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Assessing the clinical outcomes of a novel EDOF intraocular lens: a functional classification approach

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Abstract

Background Functional assessment can help identify the true extended depth of focus intraocular lenses (EDOF IOLs) on the market. This study aimed to demonstrate the eligibility of the 877PEY ELON IOL (Medicontur Medical Engineering) as a suitable model for this category and to assess its efficacy in clinical settings.

Methods In total, 38 patients (76 eyes) were enrolled in the study with bilateral implantation of the investigational IOL. For functional classification, a distance-corrected monocular defocus curve was taken 3 months postoperatively. At the 3- and 12-month follow-ups, manifest refraction, monocular and binocular distance, intermediate and near visual acuities, contrast sensitivity, and patient-reported outcomes were recorded.

Results The defocus range (visual acuity [VA] ≤ 0.2 logMAR) on the distance-corrected monocular normalized defocus curve taken at 3 months was 1.7 D, which falls into the Partial Range of Field Extended (later referred to as PRoF-Ex) category, confirming expectations. The binocular depth of focus (VA ≤ 0.1 logMAR) spanned approximately 0.50 D to -1.50 D, and the functional visual acuity (VA ≤ 0.3 logMAR) spanned approximately 1.00 D to -2.50 D. Monocular CSV-1000 outcomes were above the population's normal ranges. 90.9% of the patients were within ± 0.50 D, and 97.7% were within ± 1.00 D SEQ at the 3-month follow-ups. The outcomes of the VFQ-25 questionnaire demonstrated high scores, and the level of spectacle independence, similar to visual acuity, reflected a strong efficacy in distance and intermediate correction with functional near vision. In terms of photopic phenomena, 90% and 87.5% of patients experienced no-to-moderate rates of glare and halos, respectively. The posterior capsular opacification (PCO) rate was 7.89% at the 12-month follow-up. No adverse events were considered serious.

Conclusions The 877PEY model demonstrated capability as a PRoF-Ex IOL with remarkable performance. It is safe to use and delivers a high degree of patient satisfaction.

Keywords Cataract surgery, Presbyopia, Intraocular lens, EDOF, Extended depth of focus, PRoF-Ex, Functional classification

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Background

Cataract has been and is still a predominant factor in vision impairment, affecting many patients globally [1]. Currently, as the leading therapeutic intervention, intraocular lenses (IOLs) are routine replacements for the natural crystalline lens during cataract surgery [1]. Over the years, continuous advancements in surgical equipment and techniques have led to these surgeries becoming some of the safest and most successful operations [2]. To fully capitalize on the opportunities presented by these changes, along with the increasing number of presbyopia patients, rising living standards, and increasing expectations of spectacle independence, IOLs are constantly evolving in terms of their material, design, and optical characteristics. This has led to advances in IOL technologies to satisfy patients' individual needs and achieve high-quality vision at all distances [1–5]. For a long time, multifocal IOLs have been the only lenses available in this category. Unlike their monofocal counterparts, these lenses offer a wider field of vision by allowing focus on multiple foci [6]. Implantation usually yields sharp vision at all distances [7], enabling greater spectacle independence [5, 8]. Nevertheless, monofocal lenses still lead the market. The superiority of multifocal lenses in terms of intermediate and near vision is indisputable [1, 9], but these advantages come with compromises [9]. In addition to the challenges of neuroadaptation [10], implantation of multifocal IOLs is commonly associated with dysphotopsia and loss of contrast sensitivity [8–10]. As a result, the majority of surgeons and patients still tend to lean toward monofocal lenses, despite their allowing limited vision compared with multifocal lenses [4].

To compensate for the gap between mono- and multifocal IOLs, a new generation of extended depth of focus (EDOF) IOLs has been gaining attention [5, 8]. Compared with multifocal IOLs, these lenses can achieve a good balance between vision quality and undesired photic phenomena, as they provide greater spectacle independence than monofocal lenses do and reduce visual disturbances and loss of contrast sensitivity [4, 11, 12]. Their unique technology exploits the creation of a single, continuous, elongated focal tunnel [4, 5] to promote an uninterrupted range of vision from far to intermediate viewing distances [8]. In the past few years, however, the rise of trademarked technologies in the EDOF field has been accompanied by uncertainties about completely understanding these novel optical concepts, leading to challenges in adequate information comprehension [6]. Owing to limitations in proper representation and bias in results from different testing conditions, there are numerous inconsistencies in nomenclature, which further complicate surgeons' ability to make informed decisions. The same applies to factors that are subject to subjective interpretation, such as dysphotopsia rates or patient satisfaction. In the absence of standardization, parameters such as these can easily be affected by individual habits and lifestyles, meaning that they are not fully representative and that discrepancies are normal and expected [5].

