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MONOFOCAL VS EXTENDED-DEPTH-OF-FOCUS INTRAOCULAR LENSES: COMPARISON OF VISUAL QUALITY, DYSPHOTOPSIA, AND SPECTACLE INDEPENDENCE

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ABSTRACT

Background: Cataract surgery has evolved from a purely sight-restoring procedure to a refractive intervention aimed at improving visual performance across multiple distances. Conventional monofocal intraocular lenses (IOLs) provide excellent distance vision but often require postoperative spectacle correction for intermediate and near tasks. Extended-depth-of-focus (EDOF) IOLs have been introduced to enhance the range of functional vision while maintaining satisfactory visual quality. However, concerns remain regarding dysphotopsia and overall patient satisfaction with these lenses. The aim is to compare monofocal and extended-depth-of-focus intraocular lenses with respect to visual quality, dysphotopsia, and spectacle independence in patients undergoing phacoemulsification at a tertiary care hospital.

Materials and Methods: This hospital-based comparative study included 98 patients with age-related cataract who underwent phacoemulsification with posterior chamber IOL implantation. Patients were divided into two groups: monofocal IOL group (n = 49) and EDOF IOL group (n = 49). Preoperative assessment included demographic details, visual acuity, keratometry, axial length, slit-lamp examination, intraocular pressure measurement, and fundus evaluation. Postoperative evaluation included uncorrected and corrected distance visual acuity, uncorrected intermediate and near visual acuity, refractive outcomes, contrast sensitivity, dysphotopsia symptoms, spectacle independence, and functional visual performance.

Results: Baseline demographic and ocular characteristics were comparable between the two groups. Postoperatively, mean uncorrected distance visual acuity and corrected distance visual acuity were similar in both groups. However, the EDOF group showed significantly better uncorrected intermediate visual acuity (0.16 ± 0.07 vs 0.28 ± 0.10 logMAR, $p < 0.001$) and uncorrected near visual acuity (0.19 ± 0.08 vs 0.34 ± 0.11 logMAR, $p < 0.001$) compared with the monofocal group. Spectacle independence for intermediate and near vision was significantly greater in the EDOF group. Functional performance in activities such as reading, mobile phone use, and computer work was also significantly better with EDOF lenses. Dysphotopsia symptoms including glare, halos, starbursts, and night vision difficulty were more common in the EDOF group, whereas contrast sensitivity and refractive outcomes were comparable between groups.

Conclusion: Both monofocal and EDOF IOLs provided excellent postoperative distance vision and satisfactory refractive outcomes. EDOF IOLs offered superior intermediate and near vision, greater spectacle independence, and better performance in daily visual tasks, but were associated with a higher frequency of dysphotopsia. Appropriate IOL selection should therefore be

individualized according to patient expectations, lifestyle needs, and tolerance for photic phenomena.
Keywords: Cataract surgery; Monofocal intraocular lens; Extended-depth-of-focus intraocular lens; Dysphotopsia; Spectacle independence.

