

Patient-Reported Outcomes After Bilateral Implantation of Monofocal versus Monofocal-Plus Toric Intraocular Lenses

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Purpose: To compare patient-reported outcomes and visual performance after implantation of a conventional monofocal toric intraocular lens (Clareon, Alcon) versus a monofocal-plus toric intraocular lens (Eyehance, Johnson & Johnson Vision).

Design: Single-center retrospective observational study with cross-sectional postoperative survey.

Setting: Vance Thompson Vision, West Fargo, North Dakota.

Methods: Patients who underwent bilateral cataract surgery between 2020 and 2025 with monofocal (Clareon) or monofocal-plus (Eyehance) toric IOLs were included. Chart data included uncorrected and best-corrected visual acuities, lens power, prior LASIK, and postoperative YAG capsulotomy or laser fine-tune. Eligible patients completed an 11-question telephone survey assessing satisfaction, glare/haloes, spectacle use across visual tasks, and willingness to choose the same lens again. Differences between groups were analyzed using Fisher's exact, Chi-square, and Wilcoxon rank-sum tests. Multivariable ordinal logistic regression evaluated independent predictors of satisfaction.

Results: In total, 92 patients completed the survey (response rate 83.6%). Distance UCVA and BCVA were excellent and not significantly different between groups. Eyehance patients demonstrated better near UCVA ($p < 0.001$), consistent with its optical design. Spectacle independence across intermediate and near tasks was broadly similar, showing only a non-significant trend toward greater independence for computer use in the Eyehance group. Eyehance patients reported glare more frequently ($p = 0.034$), but glare-related bother remained low and did not differ significantly between groups. Clareon patients reported being "very satisfied" more frequently ($p < 0.001$), but adjusted ordinal regression showed higher overall satisfaction odds in the Eyehance group (adjusted OR 2.11, 95% CI 1.08–4.18, $p = 0.031$).

Conclusion: Both toric IOL platforms provided excellent distance vision and favorable patient-reported outcomes. The monofocal-plus Eyehance design offered superior uncorrected near vision with increased glare frequency, without significant differences in glare bother between groups. These findings support individualized counseling and shared decision-making when choosing between conventional monofocal and monofocal-plus toric IOLs.

Keywords: cataract surgery, intraocular lens, patient-reported outcomes, visual acuity, spectacle independence

Introduction

Increasing diversity of intraocular lenses (IOLs), particularly toric designs which correct for astigmatism, has expanded options for patients with cataracts and pre-existing astigmatism. Approximately 40% of cataract patients have corneal astigmatism of 1D or more, which is considered clinically significant and will result in a decrease in uncorrected vision.¹ If this astigmatism is left uncorrected, patient satisfaction decreases postoperatively.² Options for correcting residual astigmatism include arcuate partial-depth incisions, corneal refractive surgery such as LASIK, pinhole IOLs, Light Adjustable Lenses (LAL), or toric IOLs.^{3–6} Toric IOLs have many advantages compared to the other options listed, with a major one being correcting the astigmatism at the time of cataract surgery versus at a later time with a secondary procedure. Particularly at higher levels of corneal astigmatism, toric IOLs have been shown to have better predictability

and are often considered the preferred option over corneal arcuate incisions.^{7,8} Toric IOLs offer simultaneous cataract removal and astigmatic correction at the time of surgery, which reduces the need for postoperative refractive procedures.

Randomized clinical trials have demonstrated favorable refractive and visual outcomes with toric IOLs; however, patient satisfaction is influenced by more than just visual acuity. Factors such as contrast sensitivity, dysphotopsias, and spectacle need at different distances contribute to the overall visual experience.^{9–11} Positive dysphotopsias are largely caused by light reflection off the interior surface of IOLs onto the retina. They can be caused by non-imaging optic geometry but are typically associated with square-edge IOL designs.¹² Negative dysphotopsias are believed to be caused by a gap between the retinal images formed by both light bypassing the IOL and light passing through the IOL optic.¹³ Real-world data have shown that patients with excellent visual acuity may report dissatisfaction due to glare, halos, or unmet expectations.^{14,15}

Different toric IOL brands may vary in optical design, material properties, and rotational stability, which can affect visual performance. Hydrophobic vs hydrophilic acrylic materials and variations in haptic design may contribute to differences in long-term rotational alignment and visual quality.^{16–18} These design features can influence both objective outcomes and subjective experiences, including dysphotopsias or the frequency of spectacle use. In particular, newer monofocal-plus toric designs, such as TECNIS Eyehance, aim to provide a modest extension of depth of focus while maintaining the dysphotopsia profile of a conventional monofocal lens.

Despite the increasing use of toric IOLs and the growing number of available options, few real-world studies have evaluated patient-reported outcomes such as satisfaction, dysphotopsias, and spectacle dependence when comparing conventional monofocal and monofocal-plus toric platforms. These data are important for guiding surgeons and patients in shared decision-making regarding lens selection. In particular, the comparison between these lenses reflects differences in optical design, specifically a conventional monofocal versus a monofocal-plus platform, rather than purely brand-based distinctions. The purpose of this study was to compare patient-reported outcomes, including the frequency of spectacle correction during various activities of daily living, in patients who underwent cataract surgery with bilateral toric IOLs. We hypothesized that both platforms would provide comparable distance visual outcomes and overall patient satisfaction, with the monofocal-plus model offering potential improvements in near and intermediate visual performance.

Methods

Study Design and Setting

This was a single-center, IRB-approved, retrospective observational study with a cross-sectional survey component. This study was conducted at Vance Thompson Vision, West Fargo, ND. Institutional Review Board approval was obtained prior to data collection, and the study adhered to the tenets of the Declaration of Helsinki.

Participants

Patients who underwent uncomplicated cataract surgery with bilateral implantation of toric intraocular lenses (IOLs), including the TECNIS Eyehance Toric (Johnson & Johnson Vision) and Clareon Toric (Alcon), between 2020 and 2025 were eligible for inclusion.

Inclusion criteria were: age ≥ 18 years, at least 4 months postoperative from bilateral cataract surgery, postoperative monocular uncorrected distance visual acuity (UDVA) of ≤ 0.176 logMAR (20/30) in each eye, and a biometry-predicted spherical equivalent target between 0.00 and -0.50 diopters in each eye.

While the primary analysis focused on patients receiving bilateral implantation of the same IOL platform, a small subset of patients received a toric IOL in one eye and a non-toric version of the same platform in the opposite eye. These patients were retained to reflect real-world clinical practice and were included in the overall analysis. Given the study's focus on patient-reported outcomes rather than refractive precision, inclusion of these cases was not expected to significantly influence overall satisfaction results. Although this introduces some heterogeneity into the cohort, it reflects routine clinical practice and was considered appropriate for evaluating real-world patient-reported outcomes.

Intraocular Lenses

The TECNIS Eyehance toric IOL (Johnson & Johnson Vision) is a one-piece, hydrophobic acrylic, foldable monofocal lens of 13.0 mm overall length and 6.0 mm optic diameter. The design of the innermost 2.0 mm diameter of the anterior surface is aspheric, allowing it to sustain a modest increase in central lens power and promote a slightly extended depth of focus.¹⁹ It is characterized by a squared and frosted haptic design, aimed to offer more surface texture and friction between the lens haptics and the capsular bag.^{20,21} The toric (DIUxxx) version was included in this study in addition to seven patients who received one toric version in one eye and the non-toric (DIB00) version in the other eye.