A recent publication by Fernandez et al., 2024 [6], appears to have found a solution to this problem for the first time. They introduced a novel functional classification based on monocular visual acuity defocus curves, categorizing IOLs by their range of field (RoF) and defocus curve shape. Within this framework, the PRoF-Ex category was precisely defined to objectively classify EDOF IOLs, distinguishing them by their extended but partial range of vision, which bridges the gap between monofocal and full-range IOLs. The established criteria for classifying a PRoF-Ex lens are as follows: a monotonous decrease in visual acuity across distances and a RoF between 1.58 to < 2.3 D for a 0.2 logMAR cut-off and 1.98 to < 2.75 D for a 0.3 logMAR cut-off.

The 877PEY IOL by Medicontur (Medicontur Medical Engineering Ltd., Zsámbék, Hungary) is a recent addition to the available EDOF solutions on the market. This lens is a refractive EDOF IOL utilizing the modification of the central optics profile for continuous light distribution [13]. Given the limited clinical evidence available [28], the current study is among the first investigations to assess the safety and efficacy of this novel lens. For the best illustration, we aimed to demonstrate the eligibility of the 877PEY as a PRoF-Ex IOL and to assess visual performance outcomes.

Materials and methods

Study design

In this prospective, observational, multicentric study involving 3 investigational sites and surgeons (all located in Hungary), patients indicated for cataract surgery and subsequent implantation of the 877PEY IOL were enrolled. The study was conducted according to the tenets of the Declaration of Helsinki [14] and was approved by the National Institute of Pharmacy and Nutrition of Hungary (OGYÉI; ref: OGYEI/34155-6/2020; July 2020). The study also complied with applicable regulatory requirements set by the International Conference on Harmonisation Good Clinical Practice E6 (ICH-GCP). Informed consent was obtained from each patient, and they were free to withdraw from the clinical investigation at any time without giving a reason. The IOLs were supplied by the sponsor (Medicontur Medical Engineering Ltd., Zsámbék, Hungary). The necessary IOL power was calculated by the investigators using the ARGOS® Biometer (Alcon Laboratories, Fort Worth, Texas) or the ANTERION® Cataract App (Heidelberg Engineering GmbH, Heidelberg, Germany), based on the

Barrett Universal II formula, with the target set to the negative spherical equivalent closest to 0.0 D.

Patient selection

The patients included in the study were adults with no ocular pathologies (apart from cataracts) and a preoperative keratometric astigmatism of 1.0 D or less who wished to achieve partial spectacle independence. Patients with one or more of the following characteristics were excluded: prior ocular surgery in personal medical history or any other ocular comorbidity that could skew the study results. Patients with severe myopia (IOL power required < 10.0 D), inadequate fundus visualization, eye trauma, or those who were deemed at risk by the clinical investigator(s) due to systemic diseases were also excluded.

Investigational device

The 877PEY is a single-piece, hydrophobic, acrylic polymer IOL with a UV absorber and a natural blue-light filter. It has an overall diameter of 13 mm and a 6 mm refractive aspheric optic surface with 0° haptic angulation. The patented 360° special square-edge technology prevents posterior capsule opacification (PCO). The IOL material has a refractive index of 1.47 and an Abbe number of 58, contributing to high-quality retinal images. The refractive extended depth of focus optical performance is provided by the modified central optics profile developed by the manufacturer. The standard power range (spherical equivalent, SEQ) is available from + 8.00 D to + 30.0 D with 0.50 D increments.

Surgical technique

Standard phacoemulsification was performed via a 2.2–2.8 mm incision and sutureless wound closure. The IOLs were preloaded and implanted into the capsular bag via a POB-MA injector (Medicontur Medical Engineering Ltd., Zsámbék, Hungary). Surgery on the two eyes was performed separately, with a minimum of one week having elapsed after the first surgery before proceeding with the IOL implantation of the fellow eye. Concomitant treatments followed the standard-of-care clinical protocol at each investigational site.

Data collection/postoperative examinations

Patient demographics, medical and surgical history, and concomitant medications or treatments were recorded during the preoperative examination. A comprehensive examination was carried out to register the following parameters before surgery: optical biometry (ARGOS or the ANTERION biometers) and intraocular pressure (TOPCON CT-80 A tonometer, Topcon Inc., Tokyo, Japan).