INTRODUCTION

Cataract remains one of the leading causes of reversible visual impairment worldwide, and cataract surgery with intraocular lens implantation has become one of the most successful procedures for restoring vision. The goals of contemporary cataract surgery, however, extend beyond simple removal of lens opacity and recovery of distance acuity. Increasingly, both surgeons and patients expect high-quality postoperative vision across multiple distances, improved functional performance in daily life, reduced dependence on spectacles, and minimal unwanted optical phenomena. This shift has driven continuing innovation in intraocular lens design, particularly in the development of lenses intended to expand the range of clear vision while preserving visual quality.[1] Conventional monofocal intraocular lenses have long been regarded as the standard option in cataract surgery because they provide predictable refractive outcomes, excellent distance visual acuity, relatively simple optics, and a lower risk of disturbing photic symptoms. Their principal limitation is that they create a single focal point, usually optimized for distance, leaving most patients dependent on spectacles for intermediate and near activities such as computer use, mobile phone viewing, reading labels, and prolonged near work. In the modern era, when visual demands are increasingly centered around digital devices and multitasking at different working distances, this limited range of focus has become more clinically relevant. As a result, patient expectations after cataract surgery have evolved from restoration of sight alone to enhancement of lifestyle-related visual function.[2] Extended-depth-of-focus (EDOF) intraocular lenses were developed to address this gap between good distance vision and the need for functional intermediate and near vision. Rather than splitting incoming light into several distinct foci, as in traditional multifocal systems, EDOF optics are designed to create an elongated focal area or broaden the defocus curve, thereby extending the range of usable vision. The theoretical advantage of this design is that it may provide better intermediate performance, functional near vision, and greater spectacle independence while avoiding some of the contrast loss and photic disturbances associated with multifocal designs. At the same time, the actual clinical profile of EDOF lenses may vary depending on whether the technology is diffractive, refractive, nondiffractive, wavefront-shaping, or hybrid in nature. The comparison between monofocal and EDOF intraocular lenses is therefore highly relevant in present-day cataract practice. Patients who choose monofocal lenses generally prioritize sharp distance vision, optical simplicity, and fewer dysphotopsia symptoms, whereas those selecting EDOF lenses often seek a broader range of vision and reduced reliance on spectacles. Recent evidence has shown that EDOF technology can improve intermediate visual acuity without significantly compromising distance visual acuity, making these lenses attractive for patients with active lifestyles. Nevertheless, the balance between improved visual range and the possibility of glare, halos, starbursts, or reduced contrast sensitivity remains an important issue in clinical decision-making.[3] Another important aspect in this comparison is the concept of visual quality. Visual outcomes after cataract surgery are no longer assessed only by Snellen or logMAR acuity at a single distance. Modern evaluation includes refractive predictability, contrast sensitivity, optical quality, dysphotopsia profile, patient-reported visual satisfaction, and the ability to perform real-world tasks without spectacles. A lens may provide excellent chart-based acuity and yet still produce bothersome night-time symptoms or inadequate performance in dim light. Similarly, a lens that slightly increases optical phenomena may still be preferred by some patients if it substantially reduces spectacle dependence. Thus, the true value of any intraocular lens lies in its overall functional performance rather than in visual acuity alone.[4] Spectacle independence has emerged as one of the most meaningful patient-centered outcomes in cataract and refractive lens surgery. The ability to perform daily tasks without glasses is particularly important for intermediate and near activities, which are inadequately addressed by standard monofocal optics. Enhanced and EDOF designs have therefore gained interest because they may bridge the gap between conventional monofocal and more aggressively presbyopia-correcting lenses. However, not all patients place the same value on spectacle freedom. Some may accept occasional spectacle use in exchange for fewer visual disturbances, while others may prioritize reduced dependence on glasses even if mild photic symptoms occur. This underlines the need for comparative studies that evaluate both objective clinical outcomes and subjective patient experience.[5] Dysphotopsia is another central consideration when comparing monofocal and EDOF intraocular lenses. Glare, halos, starbursts, light streaks, and difficulty with night driving can affect quality of life and postoperative satisfaction despite otherwise good refractive and visual outcomes. Although EDOF lenses were designed to improve the range of vision with less dysphotopsia than traditional multifocal lenses, they may still produce more photic symptoms than monofocal lenses depending on lens platform and patient factors. Consequently, surgeons must balance the visual benefits of extended focus against the possibility of

optical side effects, particularly in patients with high visual sensitivity, frequent night driving, or strong expectations of perfect optical quality.[6]

MATERIALS AND METHODS

This hospital-based comparative study was conducted at a tertiary care hospital to compare postoperative visual quality, dysphotopsia, and spectacle independence in patients undergoing cataract surgery with implantation of either monofocal or extended-depth-of-focus (EDOF) intraocular lenses. A total of 98 patients were included in the study and were allocated into two groups based on the type of intraocular lens implanted: 49 patients in the monofocal IOL group and 49 patients in the EDOF IOL group. The study was carried out after obtaining approval from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrolment. Adult patients diagnosed with age-related cataract and planned for phacoemulsification with posterior chamber intraocular lens implantation were included. Patients with visually significant cataract and good visual potential who were willing to comply with follow-up evaluations were considered eligible. Patients with corneal opacity, irregular astigmatism, glaucoma with field loss, uveitis, retinal pathology affecting vision, optic nerve disease, amblyopia, previous ocular surgery, intraoperative complications, or postoperative events likely to influence visual outcomes were excluded. Patients with significant systemic or neurological conditions affecting visual function or questionnaire responses were also excluded.

