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Clinical outcome of a quadrifocal (trifocal) intraocular lens in Chinese patients: prospective, observational case series

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Purpose: To report the visual outcomes and quality of vision and life after bilateral implantation of a single-piece trifocal intraocular lens (IOL) in Chinese patients.

Setting: Hong Kong Sanatorium & Hospital, Hong Kong, China.

Design: Prospective, observational case series.

Methods: Patients with bilateral implantation of AcrySof IQ PanOptix multifocal IOL were included. Distance, intermediate (60 cm), and near (40 cm) visual acuities (VAs) and contrast sensitivity (CS), defocus curve, preoperative higher-order aberration (HOA), dysphotopsia (0 to 5), satisfaction (1 to 5), spectacle independence, and quality of life were evaluated. The association between preoperative HOA and postoperative halos was also assessed.

Results: 54 eyes of 27 patients were included. The mean binocular distance, intermediate, and near uncorrected VA was −0.05 ± 0.06 (20/18), 0.06 ± 0.10 (20/23), and 0.04 ± 0.05 (20/22), respectively. No eyes lost more than 1 line of vision. Binocular CS was comparable with the monocular population norm of older adults. The defocus curve demonstrated that the binocular VA of 20/25 or better was achieved at a power of −3.00 to +0.50 diopters. The mean scores for halos, glare, and starbursts were 2.4 ± 1.4, 0.2 ± 0.8, and 1.4 ± 1.4 (of 5), respectively. The mean satisfaction score was 4.3 ± 0.7 (of 5). All the patients (100%) reported total spectacle independence. The mean vision-targeted composite score of the vision-related quality-of-life questionnaire was 97.2 ± 9.7 (of 100). Preoperative HOA was not associated with postoperative halos.

Conclusions: Implantation of the trifocal IOL provided satisfactory visual outcomes and quality of vision and life, which resulted in a high rate of spectacle independence.

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With the rapid advancement in intraocular lens (IOL) technology, multifocal IOL (mIOL) is gaining popularity among patients with/without cataract, seeking spectacle independence. Conventional bifocal IOLs provide clear vision at 2 focal planes; however, when targeting bilateral emmetropia, the intermediate vision is compromised. Although a viable option, monovision with bifocal IOLs is a compromise.[1] Trifocal IOLs reportedly provide satisfactory distance, intermediate, and near vision, with a high rate of spectacle independence and patient satisfaction.[2–6]

AcrySof IQ PanOptix (Alcon Laboratories, Inc.) is a trifocal IOL designed to enhance intermediate vision by providing an optimal 60 cm intermediate working distance.[7] Previous studies on PanOptix were conducted largely in the Western population. However, clinical outcomes in the Asian population, which are different regarding reading habits, anthropometric measures such as arm length, and character strokes in writing, have not been comprehensively studied.[8,9] The impact of these differences on mIOL implantation remains unclear. Although a previous study reported the findings of distance and near vision in Chinese patients implanted with PanOptix, the intermediate vision, contrast sensitivity (CS), and subjective symptoms remain unexplored.[10]

We assessed the visual outcomes at various distances, quality of vision and life, and satisfaction in a group of Chinese patients after bilateral implantation of PanOptix. As an exploratory analysis, we also investigated the

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association of preoperative corneal higher-order aberration (HOA) with postoperative dysphotopsia, which has not been reported previously and may affect patient selection.

METHODS

Patients

This prospective, observational case series included patients who underwent cataract surgery or refractive lens exchange with bilateral implantation of PanOptix between November 2018 and October 2021 at the Hong Kong Sanatorium & Hospital. The study was approved by the hospital ethics committee and was adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from all the participants.

