. The chief limitations are the non-randomised, affordability-based allocation, which introduces the possibility of unmeasured confounding, and the modest per-group sample size, which limits statistical power to detect small between-group differences. Follow-up was restricted to 3 months and does not address longer-term rotation, posterior capsular opacification, or refractive drift. A larger randomised trial with 6- to 12-month follow-up and inclusion of posterior corneal astigmatism measurements would help to refine these findings.

**CONCLUSION**

In this prospective comparative study of 120 eyes, implantation of the AcrySof IQ Toric, Biotech Eyecryl Toric, and Acriol EC 40 Toric intraocular lenses during phacoemulsification all produced clinically acceptable correction of pre-

existing corneal astigmatism. Overall, 87.5% of eyes implanted with the AcrySof IQ Toric achieved a residual refractive cylinder of ≤0.5 D at 3 months, compared with 70.0% for the Acriol EC 40 Toric and 60.0% for the Biotech Eyecryl Toric (p=0.014). Rotational stability within 10° of the intended axis was seen in 95.0%, 85.0% and 80.0% of eyes respectively, and refractive surprise was concentrated in the Acriol EC group. AcrySof IQ Toric therefore provided the most predictable astigmatism correction and the tightest rotational profile, but the absolute clinical differences among the three lenses were small, particularly for eyes with moderate to high pre-existing astigmatism. In a resource-limited setting such as the Indian training-centre environment, the more affordable Eyecryl and Acriol EC platforms remain reasonable choices provided that biometry, axis marking, and postoperative surveillance are meticulous. Selection of a toric IOL for a given patient should therefore balance predictability against affordability, and both surgeon and patient should be aware that the small predictability premium associated with the more expensive platform is not always clinically decisive.

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