Methodology: Preoperative assessment: All patients underwent detailed ophthalmic evaluation before surgery. This included recording demographic details, ocular history, unaided and corrected distance visual acuity, slit-lamp biomicroscopy, intraocular pressure measurement, and dilated fundus examination. Keratometry and axial length were measured using optical biometry for IOL power calculation. Corneal astigmatism, anterior chamber depth, and lens status were documented. Manifest refraction was performed, and patients were evaluated for ocular surface disease and macular status to ensure suitability for premium lens implantation in the EDOF group. The target postoperative refraction was emmetropia in both groups.

Grouping and intervention: Patients were assigned to one of two study groups according to the intraocular lens implanted during cataract surgery. The monofocal group received standard monofocal posterior chamber intraocular lenses, while the EDOF group received extended-depth-of-focus intraocular lenses. All surgeries were performed by experienced cataract surgeons using standard phacoemulsification techniques through a clear corneal incision with in-the-bag IOL implantation. Efforts were made to maintain uniformity in surgical technique, incision site, viscoelastic use, capsulorhexis size, and postoperative medication protocol across both groups to minimize procedural bias.

Postoperative evaluation: Postoperative assessment was performed at scheduled follow-up visits after surgery. Visual outcomes were evaluated using standardized charts under photopic conditions. Unaided distance visual acuity (UDVA), corrected distance visual acuity (CDVA), uncorrected intermediate visual acuity (UIVA), and uncorrected near visual acuity (UNVA) were recorded. Refraction was assessed postoperatively, and spherical equivalent was documented. Visual acuity measurements were converted to logarithm of the minimum angle of resolution (logMAR) for statistical analysis. Residual refractive error and postoperative complications, if any, were also noted.

Assessment of visual quality: Visual quality was assessed using both objective and subjective parameters. Objective assessment included postoperative visual acuity at distance, intermediate, and near, residual refractive error, and contrast sensitivity measured under standard illumination conditions using an appropriate contrast sensitivity chart. Subjective visual quality was assessed through patient-reported satisfaction regarding clarity of vision during routine daily activities such as reading, using mobile devices, computer work, and distance viewing. In addition, overall satisfaction with postoperative visual performance was documented using a structured questionnaire.

Assessment of dysphotopsia: Dysphotopsia symptoms were evaluated using a standardized patient questionnaire. Patients were specifically asked about the presence and severity of glare, halos, starbursts, light streaks, and difficulty with night driving or vision in dim illumination. Symptoms were graded on an ordinal scale such as none, mild, moderate, or severe. For analysis, both the frequency and severity of dysphotopsia symptoms were compared between the two groups. Particular attention was paid to the effect of these symptoms on daily functioning and overall patient acceptance of the implanted lens.

Assessment of spectacle independence: Spectacle independence was assessed by asking patients about their need for spectacles for distance, intermediate, and near activities after surgery. Responses were categorized as never, occasionally, or always requiring spectacles. Patients were also asked whether they were satisfied with their level of dependence on glasses in daily life. The primary comparison between groups focused on the proportion of patients achieving functional spectacle independence, particularly for intermediate and near tasks.

Statistical analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 27.0. Continuous variables were expressed as

mean ± standard deviation, while categorical variables were presented as frequency and percentage. The independent samples t-test was used to compare normally distributed continuous variables between the two groups, and the Mann–Whitney U test was applied for non-normally distributed data. The chi-square test or Fisher's exact test was used for comparison of categorical variables such as dysphotopsia symptoms and spectacle independence. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 98 patients undergoing phacoemulsification with intraocular lens implantation were included in the study. Among them, 49 patients received monofocal intraocular lenses and 49 patients received extended-depth-of-focus (EDOF) intraocular lenses.