Inclusion criteria were as follows: age older than 40 years, strong visual demand for near tasks, target refraction of emmetropia in both eyes, and expected postoperative monocular corrected distance visual acuity (CDVA) of 20/25 or better. Exclusion criteria were as follows: interval of >6 months between the first-eye and second-eye surgeries, need for toric IOLs, use of systemic or ocular medications that may affect vision, preexisting ocular conditions or systemic diseases that could affect vision, history of ocular trauma or prior ocular surgery, and intraoperative complications.

Preoperative Examination

A comprehensive preoperative eye examination included detailed history taking, noncycloplegic subjective refraction, tonometry, manual keratometry, automated keratometry by IOLMaster (Carl Zeiss Meditec AG), corneal topography and corneal HOA using Pentacam-AXL (Oculus Optikgeräte GmbH), slitlamp biomicroscopy, and dilated fundus examination. Any macular abnormality was excluded using optical coherence tomography. Biometry was measured using an IOLMaster. IOL power calculation was based on the Barrett Universal II formula.

Intraocular Lens

PanOptix is a single-piece, foldable, nonapodized diffractive trifocal IOL with a central biconvex design. The central 4.5 mm diffractive zone provides +2.17 diopters (D) intermediate addition and +3.25 D near addition at the IOL plane (60 cm and 40 cm working distance, respectively). Its quadrifocal design, ENLIGHTEN technology, redistributes light energy from an extra fourth focal point at 120 cm working distance into the distant focus for amplified visual performance. It distributes 42%, 22%, and 24% of the light energy to the distant, intermediate, and near foci, respectively.[11]

Surgical Technique

A single surgeon (J.S.M.C.) performed all the surgeries under topical anesthesia (oxybuprocaine 0.4%) and intracameral preservative-free lidocaine 2%. Preoperatively, nepafenac ophthalmic suspension 0.1% (Nevanac, Alcon Laboratories, Inc.) and tropicamide 0.5%/phenylephrine hydrochloride 0.5% (Mydrin-P, Santen Pharmaceutical Co., Ltd.) were applied to the eye. A 2.25 mm clear corneal incision was created superiorly or temporally with a 2.2 mm microkeratome. DisCoVisc ophthalmic viscosurgical device (Alcon Laboratories, Inc.) was injected into the anterior chamber, and a manual continuous curvilinear capsulorhexis was created using forceps. After hydrodissection and nucleus splitting, coaxial phacoemulsification was performed using a Centurion Vision System (Alcon Laboratories, Inc.). The residual cortex was irrigated and aspirated. The posterior capsule was polished using a coaxial system. Clear corneal incision and continuous curvilinear capsulorhexis in some cases were created using femtosecond laser. All the IOLs were placed in the capsular bag.

Postoperative Examination

Day 1, 1-week, 1-month, and 3-month evaluations were performed after the second-eye surgery. Data obtained at the 1-week, 1-month and 3-month visits were reported. At the 1-week visit, monocular and binocular uncorrected distance VAs (UDVA) under photopic condition were assessed. At the 1-month and 3-month visits, the monocular and binocular UDVA, uncorrected intermediate VA, and uncorrected near VA under photopic conditions; noncycloplegic refraction; monocular and binocular CDVA, distance-corrected intermediate VA (DCIVA), and distance-corrected near VA (DCNVA) under photopic and mesopic conditions; and binocular photopic distance-corrected defocus curve were obtained.

Furthermore, at the 3-month visit, manual keratometry, binocular distance-corrected CS at 3 cycles per degree (cpd), 6 cpd, 12 cpd, and 18 cpd under photopic and mesopic conditions with and without glare; photopic and mesopic pupillary size; and quality of vision and life were recorded.