Monocular and binocular distance-corrected visual acuity defocus curves (measured from + 1.50 to -3.00 D with 0.50 D increments) were taken under photopic conditions at the 3- and 12-month follow-up visits, respectively (referred to as M3 and M12 in the future), via the Multifocal Lens Analyzer (MLA) application (QVision, Almería, Spain). Patients also underwent monocular contrast sensitivity testing via a CSV-1000 device (Vector Vision, Ohio, USA) with distance correction in place at spatial frequencies of 3, 6, 12, and 18 cycles per degree (cpd) under photopic conditions.

In addition, follow-up visits were carried out at M3 and M12 post-surgery, and manifest refraction and monocular and binocular uncorrected visual acuities were measured at the following distances: distance at 4 m (UDVA) without adjustment to infinity, intermediate at 67 cm (UIVA), and near at 40 cm (UNVA) via the Early Treatment Diabetic Retinopathy Study (ETDRS) charts (photopic, registered in decimal). Corrected distance visual acuity (CDVA) was also evaluated. Excluding intermediate and near visual acuity, the above parameters were also assessed preoperatively.

All surgical complications or postoperative adverse events were recorded at all postoperative visits. Postoperatively, patients were checked for PCO formation and IOL discoloration or dislocation at each visit. Visual function and quality of life were evaluated by completing the VFQ-25 questionnaire at the 1-year follow-up (VFQ-25, National Eye Institute, Bethesda, MD, USA). The levels of visual disturbance (dysphotopsia) and spectacle independence were assessed and recorded separately as patient-reported outcomes at the 3-month follow-up visit.

Statistical analysis

Analysis was performed using the data acquired preoperatively and postoperatively at 3 and 12 months. All the data were registered and processed in Microsoft Excel (Redmond, WA, USA) with the aid of GraphPad Prism 10.2.2 statistical analysis software (GraphPad Software, Boston, USA). Visual acuity defocus curves and contrast sensitivity values measured by CSV-1000 were visualized using the same software. In addition, to match the standardization set by Fernandez et al. (2024) [6], the monocular visual acuity defocus curve acquired at 3 months was normalized to 0.00 logMAR at 0.00 D by an upward shift of the entire curve. Descriptive statistics (mean, standard deviation, median, minimum, and maximum values) were calculated for each relevant variable. A group comparison of the monocular visual acuity and residual refraction results between follow-up visits (M3 vs. M12) was conducted using a linear mixed-effects model. For the binocular datasets, we performed comparisons using the Wilcoxon matched-pairs signed-rank test or its parametric equivalent. All cases were based on the results of

the D'Agostino & Pearson normality test applied to each dataset. For all analyses, which employed an overall type I error rate, a p-value of <0.05 was considered to indicate statistical significance. Throughout the analysis, the results for all eligible subjects/eyes were used for summarization and statistical analysis. The evaluation of the VFQ-25 questionnaires was performed following the guidance set by the authors [15].

Results

Patient population

A total of 38 patients were enrolled and implanted with the 877PEY in three centers. The mean age was 65.5 ± 8.24 years, with a male-to-female ratio of 51.7%:48.3%. The preoperative patient demographics and other baseline characteristics are summarized in Table 1. Per protocol, the investigational device was implanted bilaterally. Two patients underwent monocular implantation due to protocol deviation and were consequently excluded from the performance analysis. After thorough monitoring, seven additional patients were excluded due to concerns unrelated to the study device. As a result, the number of subjects included in the performance analysis was 29 (58 eyes).

Functional performance

Defocus curve

Fig. 1 displays the photopic, distance-corrected mono- and binocular visual acuity defocus curves obtained during the 3- and 12-month follow-up visits, respectively. Monocularly, the normalized defocus range (≤ 0.2 logMAR) was ~ 1.8 D, with a steady decline toward positive and negative defocus. Binocularly, the depth of focus (VA ≤ 0.1 logMAR) spanned approximately 0.50 D to -1.50 D, simulating far to intermediate vision at 66 cm. Functional binocular visual acuity (VA ≤ 0.3 logMAR) was achieved in the range of 1.00 D to -2.50 D.