The Clareon toric IOL (Alcon) is a one-piece, hydrophobic, acrylic, foldable monofocal lens of 13.0 mm overall length and 6.0 mm optic diameter. The lens is composed of a flexible acrylic material (hydrophobic acrylate/methacrylate copolymer) with STABLEFORCE[®] modified L-haptics designed to reduce glistenings and raise friction against the capsular bag.^{22,23} It is composed of an aspheric anterior surface and a spherical posterior surface.²⁴ The toric (CCWOTx) version was included in this study in addition to eleven patients who received one toric version in one eye and one non-toric (CC60WF) version in the other eye.

Surgical Technique

All cases included in this study were performed by one surgeon at a single private practice institution in West Fargo, North Dakota. The choice of IOL was made before surgery after a discussion between the patient and the surgeon and the IOL power selection and outcome targets included bilateral emmetropia. Because lens selection was based on shared decision-making rather than randomization, this reflects real-world clinical practice but may introduce selection bias.

The surgeon performed the standard cataract extraction technique, phacoemulsification, and implanted one of the previously described IOLs in the capsular bag. Toric alignment was performed using standard preoperative marking and intraoperative alignment techniques according to surgeon preference. If patients healed with residual refractive error, they were given the option to have this residual refractive error corrected via corneal refractive surgery (laser fine-tune). This was done at least 2 weeks prior to any data collection. Approximately 10% of patients needed a laser fine-tune following cataract surgery.

Data Collection

Charts were reviewed to extract surgery date, previous history of LASIK or PRK, IOL brand and model, IOL power, ocular comorbidities, concurrent procedures including minimally invasive glaucoma surgeries (MIGS), biometry targets, and postoperative visual acuity.

All surveys were completed within a defined collection period between June 9 and June 18, 2025. Because an exact survey timestamp was not available for each participant, June 18, 2025 was assigned as the survey date for all patients when computing time from surgery to survey. This provided a consistent reference point for comparison across groups.

From the most recent follow-up, monocular and binocular uncorrected visual acuity (UCVA) distance and near, best corrected visual acuity (BCVA) distance, and manifest refraction were collected. These objective visual measures were included to provide clinical context for patient-reported outcomes, allowing comparison between functional vision performance and subjective satisfaction. Not all charts were complete with uncorrected near and/or distance BCVA. Postoperative enhancements (YAG) and prior LASIK were recorded and included as covariates in subsequent analysis because of their potential impact on visual outcomes and patient satisfaction. Because the primary objective of this study was to evaluate patient-reported outcomes rather than refractive precision, detailed vectorial analysis of astigmatism correction (eg, angle of error, correction index) was not included. Instead, emphasis was placed on functional visual outcomes and patient satisfaction as captured through survey responses.

Patient Survey

Eligible patients were contacted over four months postoperatively after their bilateral cataract surgery and were invited to complete an 11-question structured survey regarding their postoperative visual experience. The survey was designed to assess subjective satisfaction, frequency of spectacle use for various daily activities, the presence and impact of

dysphotopsias (glare and halos), and the willingness to choose the same IOL again. Survey responses were linked to corresponding clinical data for analysis.

A total of 110 eligible patients were identified from the medical record, of whom 102 were successfully contacted and 92 completed the survey, leading to a response rate of 83.6%. Patients who could not be reached or declined participation were excluded from the analysis.

Overall satisfaction with vision was assessed with a 5-point scale from “very satisfied” to “very dissatisfied”. Both the frequency and the amount that glare and haloes bothered patients were assessed on a 5-point scale from “not at all” to “extremely”. Frequency of spectacle use was assessed for 6 common visual tasks, including daytime driving, nighttime driving, using a computer, using a mobile phone, watching television, and reading small print. Each of the 6 spectacle use responses was rated on a 5-point scale from “never” to “all the time”, with an option for “I don’t do this activity”. Both willingness to tolerate spectacles in exchange for reduced glare/haloes and willingness to choose the same IOL again were assessed with the options “yes”, “no”, and “maybe”. All data was linked to chart records for analysis.

The survey was developed based on commonly assessed patient-reported outcome domains in cataract and refractive surgery including satisfaction, dysphotopsias, and spectacle dependence. Although the survey was not formally validated, the content was designed to reflect clinically relevant postoperative visual experiences routinely assessed in practice. The complete survey is provided in [Supplementary Appendix 1](#).

Ethics Approval and Informed Consent

This study was reviewed and approved by the University of North Dakota Institutional Review Board (IRB Project Number: IRB0006606; Review Level: Expedited, Categories 5 and 7). The study was conducted in accordance with the Declaration of Helsinki.

Given the minimal-risk nature of the study and the use of telephone-based surveys, verbal informed consent was obtained from all participants prior to data collection. Participants were provided with a standardized script explaining the study purpose, voluntary nature of participation, estimated time commitment, and potential risks and benefits. Participants were informed that responses would remain confidential and that they could decline to answer questions or withdraw at any time without penalty. Contact information for the study team and the Institutional Review Board was provided.

Verbal consent was confirmed prior to survey initiation and documented by the study team by recording the date, time, and initials of the individual obtaining consent.

Statistical Analysis

Descriptive statistics were reported as means (SD) or medians (IQR) for continuous variables, and as counts (percentages) for categorical variables. Group differences between Clareon (Alcon) and Eyehance (J&J) IOLs were assessed using Pearson’s Chi-square tests for categorical variables and Wilcoxon rank-sum tests for continuous variables. Fisher’s exact test was applied when cell counts were small, including analyses of glare frequency and glare bother.

Visual outcomes (UCVA near, UCVA distance, BCVA distance) were compared between IOL brands using Wilcoxon rank-sum tests and displayed as boxplots. Timing of survey completion relative to surgery was compared between brands with a Wilcoxon rank-sum test.

Survey responses were visualized using stacked bar charts (satisfaction, willingness to choose same IOL, glare frequency and bother, spectacle independence by task) and a Sankey diagram (brand → satisfaction → choice of same lens). Spectacle independence proportions by activity were compared across brands with Chi-square tests.

To identify independent predictors of overall satisfaction and account for potential confounding effects, an ordinal logistic regression was performed with satisfaction (five-point Likert scale) as the dependent variable. Covariates included IOL brand, age, sex, prior LASIK, lens power, and YAG capsulotomy. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported.

Finally, a Spearman correlation heatmap was generated to examine relationships among patient-reported outcomes (satisfaction, glare frequency, glare bother, spectacle independence).

All analyses were performed using two-sided tests, with a significance threshold of $p < 0.05$.

No formal a priori sample size or power calculation was performed because of the retrospective observational design. Emphasis was thus placed on reporting effect sizes with 95% confidence intervals for regression-based associations to convey the magnitude and precision of key findings.

Results

Demographics

A total of 92 patients (184 eyes) satisfied the inclusion and exclusion criteria and were included in the analysis. In total, 43 patients were in the Eyehance group and 49 patients were in the Clareon group. The mean age was 69.6 ± 6.5 years, and 57% were male (Table 1). The most common implanted IOL was Clareon (Alcon) in 53% of eyes, followed by Eyehance (J&J) in 47%. The mean lens power was 18.0 ± 4.9 D, and the mean target spherical equivalent (SE) from biometry was -0.18 ± 0.12 D. A history of LASIK was present in 5.4% of patients, and 10% underwent a postoperative laser fine-tune. Following cataract surgery, 63% of patients received a YAG capsulotomy.

Patient-Reported Satisfaction (Overall Cohort)

Patient-reported satisfaction was generally high, with 65% of respondents reporting they were “very satisfied”, 26% “somewhat satisfied”, and 3.3% “somewhat dissatisfied” with their vision. No patients reported being “very dissatisfied”. When asked if they would choose the same lens again, 63% responded “yes”, 23% responded “maybe”, and 15% responded “no” (Table 1).

