

Comparison of visual performance between two extended depth-of-focus intraocular lenses: the novel aspheric hybrid diffractive bifocal-based design versus wavefront-shaping

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Abstract

Purpose

To compare the 6-month visual outcomes of two extended depth-of-focus (EDOF) intraocular lenses (IOLs) with distinctly different optical designs: the hybrid aspheric diffractive bifocal-based AMEUH and the wavefront-shaping DFT015.

Methods

In this prospective non-randomized study, 73 cataract patients (AMEUH n = 37; DFT015 n = 36) were implanted targeting emmetropia. Postoperative assessments included best-corrected distance visual acuity (BCDVA), distance-corrected intermediate (DCIVA) and near (DCNVA) visual acuity, contrast sensitivity, defocus curves with area-under-curve (AUC) analysis, and patient-reported satisfaction and photic phenomena.

Results

AMEUH showed significantly better DCNVA ($P = 0.02$) and near AUC ($P = 0.005$), while DFT015 had better DCIVA ($P = 0.03$). Near satisfaction was higher in AMEUH ($P = 0.002$), but total AUC also favored AMEUH ($P = 0.047$). BCDVA, intermediate AUC, contrast sensitivity, and photic phenomena incidence were comparable between groups (all $P > 0.05$).

Conclusions

Both IOLs provide good distance-to-intermediate vision. AMEUH offers superior functional near vision, suggesting a preference for patients with high near demands, whereas DFT015 may be better for those prioritizing intermediate acuity. Individualized selection should balance near benefit against potential optical trade-offs.

Trial registration

Chinese Clinical Trial Registry (ChiCTR), ChiCTR2600132634, registered in September 2026. Retrospectively registered.

Introduction

With the improvement of people's living standards, cataract surgery has evolved from a purely vision-restoring procedure for blindness prevention to refractive cataract surgery that aims for clearer, more

comfortable, and more durable vision. This transformation relies heavily on the iterative upgrading of cataract surgical equipment and the continuous innovation of intraocular lens (IOL) technology^[1].

To meet the demands of refractive cataract surgery, various novel functional IOLs have been developed, including accommodating IOLs^[2], multifocal IOLs (MIOLs), and EDOF IOLs^[3]. Accommodating IOLs have been gradually less used in clinical practice due to issues such as postoperative decline in accommodative ability and decreased optical shift over time^[4]. Traditional MIOLs divide incident light into two or three focal points to achieve distance and near vision; however, their multifocal design often results in light energy loss and nocturnal visual disturbances, and they fail to provide true continuous full-range vision^[5]. However, EDOF IOLs, employ different designs that extend a single focus into a continuous focal range, providing good intermediate and distance vision while reducing undesirable optical phenomena such as halos and glare^[6–8]. Since the introduction of the first EDOF IOL in 2014, they have become a research hotspot in the fields of cataract and presbyopia correction^[9].

Currently, the technological approaches to achieving depth of focus extension mainly include small-aperture optics^[10], diffractive optics^[11], spherical aberration^[12], wavefront reshaping^[13], and hybrid refractive–diffractive designs^[14]. This study focuses on two representative EDOF IOLs with distinctly different design principles: one is the AcrySof® IQ Vivity® IOL (DFT015, Alcon Laboratories, Inc., USA), based on wavefront-reshaping technology, for which postoperative clinical outcomes have been reported internationally^[15, 16]; the other is the Proming® IOL (AMEUH, Eyebright Medical Technology [Beijing] Co., Ltd., China), which combines aspheric EDOF technology with a diffractive design. Although its EDOF attributes have been verified on an in vitro optical assessment^[17], and a single-center real-world study has confirmed that AMEUH generally meets the ISO standard for EDOF IOLs^[18], comparative clinical studies against mainstream EDOF IOLs are still scarce. Therefore, this study aims to compare the visual performance, contrast sensitivity, defocus curves, and patient-reported satisfaction following implantation of AMEUH versus the wavefront-reshaping EDOF IOL Vivity® (DFT015) through a prospective controlled study, so as to provide evidence-based support for the precise selection of IOLs based on individual patient needs in clinical practice, and to offer real-world data to support the optimization and improvement of EDOF IOLs.

Materials and methods

Study design and ethics approval

This study was a single-center prospective cohort study. The study adhered to the principles of the Declaration of Helsinki and was approved by the Ethics Committee of Chongqing Aier Eye Hospital (Approval No.: 202412019). Written informed consent was obtained from all patients. This study was formally registered in the Chinese Clinical Trial Registry (No.: ChiCTR2600132634). The authors confirm that the study protocol was established prior to patient enrollment.

Study population

This study consecutively enrolled patients who underwent phacoemulsification combined with IOL implantation at Chongqing Aier Eye Hospital from December 2024 to August 2025. Patients diagnosed of age-related cataract were recruited. Exclusion criteria included predicted postoperative residual regular or irregular corneal astigmatism > 1.0 D; corneal endothelial cell count < 2000 cells/mm²; natural pupil diameter < 3.0 mm or > 5.5 mm under dark conditions; Angle Kappa ≥ 0.5 mm; any ocular surface disease, fundus lesions, or other organic ocular diseases that might potentially affect postoperative visual performance; inability to cooperate with the required examinations or to complete the 6-month postoperative follow-up.

Based on their own preferences, participants were categorized into two groups: those receiving DFT015 IOL implantation (DFT015 group); and those receiving a AMEUH IOL implantation (AMEUH group).