Table 1 Summary of preoperative patient demographics

Baseline characteristics	Mean	SD	Min	Max
Age (years)	65.5	8.24	47.0	85.0
K1 (D)	43.1	1.24	40.6	46.0
K2 (D)	43.6	1.32	41.0	46.9
AXL (mm)	23.3	0.74	21.5	25.0
ACD (mm)	3.01	0.43	1.95	3.80
UDVA (logMAR)	0.57	0.43	0.00	2.00
CDVA (logMAR)	0.19	0.37	-0.20	2.00
IOP (mmHg)	17.1	2.50	11.0	22.0
SPH (D)	0.24	2.48	-6.50	5.50
CYL (D)	-0.38	0.35	-1.00	0.00
Axis (°)	87.6	34.8	40.0	170

Contrast sensitivity

Monocular CSV-1000 outcomes are summarized in Fig. 2. The outcomes were above the expected ranges for the given age groups at all examined spatial frequencies, with minimal standard deviation [16].

Residual refraction and prediction error

At the 3-month follow-up, 90.9% of eyes achieved a spherical equivalent refraction (SEQ) within ± 0.50 D, and 97.7% were within ± 1.00 D. By the 12-month follow-up, these proportions were 90.2% and 97.6%, respectively (Fig. 3). Pairwise comparison of refractive outcomes between the 3-month and 12-month visits revealed no statistically significant differences (Table 2).

Prediction error analysis indicated a mean predicted residual SEQ of -0.14 D. The achieved mean postoperative SEQ was -0.10 D at 3 months, progressing to -0.19 D at 12 months, with prediction errors of 0.03 and -0.06, respectively, suggesting a mild myopic shift over time relative to the intended refractive outcome.

Visual outcomes

Monocular visual acuity

The mean monocular UDVA at the 3-month follow-up was 0.01 ± 0.08 logMAR, and the CDVA was -0.03 ± 0.07 logMAR. The outcome was roughly the same at the 12-month visit (0.00 ± 0.12 and −-0.03 ± 0.10 logMAR, respectively) (Table 3). Both UIVA and UNVA remained stable between the 3- and 12-month follow-ups (UIVA: 0.25 ± 0.20 and 0.23 ± 0.18; UNVA: 0.27 ± 0.18 and 0.25 ± 0.21 logMAR, respectively). No significant difference was found between any of the endpoints (Table 3).

Binocular visual acuity

The mean preoperative values increased from 0.57 ± 0.43 logMAR (UDVA) and 0.19 ± 0.37 logMAR (CDVA) to -0.07 ± 0.08 logMAR by M12 postoperatively. With a p-value of less than 0.0001 in both cases, the efficiency of distance correction was significant. For intermediate and near visual acuity, binocular measurements presented an average improvement of 0.05 to 0.10 logMAR in mean and median values compared with their monocular equivalents (Table 3). There was no significant difference between any of the binocular M3 and M12 results (Table 3).

Patient-reported outcomes

Feedback from the VFQ-25 questionnaires at the 12-month follow-up revealed high patient satisfaction. All evaluated subscales reached a minimum score of 75% (0% represented the lowest and 100% the highest satisfaction rate), with the most challenging activity described as driving and the least challenging as distance vision and vision-specific dependency. The scores obtained for