Table 1 Baseline Characteristics and Overall Patient-Reported Outcomes (N = 184 Eyes)

Characteristic	Overall (N = 184)
Age	69.59 (6.54)
Sex	
Female	80 (43%)
Male	104 (57%)
IOL Brand	
Clareon (Alcon)	98 (53%)
Eyehance (J&J)	86 (47%)
Lens Power	18.01 (4.89)
Target SE	-0.18 (0.12)
YAG Performed	116 (63%)
LASIK History	10 (5.4%)
Laser Fine-tune	19 (10%)
Satisfaction Level	
Very satisfied	120 (65%)
Somewhat satisfied	48 (26%)
Neither	10 (5.4%)
Somewhat dissatisfied	6 (3.3%)
Very dissatisfied	0 (0%)
Choose Same Lens Again	
Yes	115 (63%)
Maybe	42 (23%)
No	27 (15%)

Note: Values are presented as mean (SD) or n(%).

Comparisons by IOL Brand

When comparing Clareon and Eyehance lenses, mean age did not differ significantly between groups (69.9 ± 7.2 years vs. 69.2 ± 5.8 years, $p = 0.088$) (Table 2). However, sex distribution differed, with a greater proportion of females receiving Clareon (51% vs. 35%, $p = 0.028$). Mean lens power was higher in the Clareon group compared with Eyehance (19.2 ± 4.5 D vs. 16.7 ± 5.0 D, $p < 0.001$). Clareon patients also had a slightly less myopic target SE (-0.16 ± 0.11 vs. -0.20 ± 0.12 , $p = 0.014$).

Rates of YAG capsulotomy were numerically higher in Eyehance patients (70% vs. 57%), though this difference was not statistically significant ($p = 0.077$). Prior LASIK history was more common among Eyehance patients (9.3% vs. 2.0%, $p = 0.047$) (Table 2).

Patient-Reported Outcomes by IOL Brand

Patient satisfaction distributions differed significantly between brands ($p < 0.001$). A higher proportion of Clareon patients were “very satisfied” compared with Eyehance (73% vs. 56%). Dissatisfaction was only reported in the Eyehance group (7.0%). Willingness to choose the same lens again did not differ significantly ($p = 0.3$), with 61% of Clareon and 64% of Eyehance patients indicating “yes” (Table 2 and Figure 1).

The distribution of patient satisfaction is illustrated in Figure 1. Clareon patients reported higher rates of “very satisfied” responses, whereas Eyehance patients showed a broader distribution, including a small subset reporting dissatisfaction. The difference in distributions was statistically significant (Fisher’s exact test, $p = 0.0004$), suggesting that IOL brand choice may influence satisfaction outcomes.

Spectacle Dependence and Independence by Task

Spectacle use and independence across visual tasks are summarized in Figure 2. The greatest dependence was observed for near activities, particularly reading small print, followed by intermediate tasks such as computer and mobile phone use. In contrast, distance activities demonstrated the lowest reported need for glasses.

Table 2 Baseline demographics, Clinical Characteristics, and Patient-Reported Outcomes by Intraocular Lens (IOL) Brand

Characteristic	Clareon (Alcon) N = 98	Eyehance (J & J) N = 86	p-value
Age, Mean (SD)	69.96 (7.17)	69.16 (5.76)	0.088
Sex, n (%)			0.028
Female	50 (51%)	30 (35%)	
Male	48 (49%)	56 (65%)	
Lens Power, Mean (SD)	19.19 (4.51)	16.67 (5.00)	<0.001
Target SE, Mean (SD)	-0.16 (0.11)	-0.20 (0.12)	0.014
YAG Performed, n (%)	56 (57%)	60 (70%)	0.077
LASIK History, n (%)	2 (2.0%)	8 (9.3%)	0.047
Satisfaction Level, n (%)			<0.001
Very satisfied	72 (73%)	48 (56%)	
Somewhat satisfied	18 (18%)	30 (35%)	
Neither	8 (8.2%)	2 (2.3%)	
Somewhat dissatisfied	0 (0%)	6 (7.0%)	
Very dissatisfied	0 (0%)	0 (0%)	
Choose Same Lens Again, n (%)			0.3
Yes	60 (61%)	55 (64%)	
Maybe	20 (20%)	22 (26%)	
No	18 (18%)	9 (10%)	

Notes: Values are presented as mean (standard deviation) or frequency (percentage). P-values were calculated using t-tests for continuous variables and chi-square or Fisher’s exact tests for categorical variables.

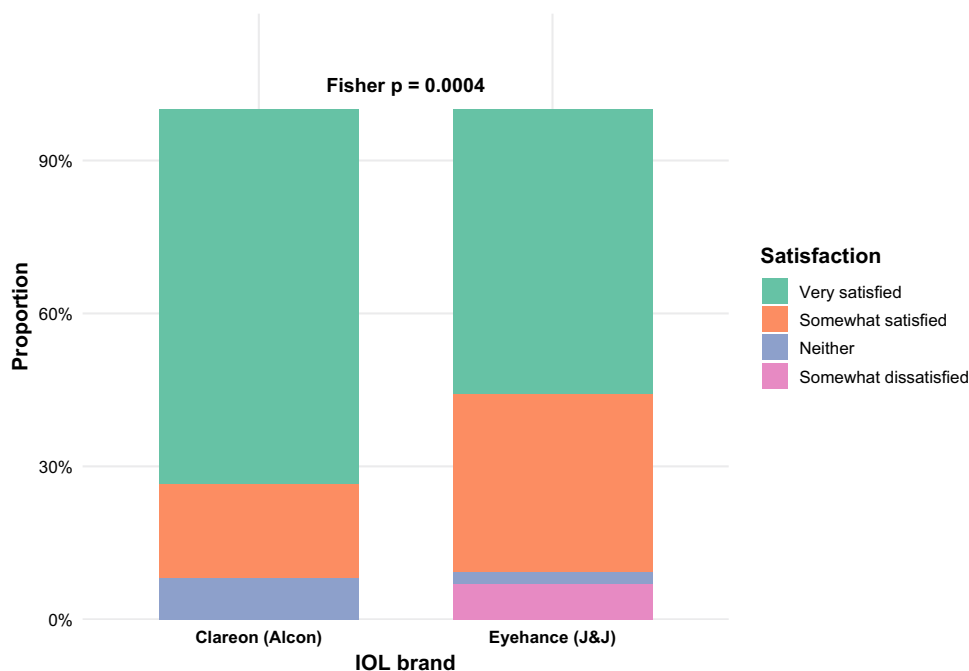


Figure 1 Patient-reported satisfaction levels by intraocular lens (IOL) brand.

When analyzed as spectacle independence (defined as reporting no glasses use), both Clareon and Eyehance groups performed similarly across all tasks, with no statistically significant differences (all $p > 0.05$). Independence was highest for distance activities (daytime driving: 76–79%, nighttime driving: 74–77%, television: 75–77%) and lowest for near tasks (small print: 4–7%). A non-significant trend toward greater spectacle independence in the Eyehance group was observed for computer use (21% vs 9%, $p = 0.0618$).

Clinical Outcomes

To assess whether differences in patient satisfaction could be explained by objective vision outcomes, visual acuity was compared across brands (Figure 3). A significant difference was found between Clareon and Eyehance in monocular uncorrected visual acuity (UCVA) near with Eyehance patients demonstrating significantly better UCVA near ($p = 0.00045$). No significant differences were noted between brands for monocular UCVA distance and monocular best corrected visual acuity (BCVA) distance.