Surgical technique

All surgical procedures were performed by a single experienced surgeon and consisted of phacoemulsification with IOL implantation. A 2.4 mm main corneal incision was created at the superior limbus. Viscoelastic material (Eyevisc) was injected into the anterior chamber, followed by continuous curvilinear capsulorhexis measuring approximately 5.0-5.5 mm in diameter (slightly smaller than the IOL optic). Adequate hydrodissection was performed using balanced salt solution. Phacoemulsification and irrigation/aspiration of cortical material were carried out using the Centurion Vision System (Alcon Laboratories, Inc., USA). Subsequently, the IOL was inserted into the capsular bag. After complete removal of the ophthalmic viscoelastic device, the wound was hydrated to ensure wound sealing.

Intraocular lens

The Proming® EDOF IOL (Model: AMEUH) (Eyebright Medical Technology [Beijing] Co., Ltd., China) features a hybrid design combining aspheric and diffractive technologies. The anterior surface employs an aspheric EDOF design that increases the spherical aberration of the IOL to elongate the focal point, achieving an extended depth of focus of approximately 1.0 D. The posterior surface incorporates diffractive rings with a near addition of + 2.4 D to realize a bifocal design. The depth of focus derived from the anterior surface spherical aberration compensates for the trough in the defocus curve between the two bifocal foci, thereby enabling smooth and continuous intermediate and distance vision^[17].

The AcrySof® IQ Vivity® (Model: DFT015) (Alcon Laboratories, Inc., USA) is an EDOF IOL that utilizes the nondiffractive wavefront shaping (X-WAVE) technology. This technology incorporates two surface transition elements within the central 2.2 mm zone of the lens: the first element is a slightly elevated plateau (~ 1 μ m) that stretches the wavefront to generate a continuous extended depth of focus; the second element is a subtle curvature change (~ 2.2 mm) that shifts the wavefront to the anterior side of

the retina to utilize all available light^[19], with the goal of maximizing light utilization and reducing optical disturbances. Its clinical efficacy and safety have been well documented in multiple published studies^[20].

Preoperative evaluation

All patients underwent preoperative measurement of ocular biometric parameters using the IOL-Master 700 (Carl Zeiss, Germany). Pupil diameter under photopic conditions was measured using the Pentacam (OCULUS, Germany), and under mesopic conditions using the iTrace (Tracey Technologies Corp., USA). The IOL power was calculated using the Barrett Universal II formula. For the AMEUIH IOL, the lens with the smallest absolute residual refractive power closest to 0.00 D) was selected; for the DFT015 IOL, the lens with the negative residual refractive power closest to 0.00 D was selected.

Postoperative outcome measures

6 months after cataract surgery, the visual acuity, manifest refraction, contrast sensitivity, and patient satisfaction were examined. Best-corrected distance visual acuity (BCDVA) at 5 m, distance-corrected intermediate visual acuity (DCIVA) at 66 cm, and distance-corrected near visual acuity (DCNVA) at 40 cm were assessed using a standard logarithmic visual acuity chart.

The defocus curves were plotted by measuring the binocular visual acuity under photopic conditions at 5 m, adding lenses in 0.5 D increments from + 0.5 D to -3.0 D. The area under the defocus curve (AUC) was subsequently calculated. It allows the defocus curve to transition from a qualitative to a quantitative comparative analysis, providing a comprehensive evaluation of visual function across a range of defocus rather than at a single discrete point^[21]. The AUC was computed using the trapezoidal rule: a line segment was drawn between each pair of adjacent points on the curve, and perpendicular lines were dropped from each point to the horizontal axis, thereby forming a trapezoid. The area of this trapezoid corresponds to the area under the curve between the two adjacent points. The total area under the defocus curve was obtained by summing the areas of all trapezoids formed by consecutive adjacent points (Fig. 1). The calculation formula is $AUC = \sum_{i=1}^{n-1} \frac{y_i + y_{i+1}}{2} \times \Delta x$, where y=0.3- visual acuity (logMAR), $\Delta x=0.5$ visual acuity ($\leq 0.3 \log \text{MAR}$).

Only the area above the 0.3 logMAR line was included in the calculation. The total area under the curve (TAUC, + 0.5 to -3.0 D), far area under the curve (FAUC, + 0.5 to -0.5 D), intermediate area under the curve (IAUC, -0.5 to -2.0 D), and near area under the curve (NAUC, -2.0 to -3.0 D) were calculated and compared between the two groups.

Contrast sensitivity was measured using the CSV-1000 chart (Vector Vision, Greenville, OH, USA) at spatial frequencies of 3, 6, 12, and 18 cycles per degree (c/d) under photopic conditions with glare, and at 1.5, 3, 6, and 12 c/d under mesopic conditions with and without glare.

The postoperative patient-reported outcomes were evaluated using a questionnaire addressing adverse visual phenomena (halo, glare, ghosting, etc.), patient satisfaction and spectacle independence in daily activities (distance, intermediate, and near vision).

Statistical analysis

All statistical analyses were conducted using SPSS software (version 22.0). The normality of continuous variables was assessed using the Shapiro-Wilk test. Variables following a normal distribution were expressed as mean $\pm$ standard deviation (SD) and were compared between groups using the independent samples t-test. Variables with a non-normal distribution were expressed as median (interquartile range, IQR) and were analyzed using the Mann-Whitney U test. Categorical variables were presented as frequencies (percentages) and were compared using the chi-square test or Fisher's exact test, as appropriate. A two-sided P-value of < 0.05 was considered to indicate statistical significance.

