AcrySof® IQ PanOptix® Trifocal IOL

Clinical Science Compendium

Summary of peer-reviewed clinical and bench research

Medical Affairs North America

Alcon

INTRODUCTION

At Alcon, our surgical medical device products, such as the PanOptix® Trifocal IOL, are designed, manufactured and marketed with a body of science developed through rigorous bench research and clinical studies. As the body of knowledge behind Alcon's products grows, so does the challenge of making our customers aware of its depth. Our medical affairs organization is thus focused on both high-quality data generation and its communication to the clinical community.

High-quality scientific publications are essential to convey the clinical community's knowledge and experience with new technology. This clinical science compendium provides a consolidated view of peer-reviewed publications for the first and only trifocal IOL approved in the United States, the PanOptix® Trifocal IOL.

In addition to exploring this compendium, we encourage you to visit Alcon's Medical Affairs website—AlconScience.com—to learn more about how medical science matters to us. Beyond scientific publications relating to Alcon's portfolio, you will find more information on independent medical educational grants, teaching facility equipment placement, and areas of interest for investigator-initiated trials.

METHODOLOGY

The 38 articles summarized in this compendium were identified using the PubMed and Google Scholar databases incorporating the search terms "PanOptix" and "trifocal intraocular lens." Articles were included when they were published between January 1, 2016 and July 31, 2020 and contained research relevant to the PanOptix® Trifocal IOL for the visual correction of aphakia in adult patients undergoing cataract surgery. Only manuscripts published in peer-reviewed journals and available in English were included in this compendium.

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Bench Studies

Clinical Studies, PanOptix® Trifocal IOL for the Visual Correction of Aphakia in Adult Patients Undergoing Cataract Surgery

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Review Articles

Optical Bench Performance of Three Trifocal Intraocular Lenses

Carson et al. *J Cataract Refract Surg.* 2016;42:1361-1367†

OVERVIEW

STUDY DESIGN
Bench evaluation of the optical characteristics of PanOptix® IOL, AT LISA® tri 839MP IOL, and FineVision Micro F IOL

STUDY SITE(S)
Alcon
(Fort Worth, TX)

PATIENTS
Not applicable (laboratory-based *in vitro* simulations using a model eye)

METHODOLOGY
Laboratory-based *in vitro* simulations using a model eye assessed by Badal images, simulated headlight images, and modulation transfer function (MTF)

IOL TYPE(S)*
AcrySof® IQ PanOptix®; AT LISA® tri 839MP; FineVision Micro F **(Table 1)**

KEY ENDPOINT(S)
Changes in optical resolution, photic phenomena, and image quality

ANALYSIS AND CONCLUSIONS

MTF measurements showed similar near and distance peaks for the IOLs, but the optimum intermediate peak for the PanOptix® IOL was 60 cm versus 80 cm for the AT LISA® tri 839MP and FineVision Micro F IOLs.

Similarly, in bench Badal image testing, the optimum intermediate image was at 60 cm for PanOptix® and 80 cm for AT LISA® tri 839MP and FineVision Micro F.

STUDY RESULTS

BADAL IMAGES
- Badal images of the ETDRS letter chart showed that the 3 trifocal IOLs had similar resolution results at distance and near
- The 20/40 text line was resolvable with PanOptix® from 80 cm to 40 cm
- PanOptix® was the only model able to resolve the 20/20 text line at an intermediate focus of 60 cm

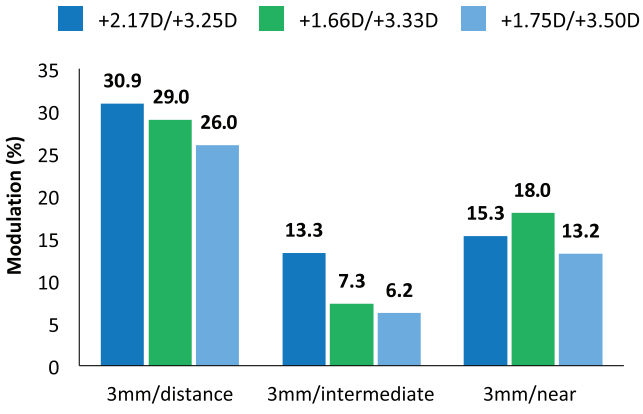
HEADLIGHT IMAGES
- The AT LISA® tri 839MP and FineVision Micro F IOLs had strong shadows in the intermediate range (more distinct with AT LISA® tri 839MP)
- The halos surrounding the FineVision Micro F and PanOptix® IOLs were reduced as the distance from the central saturated spot increased; the PanOptix® halo was reduced at shorter distances from the center

MTF MEASUREMENTS
- Distance-focus values and intermediate-focus MTF values corresponding to 20/20 and 20/40 Snellen visual acuities were highest with PanOptix®, while near-focus values were highest with AT LISA® tri 839MP **(Figure 1)**
- The MTF measurements showed similar near and distance peaks for the 3 IOLs, but the optimum intermediate peak for PanOptix® was 60 cm (vs 80 cm for the other 2 IOLs)

Table 1. Summary of IOL characteristics.

	PanOptix®	AT LISA® tri 839MP	FineVision Micro F
Technology	Trifocal	Trifocal	Trifocal
Diffractive zone	4.5 mm	6.0 mm	6.0 mm
Central Zone	Diffractive	Diffractive	Diffractive
Optic type	Nonapodized	Nonapodized	Apodized
Near add powers	+3.25 D	+3.33 D	+3.50 D
Intermediate add powers	+2.17 D	+1.66 D	+1.75 D
Active orders	0th, 2nd, & 3rd	0th,1st, & 2nd	0th,1st, & 2nd
Asphericity	-0.1 µm	-0.18 µm	-0.11 µm
Colors	Yellow	Clear	Yellow

Figure 1. IOL MTF values, using 3.0 mm pupil at focal distances of 20/20 visual acuity.