[Table 1] Demographic and Baseline Ocular Characteristics

[Table 1] shows the demographic and baseline ocular characteristics of the study participants in both groups. The mean age of patients in the monofocal IOL group was 64.82 ± 6.12 years, while in the EDOF IOL group it was 65.37 ± 5.94 years, and the difference was not statistically significant (p = 0.642). When categorized according to age groups, the majority of patients in both groups belonged to the 61–70 years age group, accounting for 48.98% in the monofocal group and 53.06% in the EDOF group, followed by patients aged 50–60 years and above 70 years. The distribution of age groups was comparable between the two groups (p = 0.867). In terms of gender distribution, males constituted 55.10% of patients in the monofocal group and 51.02% in the EDOF group, while females accounted for 44.90% and 48.98%, respectively. This difference was not statistically significant (p = 0.689). Regarding the eye operated, 53.06% of surgeries in the monofocal group and 48.98% in the EDOF group involved the right eye, whereas 46.94% and 51.02%, respectively, involved the left eye (p = 0.682). Baseline ocular parameters were also comparable between the groups. The mean axial length was 23.61 ± 0.87 mm in the monofocal group and 23.55 ± 0.92 mm in the EDOF group (p = 0.741). Similarly, the mean keratometry readings were 43.62 ± 1.21 diopters and 43.70 ± 1.18 diopters, respectively (p = 0.723). The preoperative corrected distance visual acuity (CDVA) was 0.76 ± 0.19 logMAR in the monofocal group and 0.79 ± 0.21 logMAR in the EDOF group (p = 0.512).

[Table 2] Postoperative Visual Acuity Outcomes

[Table 2] presents the postoperative visual acuity outcomes in both groups. The mean uncorrected distance visual acuity (UDVA) was 0.08 ± 0.06 logMAR in the monofocal IOL group and 0.07 ± 0.05 logMAR in the EDOF IOL group, with no statistically significant difference (p = 0.331). Similarly, the mean corrected distance visual acuity (CDVA) was 0.04 ± 0.03 logMAR in the monofocal group and 0.03 ± 0.02 logMAR in the EDOF group (p = 0.284), indicating comparable distance visual outcomes between the two lens types. However, significant differences were observed in intermediate and near vision. The mean uncorrected intermediate visual acuity (UIVA) was 0.28 ± 0.10 logMAR in the monofocal group compared with 0.16 ± 0.07 logMAR in the EDOF group, which was statistically significant (p < 0.001). Similarly, the mean uncorrected near visual acuity (UNVA) was 0.34 ± 0.11 logMAR in the monofocal group and 0.19 ± 0.08 logMAR in the EDOF group, again showing a highly significant difference (p < 0.001). When considering the proportion of patients achieving good visual outcomes, 83.67% of patients in the monofocal group and 89.80% in the EDOF group achieved UDVA ≤ 0.1 logMAR, with no significant difference (p = 0.379). In contrast, significantly more patients in the EDOF group achieved good intermediate and near visual acuity. Specifically, 75.51% of patients in the EDOF group achieved UIVA ≤ 0.2 logMAR, compared with only 30.61% in the monofocal group (p < 0.001). Similarly, 69.39% of EDOF patients achieved UNVA ≤ 0.2 logMAR, compared with 20.41% in the monofocal group (p < 0.001).

[Table 3] Postoperative Refractive Outcomes and Contrast Sensitivity

[Table 3] summarizes the postoperative refractive outcomes and contrast sensitivity in the two groups. The mean postoperative spherical equivalent was −0.21 ± 0.43 diopters in the monofocal group and −0.17 ± 0.39 diopters in the EDOF group, showing no statistically significant difference (p = 0.604). Similarly, the mean residual astigmatism was 0.46 ± 0.29 diopters in the monofocal group and 0.49 ± 0.31 diopters in the EDOF group (p = 0.668), indicating comparable refractive outcomes. Regarding refractive accuracy, 77.55% of patients in the monofocal group and 83.67% in the EDOF group achieved emmetropia within ±0.50 diopters, although the difference was not statistically significant (p = 0.446). Residual myopia greater than −0.50 diopters was observed in 12.24% of monofocal patients and 8.16% of EDOF patients, while residual hyperopia greater than +0.50 diopters occurred in 10.20% and 8.16%, respectively (p = 0.781). Contrast sensitivity measurements also showed similar results between the groups. The mean contrast sensitivity was 1.63 ± 0.14 log units in the monofocal group and 1.58 ± 0.16 log units in the EDOF group (p = 0.091). Reduced contrast sensitivity was observed in 6.12% of patients in the monofocal group and 10.20% in the EDOF group, with no statistically significant difference (p = 0.462).