Results

Baseline characters

A total of 73 patients were initially enrolled in this study (36 in the DFT015 group and 37 in the AMEUH group), including 33 right eyes and 40 left eyes. And there were 28 males and 45 females. The DFT015 group comprised 36 patients (36 eyes), and the AMEUH group comprised 37 patients (37 eyes). At the 6-month postoperative follow-up, 8 patients in the AMEUH group were lost to follow-up due to personal reasons. Consequently, 65 patients (36 in the DFT015 group and 29 in the AMEUH group) were included in the final satisfaction analysis. No statistically significant differences were observed between the two groups in terms of age or sex (all $P > 0.05$). Ocular biometric parameters, including axial length (AL), flat keratometry (K1), steep keratometry (K2), anterior chamber depth (ACD), and photopic and mesopic pupil diameters, were well balanced and comparable between the two groups, with no statistically significant differences (all $P > 0.05$) (Table 1).

Table 1
Baseline demographics and ocular biometry characters in DFT015 Group and AMEUH Group.

Parameters	DFT015 (n = 36)	AMEUH (n = 37)	P
Age, years	64 ± 5	66 ± 8	0.19
Sex, Female: male	13: 23	15: 22	0.70
AL, mm	23.42 ± 1.11	23.32 ± 0.80	0.67
K1, D	43.85 ± 1.72	43.41 ± 1.49	0.25
K2, D	44.54 ± 1.74	43.91 ± 1.36	0.10
ACD, mm	3.29 ± 0.57	3.12 ± 0.38	0.25
Photopic pupil diameter, mm	2.69 ± 0.65	2.82 ± 0.66	0.44
Mesotopic pupil diameter, mm	4.59 ± 0.80	4.86 ± 0.69	0.15

AL, Axial length; K1, flat keratometry; K2, steep keratometry; ACD, anterior chamber depth.

Visual acuity and Refraction

At 6 months postoperatively, there was no statistically significant difference in BCDVA between the DFT015 group (0.03 ± 0.04 logMAR) and the AMEUH group (0.03 ± 0.06 logMAR) ($P > 0.05$). DCIVA in the DFT015 group was better than in the AMEUH group, with a statistically significant difference (0.06 ± 0.08 logMAR vs. 0.12 ± 0.11 logMAR, $P < 0.05$). However, DCNVA in the DFT015 group was worse than in the AMEUH group, also with a statistically significant difference (0.27 ± 0.12 logMAR vs. 0.20 ± 0.11 logMAR, $P < 0.05$). The manifest SE in the DFT015 group was more myopic (-0.32 ± 0.44 D), whereas that in the AMEUH group was closer to emmetropia (0 ± 0.41 D), and the difference was statistically significant ($P < 0.05$) (Table 2).

Table 2
Comparison of visual acuity and refraction between the DFT015 Group and AMEUH Group.

Parameters	DFT015 (n = 36)	AMEUH (n = 37)	P
BCDVA, logMAR	0.03 ± 0.04	0.03 ± 0.06	0.94
DCIVA, logMAR	0.06 ± 0.08	0.12 ± 0.11	0.03
DCNVA, logMAR	0.27 ± 0.12	0.20 ± 0.11	0.02
manifest SE, D	-0.32 ± 0.44	0.00 ± 0.41	0.03

SE, spherical equivalent.

Defocus curve and area under the defocus curve

The defocus curves at 6 months postoperatively are shown in Fig. 2. Both curves showed the peak corresponding to best visual acuity at 0.0 D. Within the defocus range of 0 D to -1.5 D (66cm), visual acuity declined gradually in both groups. There were no statistically significant differences in visual acuity at defocus levels of + 0.5 D, 0 D, -0.5 D, and - 1.0 D. At -1.5 D, -2.0 D, -2.5 D, and - 3.0 D, the AMEUH group showed significantly better visual acuity than the DFT015 group in near vision (all $P < 0.05$). Overall, the DFT015 group displayed a distinctly unimodal pattern, with visual acuity better than 0.3 logMAR within the range of + 0.5 D to -1.75 D. In contrast, the AMEUH group formed a visual acuity plateau within the range of -1.0 D to -2.0 D (50cm to 1m), and the range in which visual acuity was better than 0.3 logMAR extended to -2.5 D.

The AUC results for the DFT015 and AMEUH groups are shown in Table 3 and Fig. 3. The FAUC and IAUC were comparable between the DFT015 and AMEUH groups, with no statistically significant differences (all $P > 0.05$). However, the NAUC in the DFT015 group was significantly smaller than that in the AMEUH group (0.03 ± 0.06 vs. 0.08 ± 0.07 , $P < 0.05$). Similarly, the TAUC in the DFT015 group was significantly smaller than that in the AMEUH group (0.47 ± 0.16 vs. 0.55 ± 0.18 , $P < 0.05$).

Table 3
The comparison of TAUC, FAUC, IAUC and NAUC between the DFT015 Group and AMEUH Group at 6 months postoperatively.

Parameter	DFT015(n = 36)	AMEUH (n = 37)	P
TAUC, + 0.5D~-3.0D	0.47 ± 0.16	0.55 ± 0.18	0.047
FAUC, + 0.5D~-0.5D	0.22 ± 0.06	0.23 ± 0.05	0.540
IAUC, -0.5D~-2.0D	0.21 ± 0.09	0.24 ± 0.08	0.194
NAUC, -2.0D~-3.0D	0.03 ± 0.06	0.08 ± 0.07	0.005

TAUC, total area under the curve (+ 0.5 to -3.0 D); FAUC, far area under the curve (+ 0.5 to -0.5 D); IAUC, intermediate area under the curve (-0.5 to -2.0 D); NAUC, near area under the curve (-2.0 to -3.0 D).