Photopic and mesopic measurements were taken at 85 and 3 candelas/m^2, respectively. Intermediate and near VAs were measured with SLOAN 2-Side ETDRS Format Near Vision Chart (Precision Vision) at 60 cm and 40 cm, respectively. Since the chart is designed for a 40 cm viewing distance, the actual intermediate VA was obtained by calculating the visual angle subtended and converting it to logMAR. The defocus curve was obtained by assessing the binocular distance VA with trial lenses of −4.00 to +0.50 D in 0.50 D steps. CS was assessed with CSV 1000HGT (Vectorvision, Inc.).[12] Intensity of the glare light used in the CS test was set at 2.5 cd/m^2, the default intensity of the device, at an eye level. The pupillary size was assessed with Colvard Pupillometer (Oasis Medical, Inc.) or NeurOptics VIP-300 pupillometer (Neuroptics, Inc.). Corneal HOA, including spherical aberration and higher-order root mean square (RMS) analyzed at 6 and 4 mm zones, respectively, was measured using Pentacam-AXL. Quality of vision and life was assessed using 3 tools. The National Eye Institute Visual Function Questionnaire-25 (VFQ-25) was administered to evaluate the vision-related quality of life.[13] A supplementary questionnaire was administered to evaluate patient satisfaction, dysphotopsia (halos, glare, and starburst), spectacle independence, any regret undergoing surgery, and whether the patient would recommend the surgery to others. The dysphotopsia level was rated on a scale of 0 to 5 (0, none; 1, very mild; 2, mild; 3, moderate; 4, severe; and 5, very severe), whereas the patient satisfaction level was rated on a scale of 1 to 5 (1, very dissatisfied; 2, dissatisfied; 3, neutral; 4, satisfied; and 5, very satisfied). "Halo & Glare Simulator" software (ViSU-L GmbH), which offers simulation of diffuse halo ring (type 1 halo), halo with starburst (type 2 halo), distinct halo ring (type 3 halo), diffuse glare (type 1 glare), and glare with starburst (type 2 glare) (Supplemental Figure 1, http://links.lww.com/JRS/A745), was used to further evaluate dysphotopsia.[14] The examiner gradually adjusted the level of the simulated halo or glare on a 0 to 100 scale (0, none; 100, greatest). The participants were asked to match the level of halo or glare perceived at night in their daily lives with that they were presented with. Two measurements were averaged to attain the final score.

Statistical Analysis

Data are presented as mean ± SD with range or percentage, where appropriate. The Shapiro-Wilk test was used to test data normality. The repeated measures analysis of variance was used to test the difference in the UDVA among all 3 postoperative visits. The paired *t* test (or Wilcoxon signed-rank test) was used to assess the difference in refraction and VA between the 1-month and 3-month visits, difference in the VA and CS between the photopic and mesopic conditions, and between the glare and no-glare conditions. The independent *t* test (or Mann-Whitney *U* test) was used to evaluate the difference in the preoperative corneal HOA of the eye that possessed greater HOA between the participants reporting halo scores <3 and ≥3. The association of glare with preoperative corneal HOA was not evaluated because only a few participants reported glare.

Table 1. Patient demographics, preoperative ocular parameters, and surgical parameters (54 eyes of 27 patients)[a]

Parameter	Mean ± SD (range)
Age at second-eye surgery (y)	57.9 ± 5.4 (50, 72)
Sex, n (%)	
M	2 (7.4)
F	25 (92.6)
IOL power (D)	20.10 ± 4.27 (9.0, 29.5)
Follow-up period (d)	102.5 ± 11.3 (86, 133)[a]
AL (mm)	23.86 ± 1.40 (21.4, 27.5)
ACD (mm)	3.05 ± 0.34 (2.42, 3.87)
Average K (D)	43.82 ± 1.47 (41.38, 47.00)
Corneal astigmatism (D)	0.41 ± 0.26 (0.00, 0.88)
Refraction (D)	
Sphere	−0.69 ± 3.26 (−8.50, 4.50)
Cylinder	0.60 ± 0.40 (0.00, 1.75)
SE	−0.38 ± 3.19 (−8.25, 4.75)
CDVA (logMAR)[b]	0.02 ± 0.07 (−0.12, 0.22)

ACD = anterior chamber depth; AL = axial length; K = keratometry; SE = spherical equivalent
[a]One participant attended the 3-month visit on postoperative 133 days due to COVID-19–related travel restrictions
[b]Data on preoperative CDVA were unavailable for 2 eyes (3.7%)

A *P* value of <0.05 was considered statistically significant. All the statistical analyses were performed using SPSS (v. 25, IBM Corp.).