[Table 4] Dysphotopsia Symptoms and Severity

[Table 4] illustrates the frequency of dysphotopsia symptoms experienced by patients in both groups. Dysphotopsia symptoms were generally more common in patients implanted with EDOF lenses. Glare was reported by 12.24% of patients in the

monofocal group and 30.61% in the EDOF group, which was statistically significant (p = 0.028). Similarly, halos were reported by 10.20% of monofocal patients compared with 34.69% of EDOF patients (p = 0.004). Other visual disturbances also showed higher prevalence in the EDOF group. Starbursts occurred in 8.16% of monofocal patients and 24.49% of EDOF patients (p = 0.031), while light streaks were reported by 6.12% and 20.41% of patients, respectively (p = 0.037). Difficulty with night vision was also significantly more common in the EDOF group (32.65%) compared with the monofocal group (14.29%, p = 0.034). Conversely, the absence of dysphotopsia symptoms was significantly higher in the monofocal group, with 69.39% of patients reporting no dysphotopsia compared with 42.86% in the EDOF group (p = 0.008).

[Table 5] Spectacle Independence for Different Visual Distances

[Table 5] presents the requirement for spectacles following surgery for distance, intermediate, and near visual tasks. For distance vision, the majority of patients in both groups were spectacle independent. 89.80% of patients in the monofocal group and 93.88% in the EDOF group reported never requiring spectacles for distance vision, and this difference was not statistically significant (p = 0.468). However, substantial differences were observed for intermediate and near vision. For intermediate vision, only 20.41% of patients in the monofocal group were spectacle independent compared with 73.47% in the EDOF group, and this difference was highly significant (p < 0.001). Furthermore, 40.82% of monofocal patients always required spectacles for intermediate tasks, whereas only 8.16% of EDOF patients required spectacles. Similarly, for near vision, 63.27% of patients in the EDOF group were spectacle independent compared with only 12.24% of patients in the monofocal group (p < 0.001). Additionally, 57.14% of monofocal patients always required spectacles for near activities, compared with only 12.24% in the EDOF group.

[Table 6] Patient Satisfaction and Functional Visual Performance

[Table 6] shows the overall patient satisfaction and functional visual performance in both groups. Overall satisfaction levels were high in both groups. Very satisfied responses were reported by 48.98% of patients in the monofocal group and 65.31% in the EDOF group, while 36.73% and 24.49% of patients were satisfied, respectively. The difference in overall satisfaction was not statistically significant (p = 0.238). Functional visual performance for daily activities showed significant differences between the groups. Comfortable reading without glasses was reported by 18.37% of monofocal patients compared with 67.35% of EDOF patients (p < 0.001). Similarly, comfortable mobile phone use without spectacles was reported by 22.45% of monofocal patients and 71.43% of EDOF patients (p < 0.001). For computer work, 28.57% of monofocal patients and 69.39% of EDOF patients reported comfort without spectacles (p < 0.001). In contrast, comfortable distance viewing without glasses was reported by 87.76% of monofocal patients and 91.84% of EDOF patients, with no statistically significant difference (p = 0.508).

Table 1: Demographic and Baseline Ocular Characteristics

Variable	Monofocal IOL (n=49)	EDOF IOL (n=49)	p value
Age (years) Mean ± SD	64.82 ± 6.12	65.37 ± 5.94	0.642
Age 50–60 years	14 (28.57%)	12 (24.49%)	
Age 61–70 years	24 (48.98%)	26 (53.06%)	
Age >70 years	11 (22.45%)	11 (22.45%)	0.867
Male	27 (55.10%)	25 (51.02%)	
Female	22 (44.90%)	24 (48.98%)	0.689
Right eye operated	26 (53.06%)	24 (48.98%)	
Left eye operated	23 (46.94%)	25 (51.02%)	0.682
Axial length (mm) Mean ± SD	23.61 ± 0.87	23.55 ± 0.92	0.741
Keratometry (D) Mean ± SD	43.62 ± 1.21	43.70 ± 1.18	0.723
Preoperative CDVA (logMAR)	0.76 ± 0.19	0.79 ± 0.21	0.512