Contrast Sensitivity

At 6 months postoperatively, no statistically significant differences in contrast sensitivity were observed between the DFT015 group and the AMEUH group across all spatial frequencies under photopic glare, mesopic, and mesopic glare conditions ($P > 0.05$) (Fig. 4A, 4B and 4C). For both the AMEUH and DFT015 groups, intragroup comparisons revealed no statistically significant differences ($P > 0.05$) in contrast sensitivity between the mesopic and mesopic-with-glare conditions. (Fig. 4D and 4E).

Visual Symptom Questionnaire and Patient Satisfaction Questionnaire

The results of adverse visual phenomena at 6 months postoperatively (Fig. 5) showed that there were no statistically significant differences in the frequency of adverse visual phenomena between the DFT015

and AMEUH groups ($P > 0.05$). Neither group reported higher-grade (moderate or severe) adverse visual phenomena. Only one patient (3.45%) in the AMEUH group reported glare and ghosting of “mild” severity, while all others were rated as “not at all” or “slight”.

Both DFT015 and AMEUH group reported 100% satisfaction with distance and intermediate visual acuity. In terms of near visual acuity satisfaction, the AMEUH group demonstrated significantly higher satisfaction than the DFT015 group (89.7% vs 41.7%, $P < 0.001$). Likewise, patients in the AMEUH group exhibited significantly less dependence on spectacles for reading (near vision) compared to those in the DFT015 group (89.7% vs 41.7%, $P < 0.001$) (Table 4).

Table 4
The results of questionnaire regarding satisfaction and spectacle dependence.

Parameter	DFT015(n = 36)	AMEUH (n = 29)	P
Satisfaction			
Distance	36 (100%)	29 (100%)	1.000
Intermediate	36 (100%)	29 (100%)	1.000
Near	15 (41.7%)	26 (89.7%)	< 0.001
Spectacle independence			
Watching TV (Far)	36 (100%)	29 (100%)	1.000
Using Computer (Intermediate)	36 (100%)	29 (100%)	1.000
Reading book (Near)	15 (41.7%)	26 (89.7%)	< 0.001

Discussion

This study compared the six-month postoperative clinical outcomes of two EDOF IOLs with fundamentally different optical designs—the diffractive bifocal hybrid aspheric EDOF IOL AMEUH and the wavefront-reshaping EDOF IOL DFT015. Both IOLs provided excellent distance and intermediate visual performance, with AMEUH exhibiting a significant superiority in near visual acuity.

Defocus curves provide a valuable assessment of IOL performance across different distances by using stepwise defocus levels to represent various viewing ranges^[22]. The defocus curve of the DFT015 group presented a smooth unimodal profile, which is consistent with previous findings on the Vivity® DFT015 [15, 16, 19, 23] and aligns with its design principle of extending depth of focus by increasing aberrations through wavefront reshaping. The defocus curve of DFT015 typically resembles that of monofocal IOLs with a unimodal shape, but with a broader visual peak, as seen in models such as the Tecnis Eyhance ICB00^[24] and PhysiOL Isopure^[25].

However, the defocus curve of the AMEUH group did not exhibit the characteristic “bimodal-with-trough” pattern observed with conventional bifocal IOLs^[26–28]; rather, it displayed a visual acuity plateau at approximately 0.2 logMAR between – 0.5 D and – 1.5 D, without a discernible decline. This observation strongly supported its optical design: the + 2.4 D near addition on the posterior surface provides the near-vision, while the aspheric anterior surface introduces negative spherical aberration to offer approximately 1.0 D of depth of focus, effectively filling the potential trough created by the diffractive component and thus enabling a smoother, more continuous visual transition from distance to intermediate. Moreover, the defocus curve revealed that visual acuity in the AMEUH group did not drop to 0.3 logMAR until – 2.5 D, compared with – 1.75 D in the DFT015 group, indicating that the bifocal-hybrid EDOF design of AMEUH affords a broader continuous focal range.

In this study, the significantly superior DCNVA and NAUC in the AMEUH group confirmed that AMEUH offers clinically meaningful functional near vision, a finding further supported by the higher postoperative patient satisfaction with near vision in the AMEUH group. Moreover, the better TAUC in the AMEUH group suggested a broader depth of focus provided by this IOL. Interestingly, although the DFT015 group exhibited better DCIVA, the two groups showed no statistically significant difference in IAUC. This may imply that the DFT015 group outperformed the AMEUH group at the 66 cm; however, across the entire intermediate visual range, the two groups were comparable, which aligns with the 100% intermediate vision satisfaction rate observed in both groups.

It is noteworthy that the postoperative SE in the DFT015 group was significantly biased toward myopia. This may be attributed to the surgeons’ selection of a target refraction closest to 0 D on the negative side during IOL power calculation, in an effort to achieve better UNVA—a reflection of a specific clinical strategy. In contrast, for the AMEUH group, which inherently incorporates a near-vision design, surgeons tended to target emmetropia (0 D) as the goal, without intentionally favoring either positive or negative deviations.