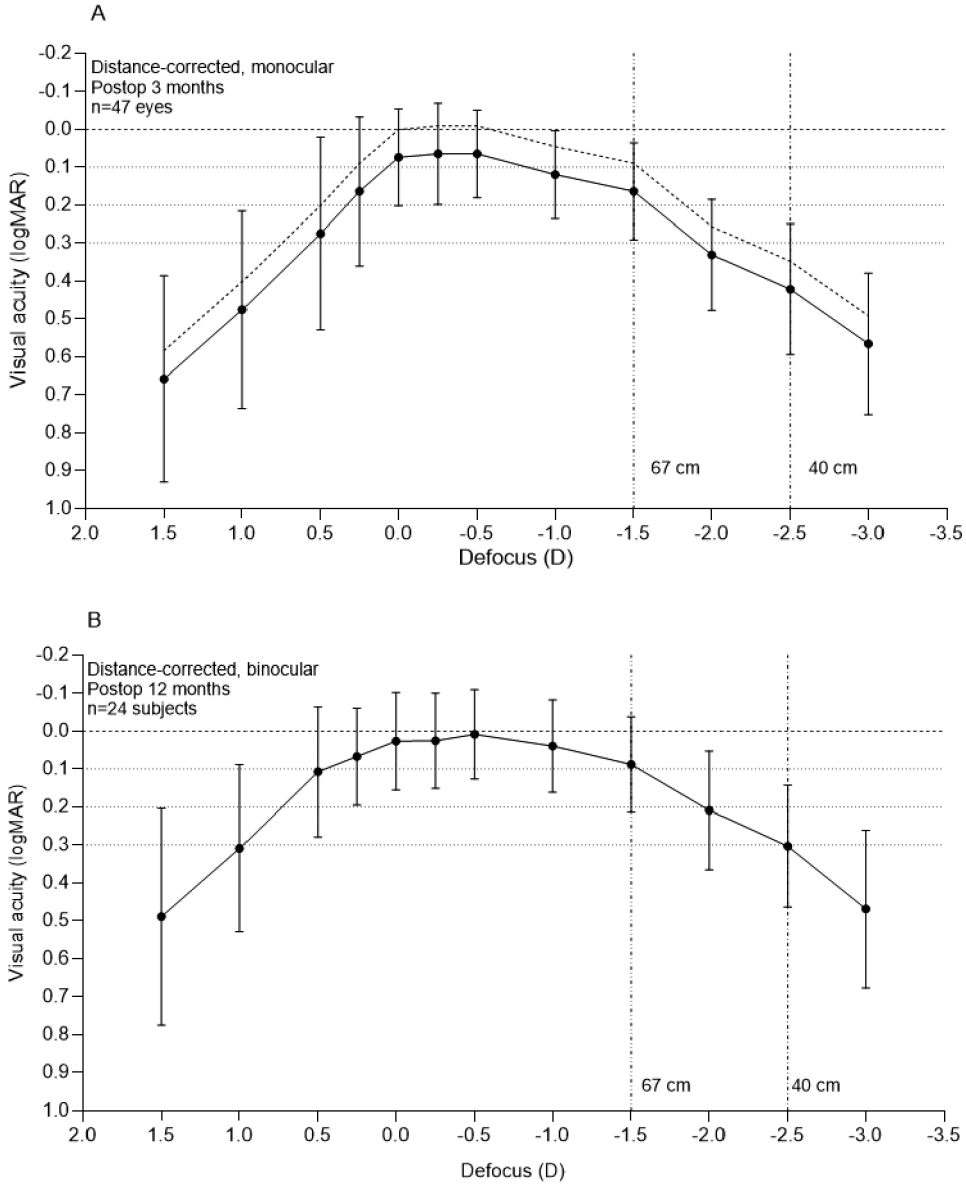

Fig. 1 (**A**) Normalized monocular visual acuity defocus curve with distance correction, taken at the 3-month follow-up. (**B**) Binocular visual acuity defocus curve with distance correction, taken at the 12-month follow-up

distance and near vision-related tasks and mental health were all above 90%. The details are summarized in Fig. 4.

In terms of photopic phenomena, 90% and 87.5% of patients experienced no-to-moderate rates of glare and halos, respectively. Moreover, none of the patients reported using spectacles for distance and intermediate vision activities, and almost 90% said they required them only occasionally for tasks related to near vision.

Safety outcomes

All the subjects who underwent surgery and received the investigational device (either mono- or binocularly) were included in the safety analysis. At the 12-month follow-up, the posterior capsular opacification and YAG capsulotomy rates were 7.89%. Other adverse events, including but not limited to expected complications of cataract surgery, were rare, only affecting a single patient each (drusen, elevated intraocular pressure, iritis, retinal detachment and tear, zonular dehiscence, red eye, dry eye). Ciliary zonular dehiscence was treated with CTR (capsular tension ring) implantation, and retinal detachment was treated with pars plana vitrectomy.

Discussion

Extended depth of focus IOLs have appeared on the market to meet the demands of modern, digitally dependent, and active lifestyles. Instead of the controversies surrounding official EDOF nomenclature, the current study