Table 2: Postoperative Visual Acuity Outcomes (logMAR)

Visual Parameter	Monofocal IOL (Mean ± SD)	EDOF IOL (Mean ± SD)	p value
UDVA	0.08 ± 0.06	0.07 ± 0.05	0.331
CDVA	0.04 ± 0.03	0.03 ± 0.02	0.284
UIVA	0.28 ± 0.10	0.16 ± 0.07	<0.001
UNVA	0.34 ± 0.11	0.19 ± 0.08	<0.001
Patients achieving UDVA ≤0.1 logMAR	41 (83.67%)	44 (89.80%)	0.379
Patients achieving UIVA ≤0.2 logMAR	15 (30.61%)	37 (75.51%)	<0.001
Patients achieving UNVA ≤0.2 logMAR	10 (20.41%)	34 (69.39%)	<0.001

Table 3: Postoperative Refractive Outcomes and Contrast Sensitivity

Parameter	Monofocal IOL	EDOF IOL	p value
Postoperative spherical equivalent (D)	-0.21 ± 0.43	-0.17 ± 0.39	0.604
Residual astigmatism (D)	0.46 ± 0.29	0.49 ± 0.31	0.668
Emmetropia achieved (±0.50 D)	38 (77.55%)	41 (83.67%)	0.446
Residual myopia (> -0.50 D)	6 (12.24%)	4 (8.16%)	

Residual hyperopia (> +0.50 D)	5 (10.20%)	4 (8.16%)	0.781
Contrast sensitivity (log units)	1.63 ± 0.14	1.58 ± 0.16	0.091
Reduced contrast sensitivity	3 (6.12%)	5 (10.20%)	0.462

Table 4: Dysphotopsia Symptoms and Severity

Dysphotopsia Symptom	Monofocal IOL	EDOF IOL	p value
Glare	6 (12.24%)	15 (30.61%)	0.028
Halos	5 (10.20%)	17 (34.69%)	0.004
Starbursts	4 (8.16%)	12 (24.49%)	0.031
Light streaks	3 (6.12%)	10 (20.41%)	0.037
Difficulty with night vision	7 (14.29%)	16 (32.65%)	0.034
No dysphotopsia	34 (69.39%)	21 (42.86%)	0.008

Table 5: Spectacle Independence for Different Visual Distances

Spectacle Requirement	Monofocal IOL	EDOF IOL	p value
Distance – Never	44 (89.80%)	46 (93.88%)	
Distance – Occasionally	4 (8.16%)	3 (6.12%)	
Distance – Always	1 (2.04%)	0 (0.00%)	0.468
Intermediate – Never	10 (20.41%)	36 (73.47%)	
Intermediate – Occasionally	19 (38.78%)	9 (18.37%)	
Intermediate – Always	20 (40.82%)	4 (8.16%)	<0.001
Near – Never	6 (12.24%)	31 (63.27%)	
Near – Occasionally	15 (30.61%)	12 (24.49%)	
Near – Always	28 (57.14%)	6 (12.24%)	<0.001

Table 6: Patient Satisfaction and Functional Visual Performance

Parameter	Monofocal IOL	EDOF IOL	p value
Very satisfied	24 (48.98%)	32 (65.31%)	
Satisfied	18 (36.73%)	12 (24.49%)	
Neutral	5 (10.20%)	3 (6.12%)	
Dissatisfied	2 (4.08%)	2 (4.08%)	0.238
Comfortable reading without glasses	9 (18.37%)	33 (67.35%)	<0.001
Comfortable mobile phone use	11 (22.45%)	35 (71.43%)	<0.001
Comfortable computer work	14 (28.57%)	34 (69.39%)	<0.001
Comfortable distance viewing	43 (87.76%)	45 (91.84%)	0.508