Contrast sensitivity is a key outcome measure following IOL implantation, reflecting the visual system’s ability to distinguish differences in luminance of static images^[29]. At the same spatial frequencies, the mean contrast sensitivity curve of the AMEUH group was slightly higher than that of the DFT015 group, however, the difference was not statistically significant ($P > 0.05$), indicating that the two EDOF IOL designs provided comparable postoperative visual quality. The contrast sensitivity of the DFT015 group was consistent with previously reported findings for this IOL^[16]. In addition, the contrast sensitivity curves of the DFT015 IOL under mesopic and mesopic with glare conditions were nearly overlapping, demonstrating the excellent resistance to optical interference conferred by its wavefront-reshaping design. Similarly, no such difference was observed for the AMEUH IOL between the same two lighting conditions.

Previous evidence indicates that MIOLs are commonly associated with a decline in contrast sensitivity^[30]. Nevertheless, in this study, at the same spatial frequencies, no statistically significant difference was observed between the AMEUH and DFT015 groups in terms of mean contrast sensitivity

curves ($P > 0.05$), suggesting that the two EDOF IOL designs yield comparable postoperative visual outcomes. This finding implies that the high-order aspheric EDOF design of the AMEUH IOL, to some extent, alleviates the drawbacks inherent in diffractive light-splitting optics. The contrast sensitivity performance of the DFT015 group was in accordance with earlier reports on this IOL^[16]. Moreover, the nearly overlapping contrast sensitivity curves of the DFT015 IOL under mesopic and mesopic-with-glare conditions underscored the robust stray-light tolerance afforded by its wavefront-reshaping design.

With respect to adverse optical phenomena, neither double vision nor visual distortion was reported in either group. The intergroup differences in the incidence of glare, halos, and blurred vision did not reach statistical significance ($P > 0.05$). Of note, only one patient (3%) in the AMEUH group experienced ghosting, color and depth perception disturbances, and night blindness. These observations imply that although the diffractive design may inherently introduce residual stray light or chromatic dispersion, the aspheric hybrid diffractive EDOF IOL has mitigated the frequency of optical disturbances typically associated with conventional diffractive MIOLs, which have been reported to cause adverse visual phenomena in 40 ~ 50% of patients^[31]. Our results are in line with the current understanding of diffractive EDOF IOLs^[32].

Given that the use of binocular visual acuity data may introduce confounding variables due to individual differences in binocular fusion, thereby obscuring the accurate assessment of visual quality and the continuous visual range, we elected to evaluate postoperative monocular visual acuity in this study. This approach minimizes individual variability associated with binocular fusion and thus provides a more precise assessment of IOL optical performance^[21].

This study has several limitations. First, the sample size was relatively small (73 eyes) and the follow-up period was only 6 months, which limits our ability to assess long-term safety, stability, and potential late-onset optical phenomena. Second, as this was a non-randomized, non-blinded clinical study, selection bias and observer bias are unavoidable. The choice of IOL was based on patient preference and surgeon recommendation, which may have been influenced by preoperative expectations and prior knowledge of each IOL's characteristics. Third, we only measured corrected distance visual acuity (BCDVA, DCIVA, DCNVA) and did not include uncorrected visual acuities; therefore, direct conclusions regarding functional vision in daily life without spectacles cannot be drawn from our data. Fourth, our defocus curve and AUC calculations were based on monocular measurements; although this eliminates confounding from binocular fusion, it may not fully reflect real-world binocular visual performance. Fifth, the questionnaire used for patient-reported outcomes was not a validated standardized instrument, which may introduce recall bias. Finally, the study was conducted at a single center and in a specific Chinese population; the generalizability of our findings to other ethnic groups or clinical settings needs further investigation.

In conclusion, both the Proming® AMEUH and Vivity® DFT015 provided satisfactory distance and intermediate visual performance in this cohort, with comparable contrast sensitivity and optical quality. The AMEUH IOL demonstrated superior functional near vision, which may benefit patients with high

near-vision requirements, whereas the DFT015 offered better intermediate visual acuity at 66 cm. However, the choice between these two IOLs should consider the trade-offs, as the AMEUEH's diffractive component may pose a slight risk of optical disturbances in susceptible patients. Moreover, our findings are preliminary and limited by the non-randomized design, small sample size, and short follow-up. Larger, randomized, and longer-term studies are warranted to confirm these results and to evaluate the stability of visual outcomes over time. In clinical practice, a thorough understanding of each patient's lifestyle habits, visual expectations, and tolerance for optical phenomena remains essential for achieving truly individualized IOL selection.

Abbreviations

EDOF: extended depth-of-focus

IOL: intraocular lenses

BCDVA: best-corrected distance visual acuity

DCIVA: distance-corrected intermediate visual acuity

DCNVA: distance-corrected near visual acuity

AUC; area under the defocus curve

MIOL: multifocal IOL

logMAR: Logarithm of the minimum angle of resolution

AL: Axial length

ACD: anterior chamber depth

SE: spherical equivalent

D: Diopter

TAUC: total area under the curve

FAUC: far area under the curve

IAUC: intermediate area under the curve

NAUC: near area under the curve

Declarations

Ethics approval and consent to participate: The study was approved by the Ethics Committee of Chongqing Aier Eye Hospital (Approval No.: 202412019).

Consent for publication: Not applicable.

Availability of data and materials: The datasets used during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare no potential conflicts of interest.