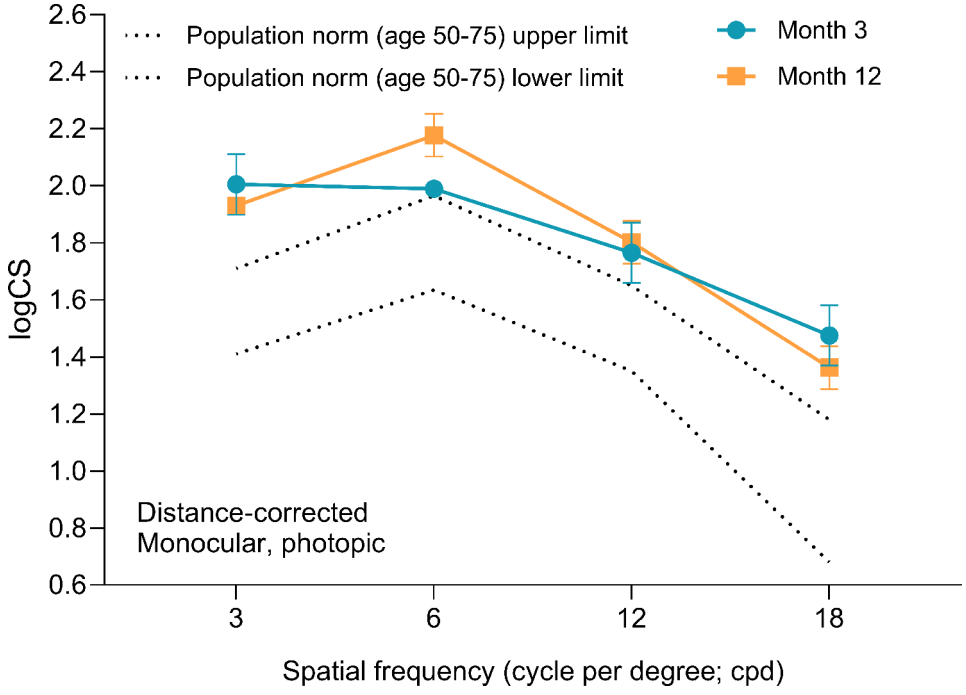

Fig. 2 Monocular CSV-1000 curves measured under photopic conditions at the 3- and 12-month follow-ups

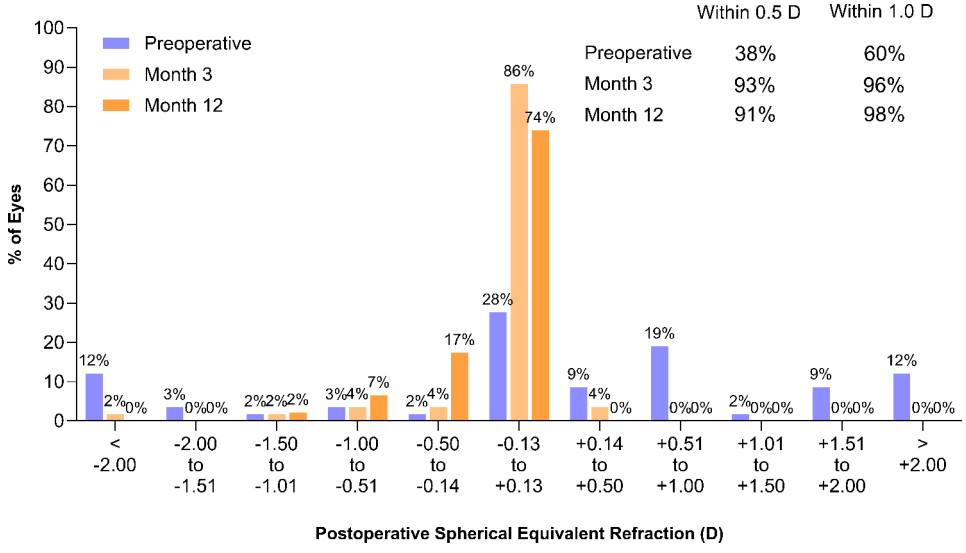

Fig. 3 Spherical equivalent prediction error distribution plot

Table 2 Refractive outcomes measured at the 3- and 12-month follow-ups

	Month 3					Month 12					*p*=
	Mean	SD	Median	Min	Max	Mean	SD	Median	Min	Max	
SPH	-0.08	0.32	0.00	-1.50	0.50	-0.09	0.27	0.00	-1.50	0.00	0.9442
CYL	-0.04	0.15	0.00	-0.75	0.00	-0.21	0.41	0.00	-1.25	0.00	0.3567
SEQ	-0.10	0.36	0.00	-1.50	0.50	-0.19	0.34	-0.00	-1.50	0.00	0.1648

Table 3 Monocular and binocular visual performance at the 3- and 12-month follow-ups

	Month 3					Month 12					
	Mean	SD	Median	Min	Max	Mean	SD	Median	Min	Max	p=
Monocular											
UDVA	0.01	0.08	0.00	0.22	-0.08	0.00	0.12	0.00	0.30	-0.20	0.6774
CDVA	-0.03	0.07	0.00	0.15	-0.20	-0.03	0.10	0.00	0.30	-0.20	0.7295
UIVA	0.25	0.20	0.20	1.10	0.00	0.23	0.18	0.22	1.00	0.00	0.7150
UNVA	0.27	0.18	0.20	1.00	0.00	0.25	0.21	0.20	1.00	0.00	0.4897
Binocular											
UDVA	-0.08	0.05	-0.08	0.00	-0.20	-0.07	0.08	-0.10	0.05	-0.20	0.6340
CDVA	-0.08	0.05	-0.08	0.00	-0.20	-0.07	0.08	-0.10	0.05	-0.20	0.7206
UIVA	0.13	0.10	0.10	0.40	0.00	0.14	0.12	0.10	0.40	0.00	0.8655
UNVA	0.14	0.10	0.10	0.40	0.00	0.19	0.20	0.10	0.70	0.00	0.7877