Glare Frequency and Bother

Glare outcomes are shown in Figure 4. The distribution of glare frequency differed significantly by brand ($p = 0.0034$). Clareon patients more often reported “Not at all” or “Very little” glare, whereas Eyehance patients were more likely to report glare “Very often” or “Extremely often”. However, glare bother did not differ significantly between groups ($p = 0.463$). In both brands, most patients reported that glare was “Not at all” or “Very little” bothersome. Fisher’s Exact Test was used instead of Chi-square due to sparse counts in some categories.

Timing of Surgery and Survey

A boxplot comparison (Figure 5) shows the interval from surgery to survey. Clareon patients were surveyed more recently (median ~450 days) compared with Eyehance patients (median >900 days). The difference was statistically significant ($p < 0.0001$). The wider spread for Eyehance reflects its earlier adoption timeline in practice.

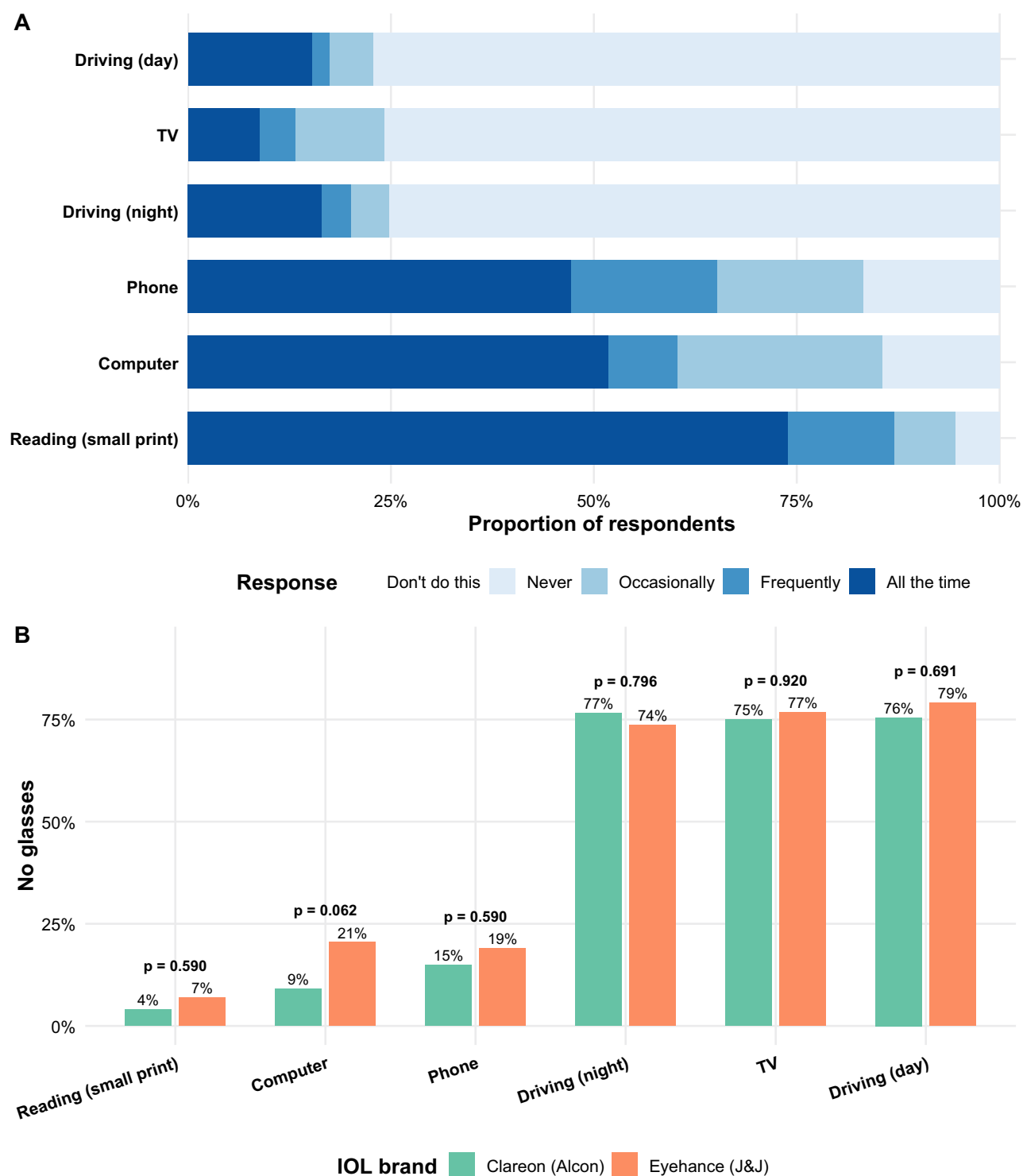


Figure 2 Spectacle dependence by visual task and IOL brand. **(A)** Distribution of patient-reported spectacle use across daily visual tasks, including daytime driving, nighttime driving, computer use, mobile phone use, television viewing, and reading small print. **(B)** Percentage of patients reporting no glasses use for each task, stratified by IOL brand.

Advanced Statistical Modeling

To assess whether IOL brand remains independently associated with overall satisfaction, an adjusted ordinal logistic regression with satisfaction (5-point scale: Very satisfied → Very dissatisfied) as the outcome and age, sex, prior LASIK, lens power, and YAG capsulotomy as covariates was performed (Table 3). Eyehance patients had a 2.11 times higher

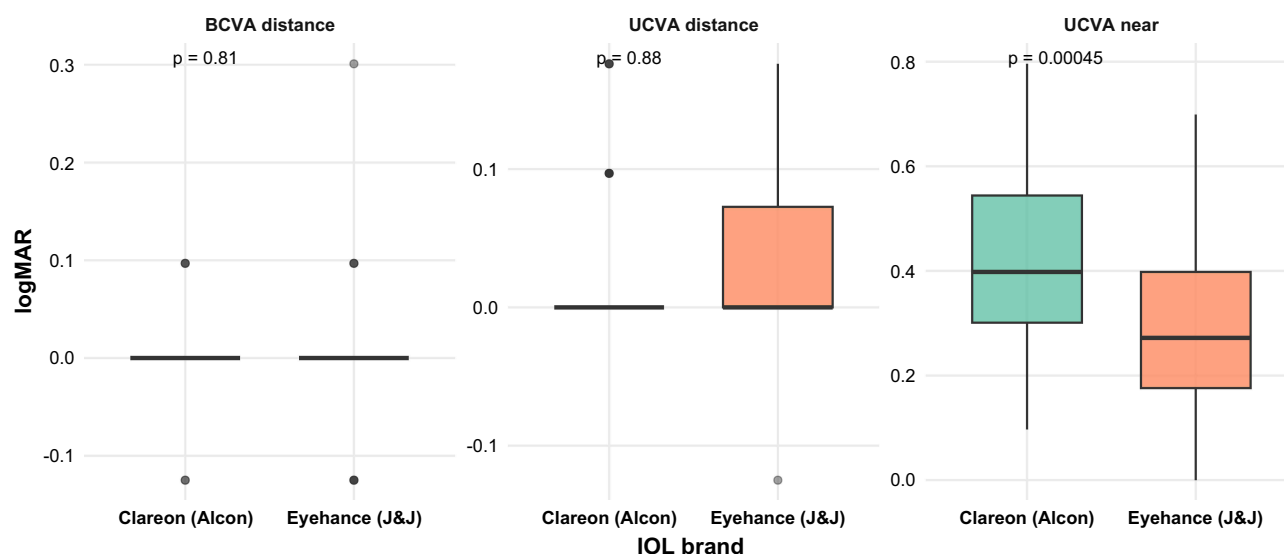


Figure 3 Comparison of visual outcomes by IOL brand. Boxplots of monocular best-corrected distance visual acuity (BCVA), uncorrected visual acuity (UCVA) distance, and uncorrected visual acuity (UCVA) near for Clareon (Alcon) and Eyehance (Johnson & Johnson Vision) lenses.

odds of being further up the satisfaction scale than Clareon patients (95% CI: 1.08–4.18, $p = 0.031$). Males had lower odds of higher satisfaction than females (OR 0.48, 95% CI: 0.25–0.92, $p = 0.027$). Patients who had postoperative YAG capsulotomies had 2.12 times higher odds of higher satisfaction (95% CI: 1.07–4.36, $p = 0.035$). Age and prior LASIK were not associated with satisfaction in the adjusted model ($p > 0.05$).