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Authors' contributions:

J. T: conceptualization, supervision, project administration, writing—review and editing, surgical procedures.

Q. G: methodology, investigation, writing—original draft, writing—review and editing.

J. W: formal analysis, software, investigation, writing—review and editing.

C. P: data curation, investigation, writing—review and editing.

Y. W: data curation, investigation, writing—review and editing.

M. C: data curation, investigation, writing—review and editing.

B. L: data curation, investigation, writing—review and editing.

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Figures

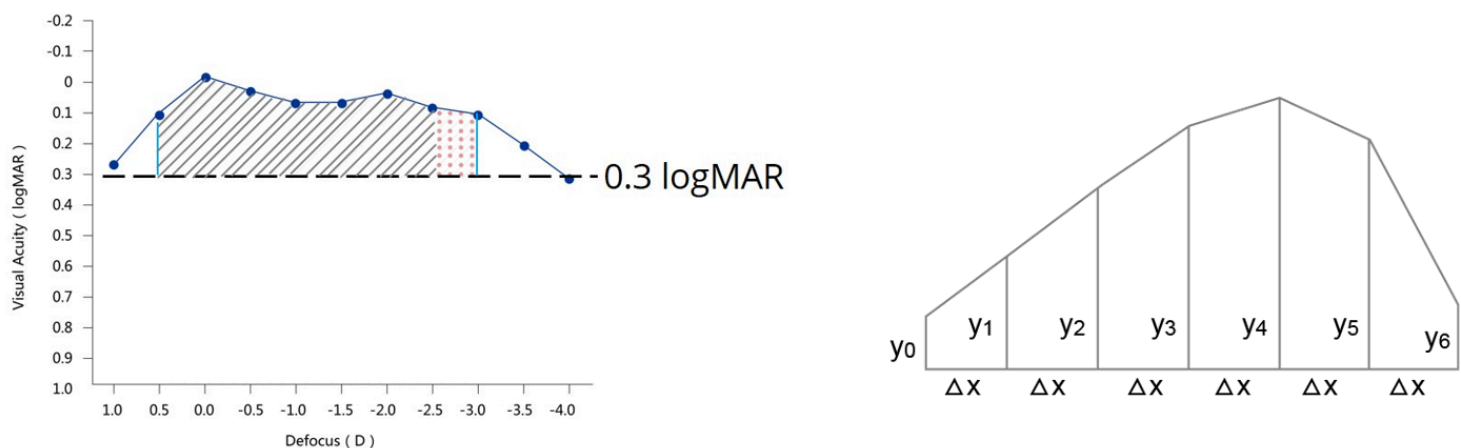


Figure 1

Schematic representation of the area under the curve (AUC) calculation.

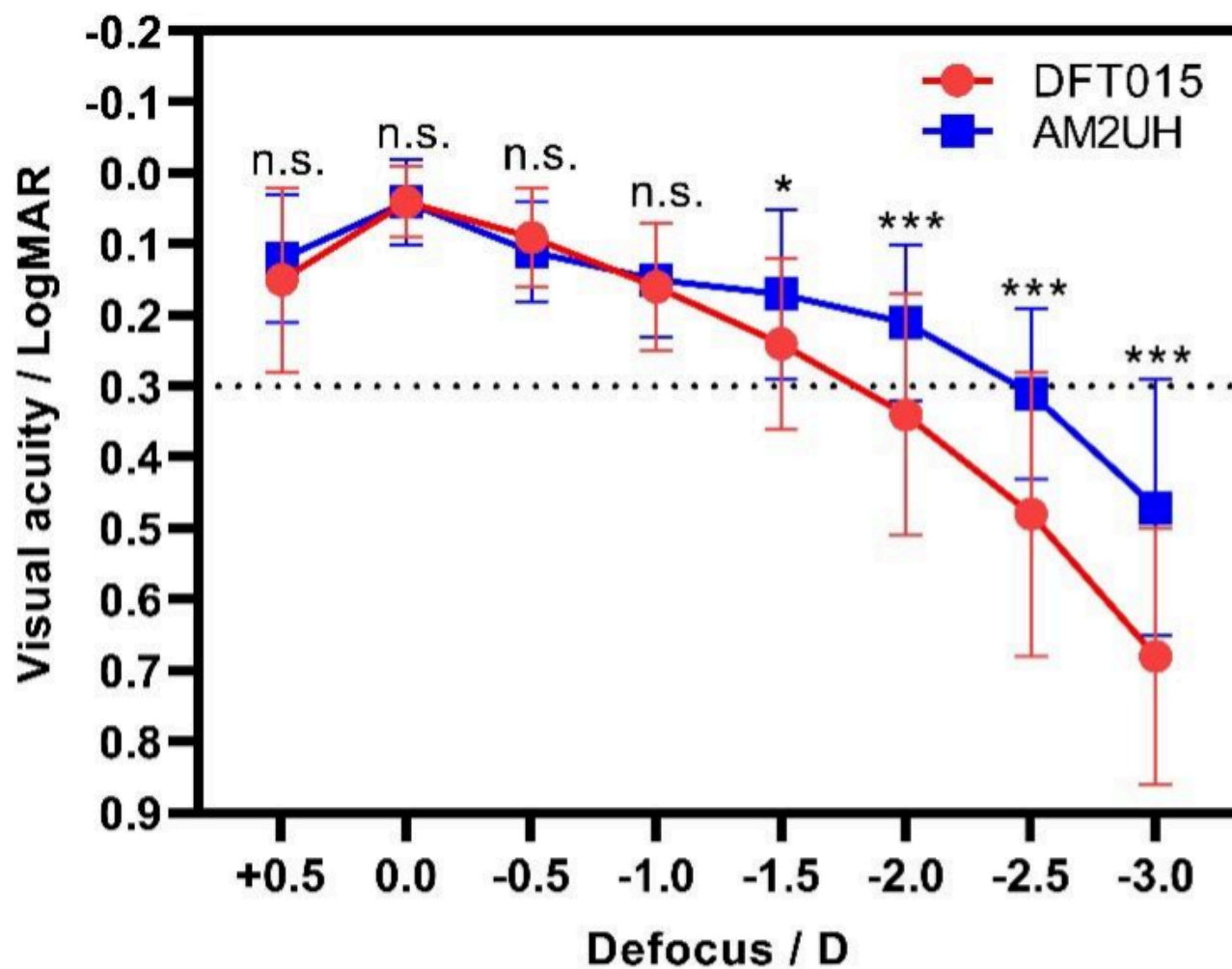


Figure 2

Defocus curves for the DFT015 Group and AMEUEH Group at 6 months postoperatively. N.s., $P > 0.05$; *, < 0.05 ; ***, $P < 0.001$.