RESULTS

Of the 30 participants initially recruited, 3 (10%) were excluded owing to postoperative external ocular abnormalities, which affected vision, and 27 participants (100%) completed the 1-month visit. However, 2 (7%) were unable to attend the 3-month visit owing to the coronavirus disease 2019 travel restrictions.

Table 1 summarizes the demographics, preoperative ocular parameters, and surgical parameters of 54 eyes of 27 participants, of whom 6 participants (22%) underwent refractive lens exchange.

Refraction and Visual Acuity

Table 2 illustrates the refraction at the 1-month and 3-month visits. There was a significant but clinically negligible hyperopic shift in sphere (0.09 D) and spherical equivalent (SE) (0.09 D) from the 1- to 3-month visit. Two eyes (4%) had hyperopic shift of 0.625 D, 1 eye (2%) had myopic shift of −0.625 D, and the remaining 47 eyes (94%) had refractive shift within ±0.50 D.

Figure 1 shows the surgical efficacy, refractive predictability, and refractive cylinder at the last visit. Supplemental Table 1 (http://links.lww.com/JRS/A748) and Supplemental Figure 2 (http://links.lww.com/JRS/A746) present the monocular and binocular uncorrected VAs and distance-corrected VAs at distance, intermediate, and near under photopic and mesopic conditions. At the 3-month visit, the binocular uncorrected photopic VA was −0.05 ± 0.06 (20/18), 0.06 ± 0.10 (20/23), and 0.04 ± 0.05 (20/22) at distance, intermediate, and near, respectively. Vision was generally stable from the 1-month to 3-month visit, except that the monocular mesopic DCNVA significantly improved at the 3-month visit compared with the 1-month visit. Monocular and binocular DCIVA and DCNVA were significantly better under photopic than mesopic conditions. Figure 2 illustrates the binocular photopic distance-corrected defocus curve.

Safety

Data on the preoperative CDVA were unavailable for 1 participant (4%) whose right-eye and left-eye postoperative CDVAs were 0.00 logMAR (20/20) and 0.02 logMAR (20/21), respectively. No eye (0%) lost 1 or more lines of CDVA postoperatively. Thirteen (27%) and 5 eyes (10%) gained 1 and 2 lines of CDVA postoperatively, respectively. No IOL exchange was required.

Contrast Sensitivity

CS was generally better under photopic than mesopic condition and without glare than with glare at spatial frequencies of 3 cpd, 6 cpd, and 12 cpd; however, a reverse trend was observed at 18 cpd (Figure 3).

Questionnaires

In the VFQ-25, 22 (88%) and 24 participants (96%) had a composite score for vision-targeted items of >90 and >95, respectively (Supplemental Table 2, http://links.lww.com/

Table 2. Postoperative refraction at the 1-month and 3-month visits

Parameter	1 mo (54 eyes)			3 mo (50 eyes)			*P* value[a]
	Mean ± SD (range) (D)	Within ±0.50 D of emmetropia, n (%)	Within ±1.00 D of emmetropia, n (%)	Mean ± SD (range) (D)	Within ±0.50 D of emmetropia, n (%)	Within ±1.00 D of emmetropia, n (%)	
Sphere	−0.11 ± 0.37 (−1.50, 0.75)	51 (94)	53 (98)	−0.02 ± 0.36 (−0.75, 1.00)	48 (96)	50 (100)	.03[b]
Cylinder	0.36 ± 0.31 (0.00, 1.25)	44 (81)	53 (98)	0.36 ± 0.31 (0.00, 1.00)	38 (76)	50 (100)	.98[b]
SE	0.07 ± 0.33 (−1.00, 1.13)	50 (93)	53 (98)	0.16 ± 0.33 (−0.38, 1.25)	44 (88)	49 (98)	.03[c]