Relationships Between Patient-Reported Outcomes

To explore interrelationships among patient-reported outcomes, a Spearman correlation heatmap was generated for satisfaction, glare frequency, glare bother, and spectacle independence across tasks (Figure 6). The strongest correlation was observed between daytime and nighttime driving ($p = 0.93$), indicating that patients who require glasses for daytime driving almost always need them at night. Spectacle use across other tasks (TV, computer, phone, small print) was also highly correlated. Frequency of glare and glare bother were strongly positively correlated ($p = 0.8$), suggesting that patients experiencing more glare also report being bothered by it more. Higher satisfaction was moderately correlated with willingness to choose the same lens again ($p = 0.47$).

Overall, these correlations suggest that near and distance visual difficulties, as well as photic phenomena like glare, tend to cluster. In addition, patient satisfaction is moderately linked with willingness to select the same IOL again.

Flow of IOL Brand, Satisfaction, and Lens Choice

An alluvial diagram was used to visualize the relationship between IOL brand, patient-reported satisfaction, and willingness to choose the same lens again (Figure 7). In this diagram, bar widths at each stage represent the number of patients and flows/strips show how patients transition from one stage to the next, with colors corresponding to the original IOL brand.

Clareon patients more frequently clustered in the “very satisfied” category, with most indicating they would choose the same lens again. Eyehance patients demonstrated a broader distribution between “very satisfied” and “somewhat satisfied”, with a higher proportion selecting “maybe” for choosing the same lens again. Few patients in either group reported dissatisfaction; among these patients, responses were more likely to indicate they would not choose the same lens again.

Willingness to Choose the Same IOL Again

Responses regarding whether patients would choose the same lens again are shown in Figure 8. Across both brands, 60% of Clareon patients and 68% of Eyehance patients indicated “yes”, with 20% and 30% responding “maybe” respectively.

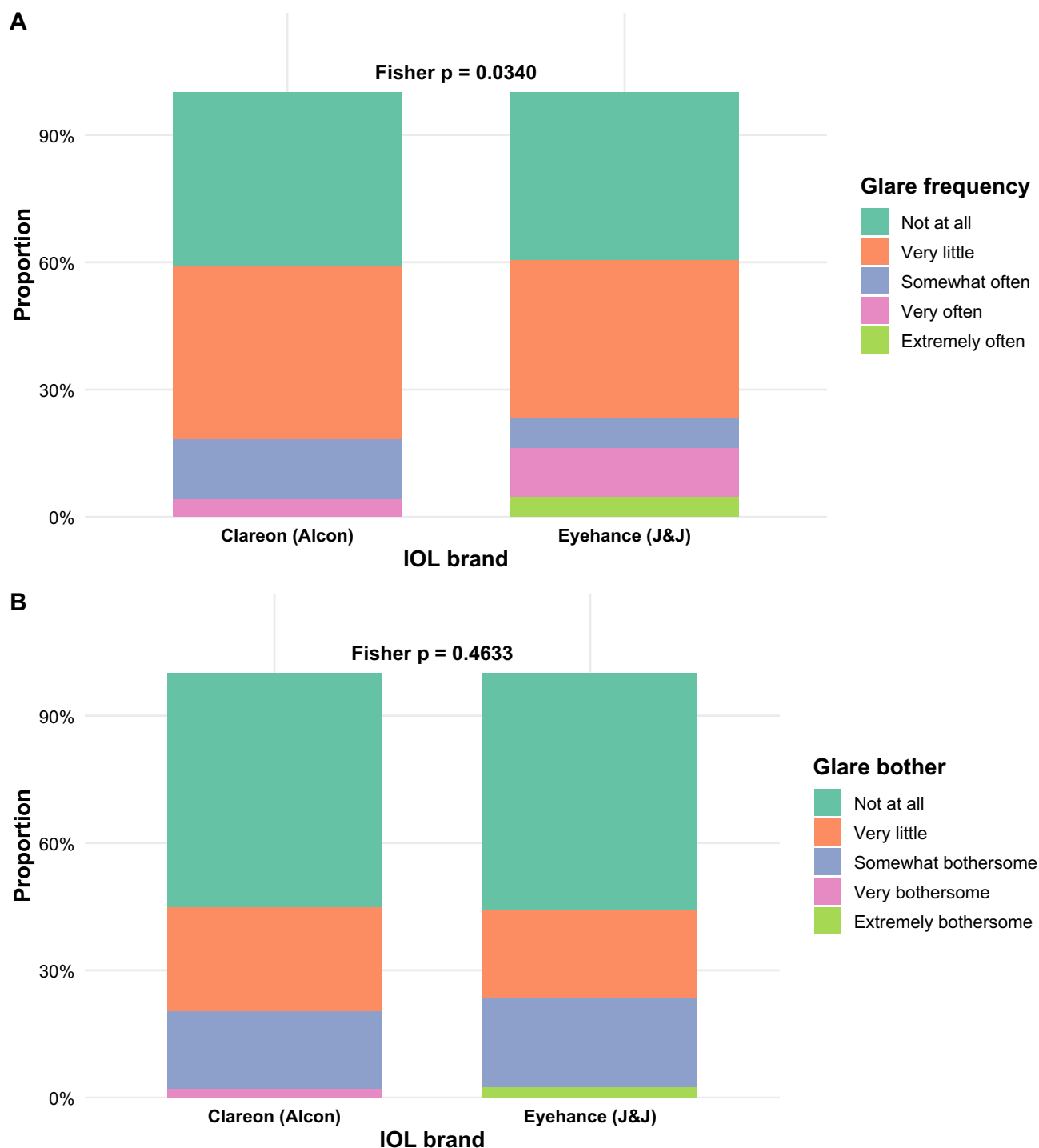


Figure 4 Glare frequency and glare-related bother by IOL brand. **(A)** Distribution of patient-reported glare/halo frequency categories for Clareon (Alcon) and Eyehance (Johnson & Johnson Vision). **(B)** Distribution of patient-reported glare/halo bother ratings for Clareon and Eyehance.

and 20% and 8% responding “no” respectively. Clareon patients showed a slightly higher proportion of “no” responses compared to Eyehance, but the difference was not statistically significant (chi-square test, $p = 0.281$).