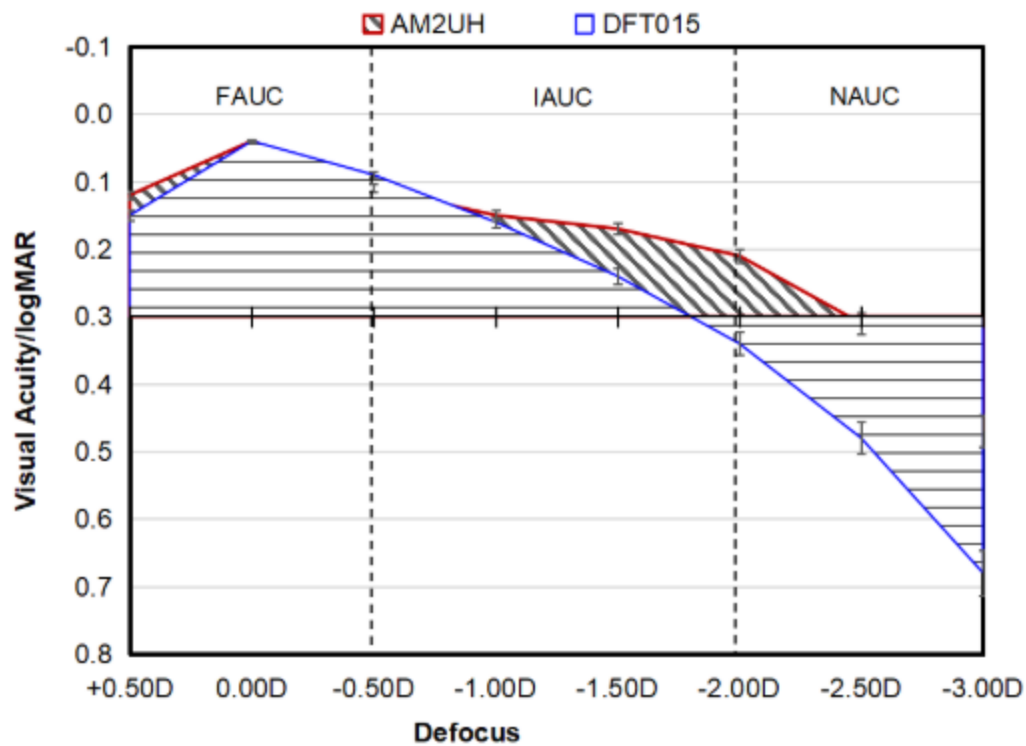


Figure 3

AUC (area under the defocus curve) for the DFT015 Group and AMEUEH Group at 6 months postoperatively.