SE = spherical equivalent
[a]Comparison between the 1-month and 3-month visits
[b]Wilcoxon signed-rank test
[c]Paired *t* test

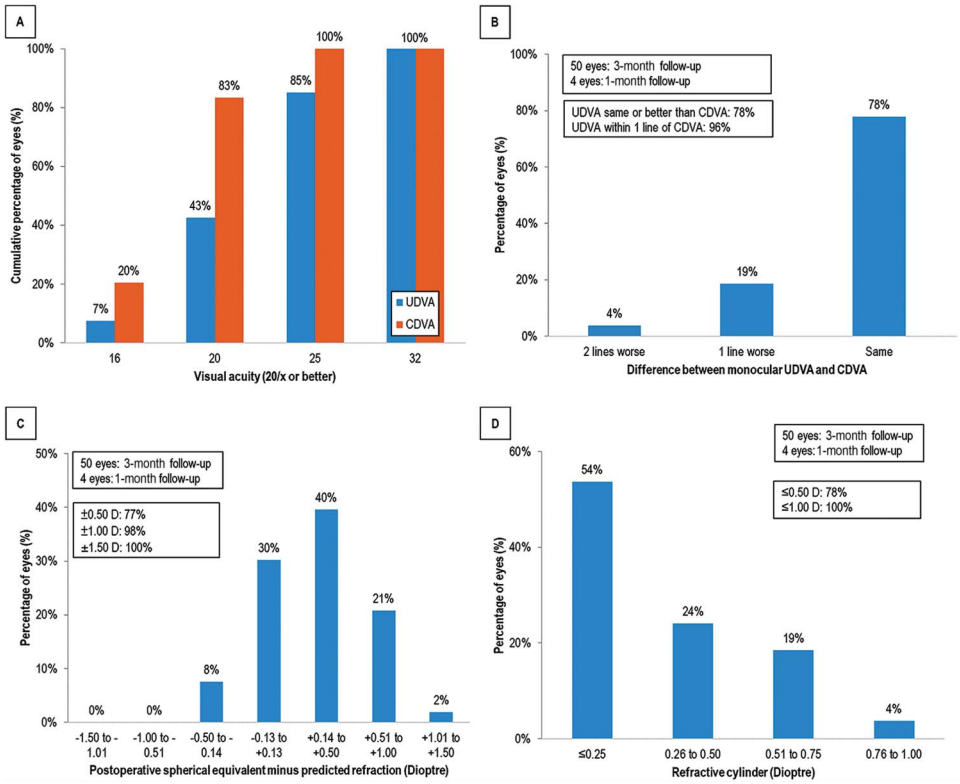

Figure 1. Efficacy of the surgery, refractive predictability, and refractive cylinder at the last visit (54 eyes). *A*: Cumulative distribution of monocular UDVA and CDVA. *B*: Comparison between monocular UDVA and CDVA. *C*: Distribution of refractive accuracy determined by the Barrett Universal II formula. *D*: Distribution of the refractive cylinder.

JRS/A749). In the supplementary questionnaire, 21 (84%), 2 (8%), and 15 participants (60%) reported halos, glare, and starbursts, respectively, among whom 6 (29%), 1 (50%), and 3 (20%) participants reported a score of >3, respectively (Supplemental Table 2, http://links.lww.com/JRS/A749). The mean score of halos, glare, and starbursts was 2.4 ± 1.4, 0.2 ± 0.8, and 1.4 ± 1.4 (of 5), respectively. The mean satisfaction score was 4.3 ± 0.7 (of 5), with 24 participants (96%) reporting a satisfaction score of ≥3.5. All the participants (100%) preferred to undergo the surgery again and would recommend the surgery to others. All the participants (100%) were spectacle independent.