Discussion

This study provides a detailed comparison of patient-reported and clinical outcomes between a conventional monofocal toric IOL (Clareon, Alcon) and a monofocal-plus toric IOL (Eyehance, J&J Vision) in a real-world setting. Both lenses

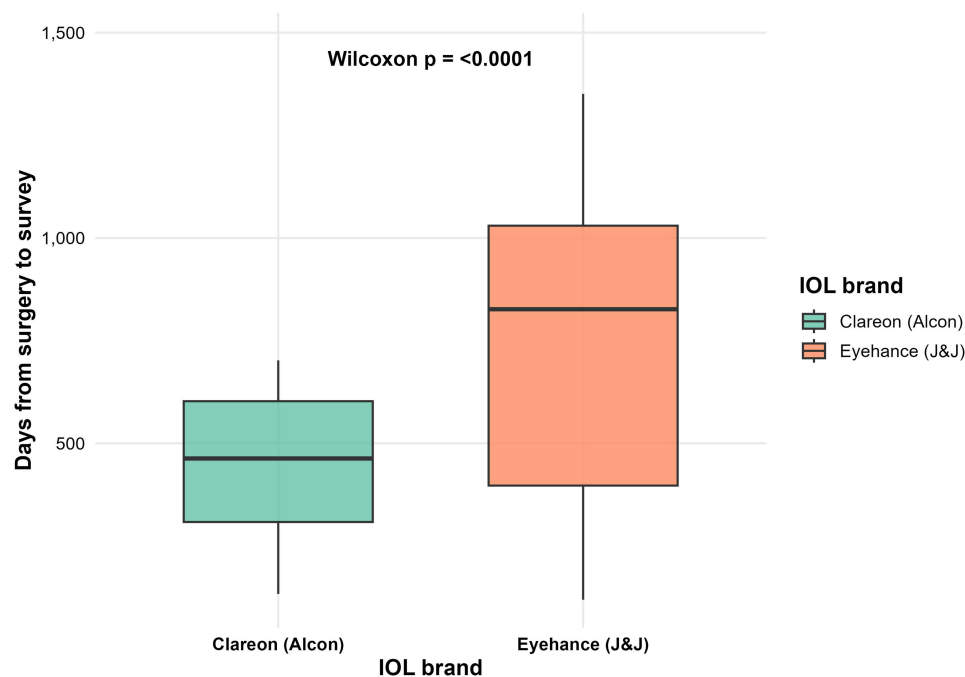


Figure 5 Time from surgery to survey completion by IOL brand. Boxplot showing distribution of days elapsed from cataract surgery to survey date.

achieved excellent distance vision outcomes, with no significant differences in UCVA or BCVA at distance. However, a significant difference was observed for UCVA near vision, with Eyehance demonstrating lower logMAR values. This is consistent with its modified central optical design intended to modestly extend depth of focus.

Despite the near-vision advantage, spectacle independence for intermediate and near activities was broadly similar between groups. Only a non-significant trend toward increased spectacle independence in the Eyehance group for computer use was observed. In general, both lenses reported low spectacle dependence at distance vision, with increasing spectacle use for intermediate and near tasks. These findings are consistent with optical profiles of monofocal and monofocal-plus lenses. This reinforces the importance of counseling patients that improved near visual acuity does not necessarily get rid of spectacle use for near tasks.

Patient satisfaction findings require nuanced interpretation. A higher proportion of Clareon patients responded with “very satisfied”, but multivariable ordinal regression demonstrated higher adjusted odds of satisfaction for Eyehance patients after controlling for age, sex, prior LASIK, lens power, and YAG capsulotomy. This likely reflects the difference between unadjusted categorical distributions and adjusted modeling across the full ordinal satisfaction scale. When this is taken together, these results suggest that Clareon recipients may cluster more strongly at the highest satisfaction category,

Table 3 Adjusted Ordinal Logistic Regression for Predictors of Overall Patient Satisfaction

Predictor	Adjusted OR	95% CI	p-value
Lens Brand: (Eyehance vs Clareon)	2.11	1.08–4.18	0.031
Age (years)	1	0.95–1.05	0.905
Sex (Male vs Female)	0.48	0.25–0.92	0.027
Prior LASIK (Yes vs No)	1.16	0.27–4.37	0.831
Lens Power (D)	0.97	0.91–1.04	0.375
YAG Performed (Yes vs No)	2.12	1.07–4.36	0.035

Notes: Adjusted odds ratios (OR) are from a multivariable ordinal logistic regression model. OR > 1 indicates higher odds of being in a higher outcome category. Confidence intervals (CI) are reported at the 95% level.

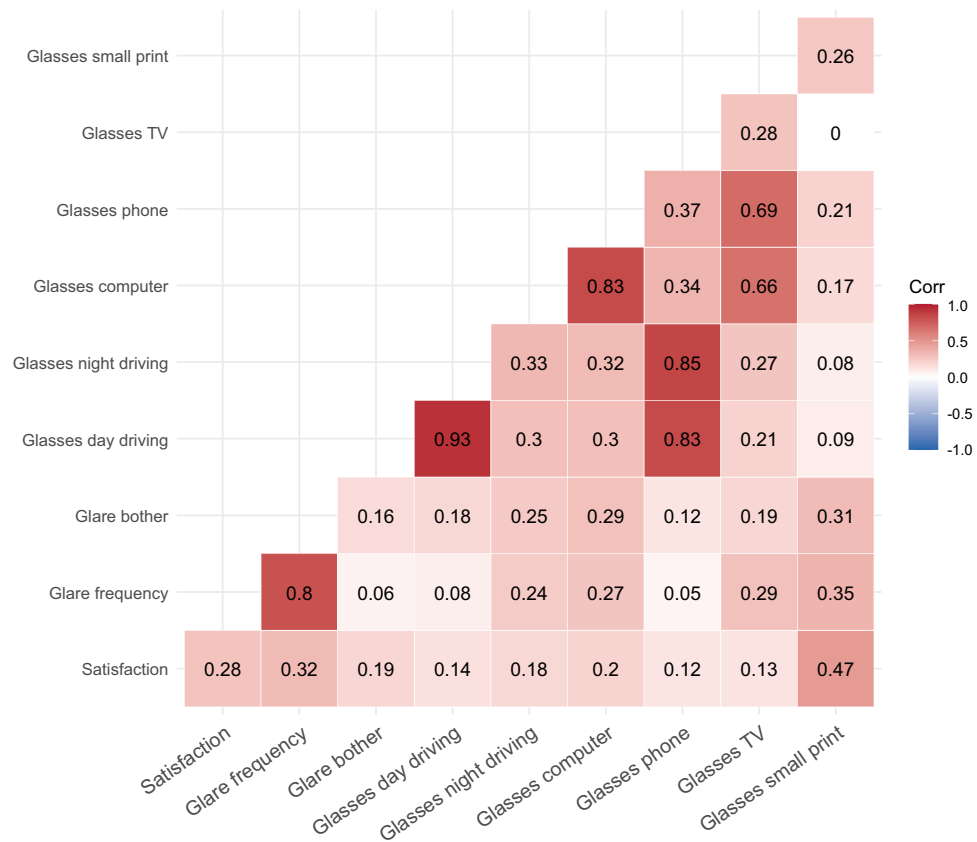


Figure 6 Spearman correlation heatmap of patient-reported outcomes (PROs). Values represent Spearman correlation coefficients between satisfaction, glare frequency, glare bother, willingness to choose the same lens again, and spectacle dependence across visual tasks.

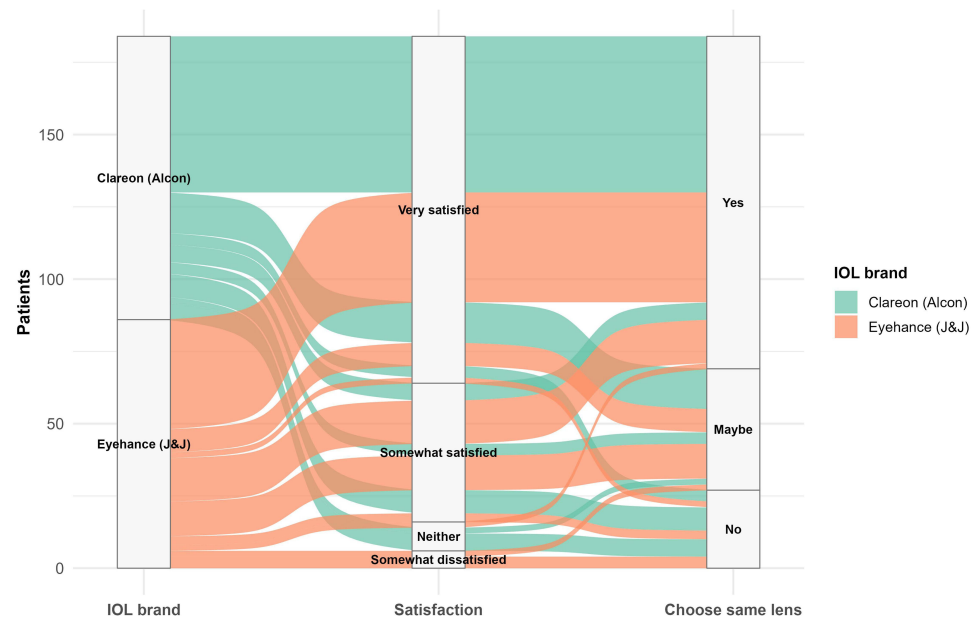


Figure 7 Alluvial diagram of patient flow from IOL brand to satisfaction and willingness to choose same lens. Flow width represents the number of patients transitioning between categories, with colors corresponding to the original IOL platform.