DISCUSSION

In the present study, the two groups were well matched at baseline, which strengthens the validity of the postoperative comparison. The mean age was 64.82 ± 6.12 years in the monofocal group and 65.37 ± 5.94 years in the EDOF group, with no significant difference; similarly, age-group distribution, sex distribution, laterality of surgery, axial length, keratometry, and preoperative CDVA were also statistically comparable. This is consistent with the prospective study by Sihmar et al. (2023), in which the Tecnis Eyhance and Supraphob EDOF groups were likewise comparable for preoperative biometry, visual acuity, and cataract status, although their cohort was younger overall with a mean age of 56 ± 6 years. The baseline comparability in both studies suggests that the postoperative differences are more likely attributable to lens design rather than pre-existing demographic or biometric imbalance.[7] Distance vision outcomes in the current study were similar between the two lens groups. The mean postoperative UDVA was 0.08 ± 0.06 logMAR in the monofocal group and 0.07 ± 0.05 logMAR in the EDOF group, while mean CDVA was 0.04 ± 0.03 and 0.03 ± 0.02 logMAR, respectively, with no statistically significant difference. A similar pattern was reported by Chang et al. (2022) in a pivotal randomized clinical trial of 299 patients, where mean binocular uncorrected distance visual acuity was comparable between the TECNIS Symfony EDOF and TECNIS monofocal groups, while the EDOF lens offered added range at other distances. The agreement between our results and that trial supports the concept that EDOF lenses can preserve excellent distance performance without compromising corrected distance outcomes.[8] The principal visual advantage of the EDOF lens in our series was at intermediate and near distances. Mean UIVA improved from 0.28 ± 0.10 logMAR in the monofocal group to 0.16 ± 0.07 logMAR in the EDOF group, and mean UNVA improved from 0.34 ± 0.11 to 0.19 ± 0.08 logMAR, both with $p < 0.001$. These findings parallel those of Pedrotti et al. (2020), who showed that postoperative uncorrected and corrected monocular and binocular intermediate and near visual acuity were significantly better in the EDOF group than in the aspheric monofocal group (all $P < .001$), while distance acuity remained similar. Thus, our study reproduces the core clinical advantage repeatedly described for EDOF optics: extension of the defocus range with maintenance of distance acuity.[9]

When visual acuity was analyzed categorically, the superiority of the EDOF lens became even more clinically evident. In our cohort, 75.51% of EDOF patients achieved UIVA ≤ 0.2 logMAR compared with 30.61% in the monofocal group, and 69.39% of EDOF patients achieved UNVA ≤ 0.2 logMAR

compared with only 20.41% in the monofocal group. Similar results were reported in the randomized multicentre trial by Reinhard et al. (2021), in which there was no significant difference in corrected or uncorrected distance visual acuity among groups at 6 months, but both EDOF lenses were significantly superior to the monofocal lens for intermediate and near visual acuities ($p < 0.0001$ for all measurements). That trial also noted that the monofocal lens provided good-quality vision mainly from around 100 cm, whereas EDOF lenses extended functional vision much closer, which is in line with the better task-related intermediate and near performance observed in our study.[10] Postoperative refractive accuracy was comparable between the two study groups in our series. The mean spherical equivalent was -0.21 ± 0.43 D in the monofocal group and -0.17 ± 0.39 D in the EDOF group, while emmetropia within ±0.50 D was achieved in 77.55% and 83.67% of patients, respectively. These findings are close to those reported by Choi et al. (2020), who found a postoperative manifest refraction spherical equivalent of -0.41 ± 0.44 D after bilateral Symfony implantation, with 72.4% of eyes within 0.50 D of target and 90.6% of eyes having less than 1.00 D of residual cylinder. Taken together, both studies indicate that refractive predictability with EDOF lenses can approach that of monofocal lenses when case selection and biometry are appropriate.[11] Contrast sensitivity also did not differ significantly between the groups in our study, with mean values of 1.63 ± 0.14 log units in the monofocal group and 1.58 ± 0.16 log units in the EDOF group ($p = 0.091$), and reduced contrast sensitivity being uncommon in both groups. This is broadly comparable to the report by Schallhorn et al. (2019), where implantation of a new EDOF lens produced 86.7% of eyes within ±0.50 D of emmetropia, 90.3% patient satisfaction, and a high level of spectacle freedom, albeit with some early optical side effects; importantly, the study still concluded that the lens delivered reasonable unaided distance and near vision with good overall functional acceptance. Our data similarly suggest that the visual gains of the EDOF lens were not achieved at the cost of a clinically meaningful reduction in contrast performance.[12]