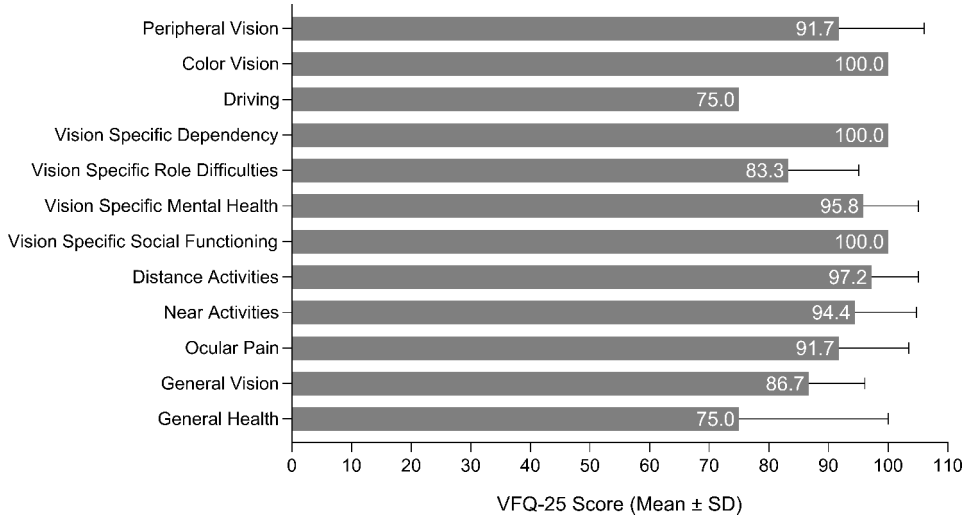

Fig. 4 VFQ-25 scores reported at the 12-month follow-up

focused on categorizing the new 877PEY IOL following the recent classification devised by Fernandez et al., 2024 [6].

The functional criterion for a PRoF-Ex performance is a range between 1.58 and 2.30 D, at or above the 0.2 logMAR level on the monocular distance-corrected visual acuity defocus curve, and a monotonous decrease in visual acuity from far to near distances [6]. The data acquired for the 877PEY IOL fit both standards, confirming its eligibility as a PRoF-Ex lens. Further performance outcomes were compared with IOLs that were given a "very high" certainty score from the same category: DFT015 (Alcon Laboratories, Fort Worth, Texas), AT LARA 829MP (Carl Zeiss Meditec, Jena, Germany), and the former ZXR00 (Johnson and Johnson Vision, Jacksonville, FL) [17]. The first two IOLs are collectively referred to as competitor models.

Among the current competitors, we found published monocular uncorrected distance visual acuity results for DFT015 [18] and AT LARA 829MP [19, 20], and our findings for 877PEY are in line with these results. Binocularly, the 877PEY IOL shows greater UDVA performance over DFT015 by 0.1 logMAR against both their intermediate-term [18, 21] and long-term outcomes [22] (-0.08 ± 0.05 vs. 0.013 ± 0.125, 0.035 ± 0.102, and 0.07 ± 0.12, respectively) and by 0.16 logMAR over ZXR00 (-0.08 ± 0.05 vs. 0.08 ± 0.12 logMAR). These results suggest that patients implanted with the 877PEY IOL could be capable of reading a further 1–2 lines on the ETDRS chart when assessed for distance vision at 4 m. This performance is as good as what could be achieved with the AT LARA 829MP, which delivered superior visual acuity outcomes over these two technologies mentioned above [8, 19].

For intermediate vision, early correlation with DFT015 is challenging due to differences in the investigated timelines. However, long-term outcomes continue to support similar performance [22, 23], indicating that the intermediate visual acuity of the 877PEY aligns closely with that of competing models.

The data recorded for near vision are consistent with expectations for functional vision. Binocular outcomes, in the long term, still appear to reflect the near visual acuity performance of all three competitor models [18, 21–24].

The contrast sensitivity outcomes observed with the 877PEY were on par with those reported for other similar lenses available on the market [29–32], and the results exceeded the expected ranges for the given age groups. This consistency across the available research highlights the effectiveness of the 877PEY in delivering good contrast sensitivity.