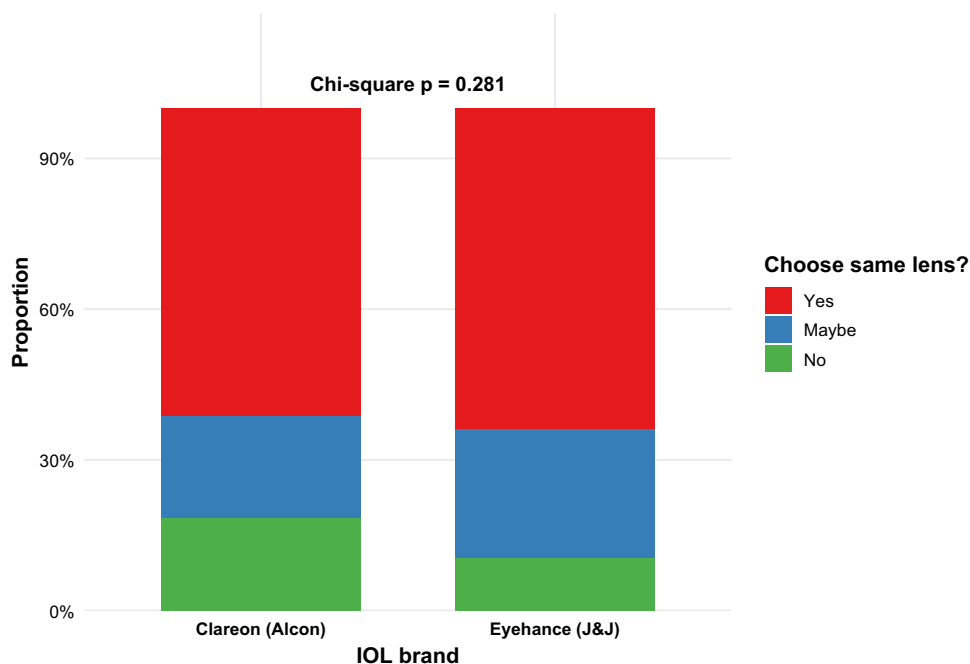


Figure 8 Willingness to choose the same intraocular lens (IOL) again by brand.

but Eyehance recipients may confer a broader shift toward higher overall satisfaction after accounting for baseline differences.

Glare outcomes also highlighted these complexities. Eyehance patients reported glare more frequently, though the subjective bother was minimal and not significantly different between groups. This suggests that frequency and dysphotopsias alone may not determine dissatisfaction, which likely depends on symptom severity, patient expectations, and functional demands of daily tasks.

Willingness to choose the same IOL again was high in both groups, which further supports the favorable overall patient-reported experience. However, a greater proportion of Clareon recipients indicated they would not choose the same lens again compared with Eyehance recipients (20% vs 8%). This supports findings in other studies showing spectacle dependence, glare, and dysphotopsias all contribute to patient-reported dissatisfaction in the postoperative period.^{10,25–27}

The correlation heatmap and alluvial diagram provided insight into relationships among outcomes and support the internal coherence of the patient-reported outcome data. Satisfaction was strongly linked to willingness to choose the same lens, and glare frequency tracked closely with glare bother. These relationships strengthen confidence that the survey gathered clinically meaningful patient experiences.

Several baseline and postoperative differences require consideration when interpreting the findings of this study. The Eyehance group had a longer average interval from surgery to survey administration, which may introduce adaptation and affect satisfaction data. Additionally, prior LASIK history was more common in the Eyehance group, and YAG capsulotomy rates were high overall. Although YAG was included in multivariable modeling and was independently associated with greater satisfaction, high prevalence likely reflects longer follow-up period and practice-specific management of posterior capsule opacification. These factors may partially contribute to the differences observed in patient-reported outcomes. While these factors introduce variability, they also reflect routine clinical practice and therefore enhance the external validity of the findings.

Overall, these findings suggest that both IOL platforms provide excellent distance vision and favorable patient-reported outcomes. The monofocal-plus Eyehance design offers a measurable near-vision advantage along with increased glare frequency without a clinically meaningful penalty in glare-related bother.

Limitations

This study has several limitations. Lens choice was not randomized but resulted from shared decision-making between surgeons and patients, which may introduce selection bias. The retrospective design also limits causal inference. Third, no formal a priori power calculation was performed, and the available sample size may have limited the ability to detect smaller differences, particularly in subgroup analyses and non-significant trends. Fourth, the interval from surgery to survey administration differed significantly between groups, which may have introduced adaptation bias and influenced patient satisfaction. Patients farther out of surgery may have had more time to adapt to their visual symptoms. In addition, postoperative interventions such as YAG capsulotomy and laser enhancement may contribute to variability in outcomes; however, these reflect common clinical management patterns and were accounted for in the analysis where appropriate. Fifth, detailed vectorial analysis of astigmatism correction was not performed, which limits assessment of refractive accuracy and rotational alignment of the Toric lenses. However, this study was designed to prioritize patient-reported outcomes and real-world visual experience rather than refractive precision metrics. Finally, although the survey instrument was designed around clinically relevant domains routinely assessed in cataract and refractive practice, it was not formally validated.

Despite these limitations, the integration of objective visual outcomes, multivariable modeling, and patient-reported measures provides a clinically meaningful real-world assessment of monofocal versus monofocal-plus toric IOL performance.

Conclusion

Both Clareon and Eyehance IOLs provided excellent distance visual outcomes along with high overall patient satisfaction in a real-world cohort. The monofocal-plus Eyehance toric IOL demonstrated superior uncorrected near distance visual acuity which is consistent with its optical design. Distribution of glare frequency was higher in the Eyehance group, but there was no significant difference in glare bother between groups.

Patients who received the conventional monofocal Clareon toric IOL more frequently reported being “very satisfied”. However, after adjusted modeling accounting for baseline and postoperative confounders, higher overall satisfaction odds were observed in the Eyehance group. This highlights that postoperative satisfaction reflects visual acuity, patient expectations, adaptation, dysphotopsia tolerance, and postoperative interventions in combination, reinforcing its multifactorial nature.

These findings reinforce the importance of individualized preoperative counseling and shared decision-making in lens selection between conventional monofocal and monofocal-plus toric IOL platforms, particularly when intermediate and near visual priorities are a central aspect of patient goals. Future research with prospective, randomized designs and longer-term follow-up will be valuable to clarify brand-specific differences further and optimize patient outcomes.

These results support the incorporation of structured patient-reported outcomes in cataract surgery follow-up and highlight the importance of individualized discussions regarding IOL choice, particularly when managing expectations for intermediate and near vision tasks. Future studies with longer follow-up and larger, more diverse populations are warranted to further characterize the relationship between IOL type, visual function, and patient satisfaction in order to help guide physicians and patients in the decision-making process.