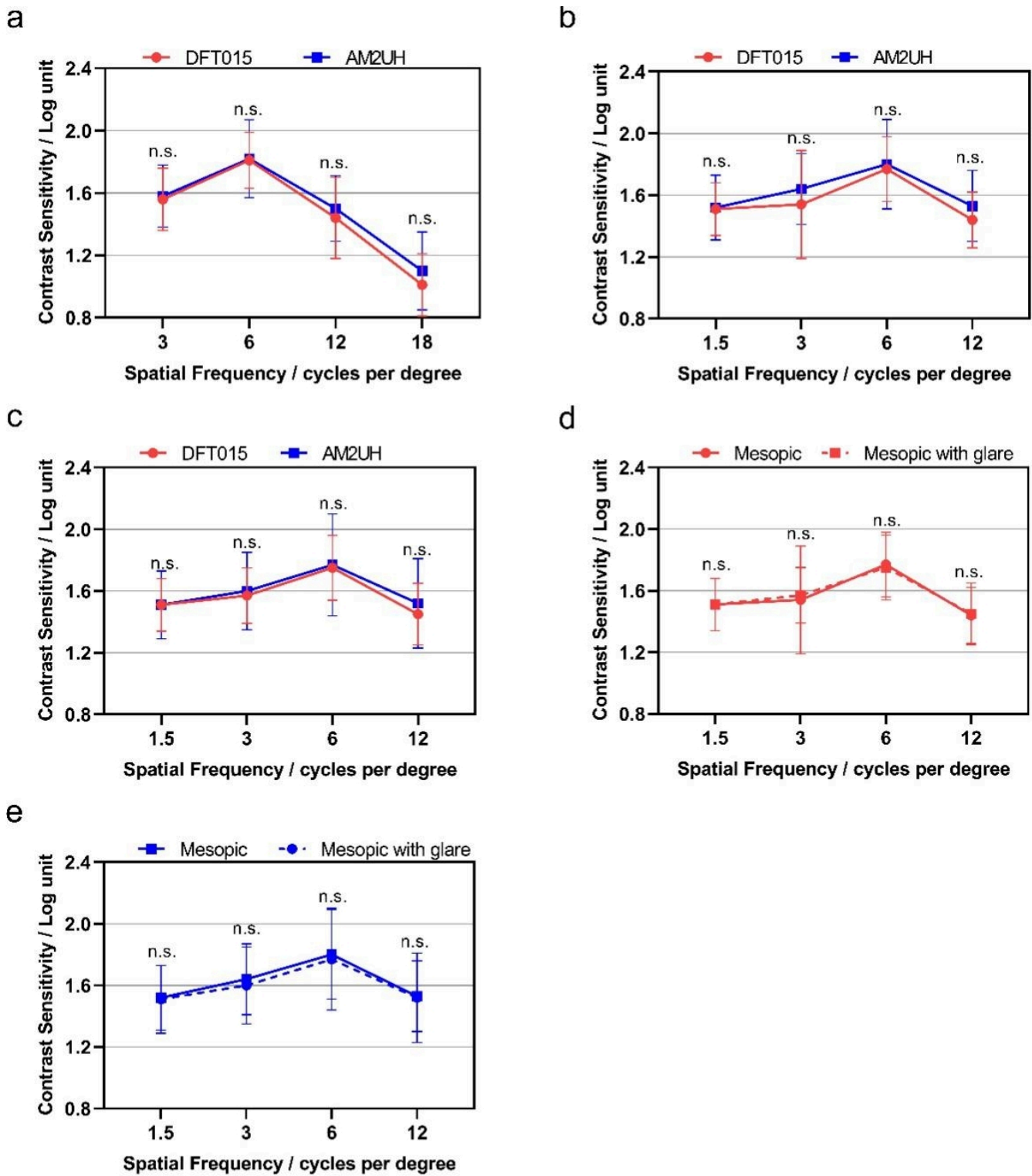


Figure 4

Contrast sensitivity at 6 months postoperatively. N.s., $P > 0.05$.

(A)-(C). Intergroup comparisons between the DFT015 group and the AMEUEH group under photopic with glare (A), mesopic (B) and mesopic with glare (C) conditions;

(D), (E) Intragroup comparison between mesopic and mesopic with glare conditions for the Vivivity Group (D) and the AMEUH Group (E).

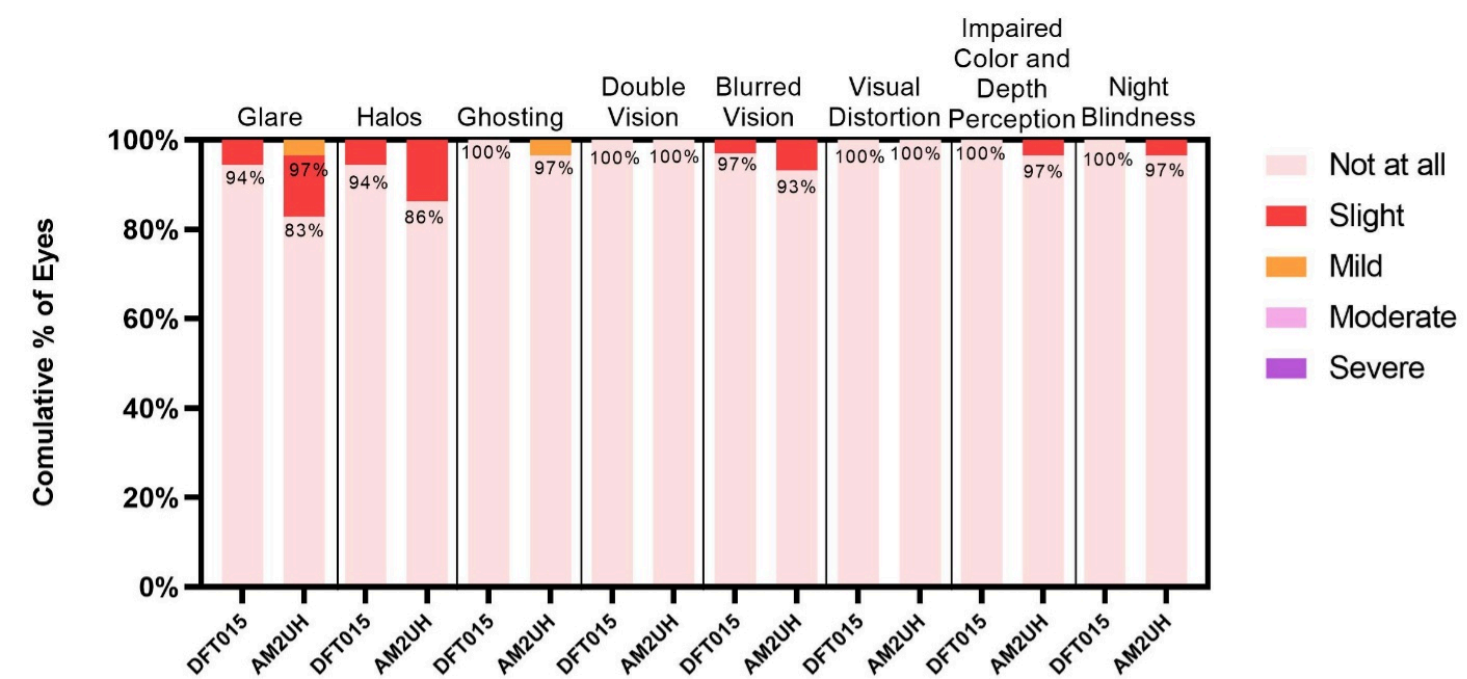


Figure 5

Adverse visual phenomena in the DFT015 and AMEUH groups at 6 months postoperatively.