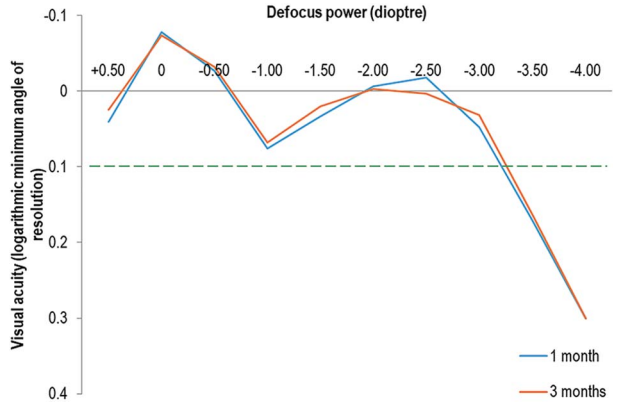

Figure 2. Mean binocular distance-corrected defocus curve under photopic condition at the 1-month (27 participants) and 3-month visits (25 participants). The *dashed line* indicates a visual acuity of 0.1 logMAR (20/25).

With simulation, 22 (88%) and 3 (12%) participants reported halo and glare, respectively. Among those reporting halos, 15 (68%), 4 (18%), and 3 (14%) perceived

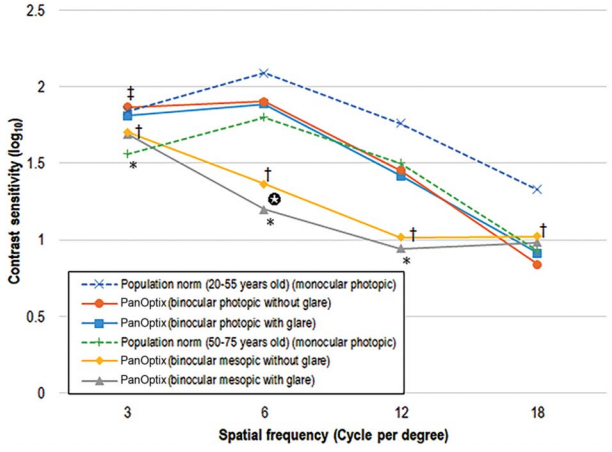

Figure 3. Mean binocular distance-corrected contrast sensitivity under photopic condition with glare (*solid line with squares*) and without glare (*solid line with circles*) and mesopic condition with glare (*solid line with triangles*) and without glare (*solid line with diamonds*) at the 3-month visit (25 participants); mean monocular population norm of individuals 20 to 55 years of age under photopic condition (*dashed line with crosses*); and mean monocular population norm of individuals 50 to 75 years of age under photopic condition (*dashed line with pluses*) at different spatial frequencies.[12,26] Stars (*) denote significant difference between photopic glare and mesopic glare conditions. Daggers (†) denote significant difference between photopic no-glare and mesopic no-glare conditions. Double daggers (‡) denote significant difference between photopic glare and photopic no-glare conditions. Circled stars (✪) denote significant difference between mesopic glare and mesopic no-glare conditions.

Table 3. Preoperative corneal HOA in patients reporting none-to-mild halo (halo score <3) and patients reporting moderate-to-severe halo (halo score ≥3)

Parameter	All patients (24 patients) Mean ± SD (range)	Reporting none-to-mild halo (11 patients) Mean ± SD (range)	Reporting moderate-to-severe halo (13 patients) Mean ± SD (range)	*P* value*
Spherical aberration at 6 mm zone (μm)	0.29 ± 0.04 (−0.30, 0.55)	0.32 ± 0.03 (0.24, 0.51)	0.26 ± 0.06 (−0.30, 0.55)	.36[a]
Higher-order RMS at 4 mm zone (μm)	0.19 ± 0.01 (0.09, 0.33)	0.17 ± 0.02 (0.10, 0.26)	0.21 ± 0.02 (0.09, 0.33)	.24[b]