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Disclosure

The senior author and surgical investigator, Dr. Greenwood, serves as a consultant for Alcon and Johnson & Johnson Vision. These companies had no role in study design, data collection, data analysis, manuscript preparation,

interpretation, reporting of this study, or the decision to publish this work. All other authors report no financial or proprietary interests in any material or method mentioned in this study.

References

- Khan MI, Muhtaseb M. Prevalence of corneal astigmatism in patients having routine cataract surgery at a teaching hospital in the United Kingdom. *J Cataract Refract Surg*. 2011;37(10):1751–1755. doi:10.1016/j.jcrs.2011.04.026
- Hayashi K, Manabe S, Yoshida M, Hayashi H. Effect of astigmatism on visual acuity in eyes with a diffractive multifocal intraocular lens. *J Cataract Refract Surg*. 2010;36(8):1323–1329. doi:10.1016/j.jcrs.2010.02.016
- Thornton SP. Astigmatic keratotomy: a review of basic concepts with case reports. *J Cataract Refract Surg*. 1990;16(4):430–435. doi:10.1016/S0886-3350(13)80795-X
- Budak K, Friedman NJ, Koch DD. Limbal relaxing incisions with cataract surgery. *J Cataract Refract Surg*. 1998;24(4):503–508. doi:10.1016/S0886-3350(98)80292-7
- Norouzi H, Rahmati-Kamel M. Laser in situ keratomileusis for correction of induced astigmatism from cataract surgery. *J Refract Surg*. 2003;19(4):416–424. doi:10.3928/1081-597X-20030701-07
- Mozayan E, Lee JK. Update on astigmatism management. *Curr Opin Ophthalmol*. 2014;25(4):286–290. doi:10.1097/ICU.0000000000000068
- Mingo-Botin D, Munoz-Negrete FJ, Won Kim HR, Morcillo-Laiz R, Rebollada G, Oblanca N. Comparison of toric intraocular lenses and peripheral corneal relaxing incisions to treat astigmatism during cataract surgery. *J Cataract Refract Surg*. 2010;36(10):1700–1708. doi:10.1016/j.jcrs.2010.04.043
- Kessel L, Andresen J, Tendal B, Erngaard D, Flesner P, Hjortdal J. Toric intraocular lenses in the correction of astigmatism during cataract surgery: a systematic review and meta-analysis. *Ophthalmology*. 2016;123(2):275–286. doi:10.1016/j.ophtha.2015.10.002
- Buckhurst PJ, Wolffsohn JS, Shah S, Naroo SA, Davies LN. Evaluation of dysphotopsia with multifocal intraocular lenses. *Invest Ophthalmol Vis Sci*. 2011;52(14):6185.
- de Silva SR, Evans JR, Kirithi V, Ziaei M, Leyland M. Multifocal versus monofocal intraocular lenses after cataract extraction. *Cochrane Database Syst Rev*. 2016;12(12):CD003169. doi:10.1002/14651858.CD003169.pub4
- Ferreira TB, Marques EF, Rodrigues A, Montés-Micó R. Visual and optical outcomes of a diffractive multifocal toric intraocular lens. *J Cataract Refract Surg*. 2013;39(7):1029–1035. PMID: 23680631. doi:10.1016/j.jcrs.2013.02.037
- Das KK, Werner L, Collins S, Hong X. In vitro and schematic model eye assessment of glare or positive dysphotopsia-type photic phenomena: comparison of a new material IOL to other monofocal IOLs. *J Cataract Refract Surg*. 2019;45(2):219–227. doi:10.1016/j.jcrs.2018.09.017
- Holladay JT, Simpson MJ. Negative dysphotopsia: causes and rationale for prevention and treatment. *J Cataract Refract Surg*. 2017;43(2):263–275. doi:10.1016/j.jcrs.2016.11.049
- Ribeiro FJ, Ferreira TB, Silva D, Matos AC, Gaspar S. Visual outcomes and patient satisfaction after implantation of a presbyopia-correcting intraocular lens that combines EDOF and multifocal profiles. *J Cataract Refract Surg*. 2021;47(12):1574–1580. doi:10.1097/j.jcrs.0000000000000659
- Frieling-Reuss EH. Comparative analysis of the visual and refractive outcomes of an aspheric diffractive intraocular lens with and without toricity. *J Cataract Refract Surg*. 2013;39(10):1485–1493. doi:10.1016/j.jcrs.2013.04.034
- Gyöngyösy B, Jirak P, Schönherr U. Long-term rotational stability and visual outcomes of a single-piece hydrophilic acrylic toric IOL: a 1.5-year follow-up. *Int J Ophthalmol*. 2017;10(4):573–578. PMID: 28503430; PMCID: PMC5406635. doi:10.18240/ijo.2017.04.12
- Chang DF. Comparative rotational stability of single-piece open-loop acrylic and plate-haptic silicone toric intraocular lenses. *J Cataract Refract Surg*. 2008;34(11):1842–1847. doi:10.1016/j.jcrs.2008.07.012
- Miháltz K, Lasta M, Burgmüller M, Vécsei-Marlovits PV, Weingessel B. Comparison of two toric intraocular lenses with different haptic design: optical quality after 1 year. *J Ophthalmol*. 2018;2018:4064369. doi:10.1155/2018/4064369
- Unsal U, Sabur H. Comparison of new monofocal innovative and standard monofocal intraocular lens after phacoemulsification. *Int Ophthalmol*. 2021;41(1):273–282. doi:10.1007/s10792-020-01579-y
- Takaku R, Nakano S, Iida M, Oshika T. Influence of frosted haptics on rotational stability of toric intraocular lenses. *Sci Rep*. 2021;11(1):15099. doi:10.1038/s41598-021-94293-3
- Osawa R, Sano M, Yuguchi T, Kaiya T, Oshika T. Effects of modified haptics on surgical outcomes and rotational stability of toric intraocular lens implantation. *J Refract Surg*. 2022;38(10):648–653. doi:10.3928/1081597X-20220715-02
- Werner L, Thatthamla I, Ong M, et al. Evaluation of clarity characteristics in a new hydrophobic acrylic IOL. *J Cataract Refract Surg*. 2019;45(10):1490–1497. doi:10.1016/j.jcrs.2019.05.017
- Lane S, Collins S, Das KK, et al. Evaluation of intraocular lens mechanical stability. *J Cataract Refract Surg*. 2019;45(4):501–506. PMID: 30686704. doi:10.1016/j.jcrs.2018.10.043
- Stanojcic N, O'Brart D, Hull C, et al. Visual and refractive outcomes and glistenings occurrence after implantation of 2 hydrophobic acrylic aspheric monofocal IOLs. *J Cataract Refract Surg*. 2020;46(7):986–994. doi:10.1097/j.jcrs.0000000000000201
- Buckhurst PJ, Naroo SA, Davies LN, Shah S, Drew T, Wolffsohn JS. Assessment of dysphotopsia in pseudophakic subjects with multifocal intraocular lenses. *BMJ Open Ophthalmol*. 2017;1(1):e000064. doi:10.1136/bmjophth-2016-000064
- Leyland M, Pringle E. Multifocal versus monofocal intraocular lenses after cataract extraction. *Cochrane Database Syst Rev*. 2006;4:CD003169.
- Shah S, Peris-Martinez C, Reinhard T, Vinciguerra P. Visual outcomes after cataract surgery: multifocal versus monofocal intraocular lenses. *J Refract Surg*. 2015;31(10):658–666. doi:10.3928/1081597X-20150611-01

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