With regard to dysphotopsia, the present study showed a clearly higher symptom burden in the EDOF group. Glare was reported by 30.61% of EDOF patients versus 12.24% of monofocal patients, halos by 34.69% versus 10.20%, starbursts by 24.49% versus 8.16%, light streaks by 20.41% versus 6.12%, and night-vision difficulty by 32.65% versus 14.29%; conversely, absence of dysphotopsia was more common in the monofocal group (69.39% vs 42.86%). Corbett et al. (2024), evaluating a newer fully refractive EDOF lens, reported a more favorable dysphotopsia profile, with 88.3% of patients never, rarely, or sometimes experiencing halos, 96.7% similarly reporting low starbursts, and 100% reporting low glare, while contrast sensitivity remained comparable to the control monofocal group. Compared with that newer platform, our results suggest that dysphotopsia remains an important trade-off for some EDOF designs, especially those with stronger presbyopia-correcting behavior.[13] Spectacle independence was one of the strongest advantages of the EDOF lens in this study. For distance, spectacle independence was high in both groups, with 89.80% of monofocal patients and 93.88% of EDOF patients never requiring glasses. However, for intermediate vision, 73.47% of EDOF patients were spectacle independent compared with only 20.41% in the monofocal group, and for near vision the corresponding figures were 63.27% and 12.24%. These findings are in agreement with Chao et al. (2022), who found that the spectacle dependence ratio was significantly higher in the monofocal group than in the EDOF group ($p < 0.001$), even though general quality-of-vision scores favored monofocal lenses. Therefore, our data reinforce the well-recognized clinical balance in presbyopia-correcting IOL selection: monofocal lenses preserve simpler optics, whereas EDOF lenses offer substantially greater freedom from spectacles.[14] Overall patient satisfaction in our study was high in both groups, and the difference did not reach statistical significance despite a greater proportion of "very satisfied" responses in the EDOF group (65.31% vs 48.98%). More importantly, task-based visual function strongly favored the EDOF lens: comfortable reading without glasses was reported by 67.35% versus 18.37%, comfortable mobile phone use by 71.43% versus 22.45%, and comfortable computer work by 69.39% versus 28.57%, while comfortable distance viewing remained similar in both groups. A comparable pattern was noted by Lee et al. (2022), who found that binocular UDVA, UIVA, and CDVA were similar between the Eyhance and Symfony groups, but monocular UNVA and near spectacle independence were better in the Symfony group, whereas contrast sensitivity, glare, halo, satisfaction, and recommendation rates were similar. This supports our conclusion that the major clinical benefit of EDOF implantation is not necessarily a dramatic increase in overall satisfaction scores, but rather a meaningful improvement in unaided performance for everyday intermediate and near tasks.[15] Taken together, the present study shows that monofocal and EDOF IOLs provide similarly good postoperative distance vision and refractive predictability, but the EDOF lens offers clear advantages in intermediate and near vision, spectacle independence, and daily functional performance, at the expense of a higher frequency of dysphotopsia. This overall interpretation is closely aligned with the prospective work of Corbelli et al. (2022), in which monofocal, enhanced monofocal, and EDOF lenses all achieved excellent distance vision, contrast sensitivity was similar across groups, the EDOF lens achieved the highest near performance, and subjective halos and glare were worst with Symfony. Accordingly, our findings support the view that lens selection should

be individualized: monofocal IOLs remain suitable for patients prioritizing optical simplicity and fewer photic symptoms, whereas EDOF IOLs are better suited to patients who value greater spectacle independence for intermediate and near activities.[16]

CONCLUSION

In conclusion, both monofocal and extended-depth-of-focus intraocular lenses provided excellent postoperative distance vision and satisfactory refractive outcomes in patients undergoing phacoemulsification. However, EDOF intraocular lenses demonstrated superior intermediate and near visual acuity, greater spectacle independence, and better functional visual performance in daily activities. These advantages were accompanied by a higher incidence of dysphotopsia symptoms in the EDOF group compared with the monofocal group. Therefore, while monofocal IOLs remain a suitable option for patients prioritizing optical simplicity and fewer photic phenomena, EDOF IOLs may be preferred in patients seeking a broader range of vision and reduced dependence on spectacles.

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