RMS = root mean square
Data on preoperative HOA were unavailable for 1 patients (4%)
*Comparison between the none-to-mild halo group and the moderate-to-severe halo group
[a]Independent *t* test
[b]Mann-Whitney *U* test

type 2, 1, and 3 halos, respectively with simulation (Supplemental Table 2, http://links.lww.com/JRS/A749). All 3 participants (100%) reporting glare perceived type 1 glare with simulation. Supplemental Figures 3, *A* and *B* (http://links.lww.com/JRS/A747) illustrate the mean levels of the halo and glares experienced. Excluding drivers did not change the results materially (data not shown).

Preoperative HOA and Postoperative Halos

Table 3 presents that preoperative corneal spherical aberration and higher-order RMS were comparable between the participants reporting none-to-mild halos (score <3) and those with moderate-to-severe halos (score ≥3).

DISCUSSION

Our study revealed an overall satisfactory visual outcome and subjective experience in patients with bilateral PanOptix trifocal IOL implantation. Previous studies on PanOptix demonstrated predictable and stable postoperative refraction.[2,4,11] We also achieved a predictable postoperative SE within ±0.50 D and ±1.00 D of the predicted refraction in 77% and 98% of the eyes, respectively. All the eyes had a postoperative refractive cylinder within 1.00 D, similar to the results reported by Cochener et al.[11] Both sphere and SE were considered clinically stable over the follow-up period, with mean hyperopic shift of <0.1 D from 1 week to 3 months.

Our mean uncorrected binocular VA was close to 20/20 at all the tested distances, similar to previous studies.[3,6,11,15–17] All the participants achieved binocular uncorrected VAs of 20/32, 20/40, and 20/32 or better at distance, intermediate, and near VA, respectively. Since a near VA of 20/40 allowed readability of fine prints on sweetener packets and an estimated intermediate distance VA of 20/74 was required for computer work, the participants would have no difficulty in performing daily visual tasks.[18,19]

Compared with other trifocal IOLs, previous studies indicated that PanOptix, FineVision (Physiol), and AT LISA tri 839MP (Carl Zeiss Meditec AG) provided similar VA at distance, intermediate (80 cm), and near (40 cm and 33 cm).[7,15,20,21] However, at a closer 60 cm intermediate distance, PanOptix performed better than FineVision and 839MP for approximately half a line of VA, implying greater applicability of PanOptix for individuals requiring shorter intermediate working distance, such as those working in cramped urban areas and using laptops more frequently than desktop computers.[7,20–22]

In PanOptix, most light energy is directed to the distance focus than other foci.[11] We found similar monocular CDVA between photopic and mesopic conditions, similar to previous studies.[4,15] However, DCIVA and DCNVA were significantly worse under mesopic than photopic conditions for approximately 2 lines in our study. Previous studies have reported mixed results, but methodological difference among studies could explain the difference in the results.[4,15] A similar trend was observed under binocular and monocular viewing conditions.

Regarding the stability in vision, both the uncorrected and distance-corrected VAs were generally stable over the follow-up period monocularly and binocularly in our study, similar to a previous study.[16]

Our binocular distance-corrected defocus curve revealed that a VA of 20/25 or better was achieved at defocus power ranging from plano to −3.00 D (infinity to 33 cm), similar to that of other studies on PanOptix that reported plano to −2.50 D and plano to −3.50 D for achieving 20/25.[6,16,17,23] Our defocus curve depicted its near peak at defocus of −2.00 to −2.50 D (50 to 40 cm), which is close to the recommended 40 cm near working distance and is consistent with previous studies reporting a near peak at a defocus of −2.00 D.[2,6,16,17,23]