Naturally, the setting of the given study can influence IOL performance, which means that drawing conclusions solely on the basis of data collected from various publications carries a risk of misinterpretation and requires caution [25]. However, the fact that we found no significant difference between any of the 3- and 12-month measurements in the current study suggests that the results of the 877PEY IOL are stable over time. The rates of spectacle independence reported at 3 months postoperatively are also reflective of strong distance and intermediate correction efficiency, along with functional near vision acuity.

For data acquired from refractive predictability, reliability is clear (> 90% of eyes were within ± 0.50 D SEQ by the 1-year follow-up), and it matches the performance of the competitor models [18–21, 26, 27]. In addition, there was no significant difference between any of the 3- and 12-month measurements, again indicating stable performance.

In terms of safety, out of the 12 reported events in total, no adverse events were concluded to be serious, and the majority were unrelated to the tested device. The frequency of complications suggests that the 877PEY IOL is safe to use. Overall, these results demonstrate long-term, high patient satisfaction.

We acknowledge the limitations of this study. While the outcomes demonstrated substantial restoration of vision across a wide focal range, further studies are needed to confirm these findings, particularly concerning visual function, contrast sensitivity, and visual disturbances in both preoperative and postoperative settings. Additionally, the reduced sample size of 38 patients, compared to the intended 50, may have impacted the statistical power of our results, emphasizing the need for more extensive investigations.

Binocular distance-corrected defocus curves should be interpreted with caution. This is due to several factors: the sample size was half that of the monocular distance-corrected defocus curve; the refractive protocol for EDOF IOLs, which recommends not advancing to more negative lenses if fewer than 3 out of 5 letters are identified [33]; and the use of the Multifocal Lens Analyzer system, which automatically determines visual acuity thresholds using a rapid psychophysical method rather than user input. These elements may explain the subtle 0.02 logMAR difference observed between the 0 and -0.5 D defocus levels, which corresponds to a variation of a single letter in a five-letter row.

Importantly, the distance corrected visual acuity measurements were conducted at 4 m without adjustment to optical infinity. While this methodological choice is not uncommon in published literature, we acknowledge that it may have contributed to the slight myopic trend observed and should be considered when interpreting the refractive and defocus results.

Finally, although posterior capsule opacification (PCO) was monitored, the 12-month follow-up period may be inadequate to fully assess the long-term incidence of PCO, which often manifests beyond this timeframe.

Collecting additional data would enhance the understanding of this intraocular lens, facilitating better alignment of patient needs with the most suitable IOL options [1].

Conclusions

The performance of the new 877PEY IOL has been evaluated across multiple parameters, demonstrating comparable or even superior outcomes in several aspects relative to existing EDOF lenses. These findings support its classification as a Partial Range of Field Extended (PRoF-Ex) category IOL and suggest its potential relevance in the premium market. However, further studies are required to validate its efficacy and long-term clinical benefits.

Abbreviations

ACD	Anterior chamber depth
AXL	Axial length
CDVA	Corrected distance visual acuity
Cpd	Cycles per degree
CTR	Capsular tension ring
CYL	Cylindrical refraction
EDOF	Extended depth of focus
EDTRS	Early Treatment Diabetic Retinopathy Study
FRoF	Full Range of Field
IOL	Intraocular lens
IOP	Intraocular pressure
logMAR	Logarithm of the Minimum Angle of Resolution
M3/M12	Month 3/Month 12
MLA	Multifocal Lens Analyzer
PCO	Posterior capsule opacification
PRoF-N	Partial Range of Field Narrowed
PRoF-Ex	Partial Range of Field Extended
RoF	Range of Field
SD	Standard deviation
SEQ	Spherical equivalent refraction
SPH	Spherical refraction
UDVA	Uncorrected distance visual acuity
UIVA	Uncorrected intermediate visual acuity
UNVA	Uncorrected near visual acuity
VA	Visual acuity
VFQ-25	Visual Function Questionnaire 25

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Author contributions

J.F.G. wrote the main manuscript text, N.P. prepared all figures and tables, and G.N. reviewed the manuscript. After the main review by G.N., all authors reviewed the manuscript again.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
The study was conducted according to the tenets of the Declaration of Helsinki and was approved by the Health Science and Research Ethical Board Committee of Hungary (OGYÉI, Hungarian Health Authority; ref: OGYEI/34155-6/2020; July 2020). Informed consent was obtained from each patient, and they were free to withdraw from the clinical investigation at any time without giving a reason.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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