PanOptix has demonstrated better VA than other trifocal IOLs at certain distances in comparative studies. FineVision and 839MP generally perform similar to PanOptix at defocus powers from −0.50 to −4.00 D except at −2.00 D (50 cm), in which they perform slightly worse than PanOptix.[7,21,22] Notably, these 2 IOLs have an optimal 80 cm intermediate-working distance.[24]

CS attenuation is an inherent disadvantage of mIOLs owing to increased light scattering at multiple focal points.[7,25] Our photopic CS was similar to most other studies on PanOptix and the monocular population norm of individuals 50 to 75 years of age.[2,6,26] As expected, mesopic CS was generally worse than photopic CS.[15] Similarly, CS was generally worse with glare than without glare.[6] The unexpected better performance in mesopic CS than photopic CS at spatial frequency of 18 cpd might be

due to fluctuations brought by small sample size in our study.

The participants generally expressed satisfaction, with a high mean VFQ-25 composite score for vision-targeted items of 97 (of 100), a high mean satisfaction score of 4.3 (of 5), and 100% complete spectacle independence.

Traditional Chinese characters are structurally complex and visually demanding (eg, for people in Hong Kong and Macau). The 100% spectacle independence rate indicated that the participants possessed good visual quality at various distances.

Halos and glare are common side effects of diffractive mIOLs, accounting for up to 50% in visually dissatisfied patients requiring IOL exchange.[27] In our study, halos were common (88%), among whom nearly one-third perceived severe halo. Those with severe halo had never driven or had given up driving mainly owing to other nonvisual reasons; they reported a satisfaction score of 4 (satisfied) or 5 (very satisfied), implying that halos were not bothersome, at least in nondrivers.

Conversely, substantially fewer participants (12%) reported glare in our study than those in previous studies on PanOptix (44% to 92%).[4,16,21,28] Only 1 participant scored glare as 4 (very severe) and satisfaction score as 2 (dissatisfied), despite satisfactory driving performance, suggesting that glares could be more bothersome than halos, which occur in the dark only. Consequently, patients often equate glare to visual quality loss.

The number of participants reporting halo and glare was different using supplementary questionnaire and simulation possibly because they referred to different conditions. The supplementary questionnaire involves verbal communication with participants on the awareness of dysphotopsia in their daily lives, whereas the simulation involves visualization of dysphotopsia with both size and intensity as measures at the time of visit. Future studies may investigate how this information should be integrated to reflect the actual impact of dysphotopsia on patients.

It is generally believed that mIOL implantation should be avoided in eyes with high preoperative HOA because HOA was associated with reduced visual function and dysphotopsia.[29–32] However, relevant studies of mIOL on this topic are limited. In our study, the preoperative corneal spherical aberration and higher-order RMS was similar between the participants reporting none-to-mild halos and moderate-to-severe halos. This finding correlates with a study reporting no association of preoperative HOA with postoperative VA in a bifocal IOL.[33] On the contrary, another study reported that higher preoperative total corneal HOA was associated with worse postoperative distance and near VA for PanOptix.[10] However, these 2 studies only reported the association of HOA with postoperative VA, which might not necessarily reflect the severity of dysphotopsia.

Our study has limitations. First, the 3-month follow-up period is too short because dysphotopsia usually improves after 6 months.[34] Second, our sample size was too small for an HOA analysis.

In summary, we demonstrated satisfactory visual outcomes, quality of vision and life, and high rate of spectacle independence in a group of Chinese patients implanted with PanOptix trifocal IOL.

WHAT WAS KNOWN

- Previous studies have reported satisfactory visual outcomes in patients implanted with PanOptix trifocal IOL.
- However, visual outcomes at various distances and patient satisfaction in Chinese patients have not been investigated.

WHAT THIS PAPER ADDS

- Implantation of PanOptix trifocal IOL provided satisfactory visual outcomes and quality of vision and life in Chinese patients.
- No association was found between preoperative corneal HOA and postoperative halos.

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