*AT LISA® tri 839MP IOL and FineVision Micro F IOL are not FDA approved
†All authors are employees of Alcon Research

Optical Bench Performance of a Novel Trifocal IOL Compared With a Multifocal IOL

Lee et al. *Clin Ophthalmol.* 2016;10:1031-1038†

OVERVIEW

STUDY DESIGN
Bench evaluation of the optical characteristics of PanOptix® IOL and ReSTOR® +3.0 D IOL

STUDY SITE(S)
Alcon
(Fort Worth, TX)

PATIENTS
Not applicable (laboratory-based *in vitro* simulations using a model eye)

METHODOLOGY
Laboratory-based *in vitro* simulations using a model eye assessed by Badal images, simulated headlight images, and modulation transfer function (MTF)

IOL TYPE(S)
AcrySof® IQ PanOptix®; AcrySof® IQ ReSTOR® +3.0 D multifocal (model SN6AD1) (**Table 1**)

KEY ENDPOINT(S)
Changes in optical resolution, photic phenomena, and image quality

ANALYSIS AND CONCLUSIONS

The PanOptix® IOL has resolution and image quality performance in distance and near foci comparable to the ReSTOR® +3.0 D multifocal IOL.

PanOptix® showed better resolution and image quality performance at the intermediate focus than ReSTOR® +3.0 D IOL, providing intermediate add power of about 60 cm in a unilateral bench test.

STUDY RESULTS

BADAL IMAGES
- PanOptix® provided equivalent distance and near performance compared with ReSTOR® +3.0 D, with a photopic pupil size of 3.0 mm **(Figure 1)**
- The intermediate visual performance was improved in PanOptix® over ReSTOR® +3.0 D, with approximately three lines of improvement at 60 and 80 cm defocus distances

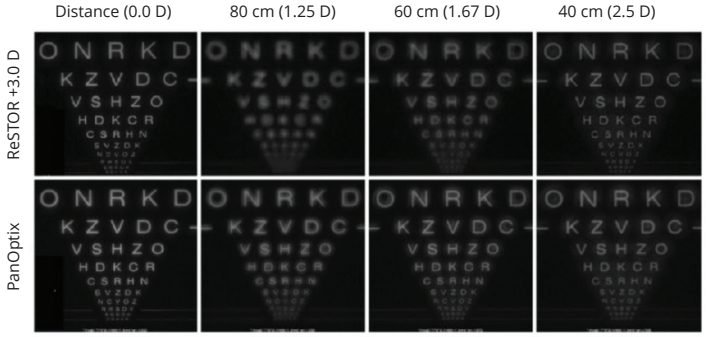
HEADLIGHT IMAGES
- PanOptix® had slightly higher halo propensity compared with ReSTOR® +3.0 D
- This result can be explained by differences in apodization; the apodized ReSTOR® +3.0 D design helps direct most of the light energy to distance focus in large pupil diameters, while the nonapodized PanOptix® design splits light energy to 3 foci independent of pupil diameter

MTF MEASUREMENTS
- At 100 and 50 line pairs per mm (lp/mm), MTF values were, respectively:
  - Distance-focus: 35.2% and 47.6% for ReSTOR® +3.0 D, vs 30.9% and 40.2% for PanOptix®
  - Near-focus: 17.5% and 22.8% for ReSTOR® +3.0 D, vs 15.3% and 18.1% for PanOptix®
  - Intermediate-focus: 2.9% and 4.4% for ReSTOR® +3.0 D, vs 13.3% and 15.3% for PanOptix®

Table 1. Characteristics of PanOptix® and ReSTOR® +3.0 D.

	PanOptix®	ReSTOR® +3.0 D
Technology	Trifocal	Multifocal
Diffractive zone	4.5 mm	3.6 mm
Central Zone	Diffractive	Diffractive
Optic type	Nonapodized	Apodized
Near add powers	+3.25 D	+3.00 D
Intermediate add powers	+2.17 D	none
Active orders	0th, 2nd, & 3rd	0th,1st, & 2nd
Asphericity	-0.1 µm	-0.1 µm
Colors	Yellow	Yellow

Figure 1. Bench-simulated mage quality of PanOptix® and ReSTOR® +3.0 D at focus distances of infinity (0.0 D), 80 cm (1.25 D), 60 cm (1.67 D), and 40 cm (2.5 D) with a 3.0 mm pupil.



†All authors are employees of Alcon Research

Topography and Longitudinal Chromatic Aberration Characterizations of Refractive-Diffractive Multifocal IOLs

Bench Performance

Loicq et al. *J Cataract Refract Surg.* 2019;45:1650-1659.

OVERVIEW

STUDY DESIGN
Optical and topology analyses to characterize longitudinal chromatic aberration (LCA) of multifocal diffractive IOLs

STUDY SITE(S)
One center in Belgium

PATIENTS
Not applicable (laboratory-based in vitro simulations)

METHODOLOGY
Seven diffractive multifocal IOLs exhibiting different diffractive profiles and made from various biomaterials were characterized under different wavelengths

IOL TYPE(S)*
TECNIS Multifocal ZMB00; TECNIS Symfony® ZXR00; FineVision PODFGF; FineVision POD F; LCA corrected FineVision; AcrySof® IQ PanOptix®; AT LISA® tri 839MP

KEY ENDPOINT(S)
Surface topography of diffractive profiles; modulation transfer function (MTF) through-focus curves; longitudinal chromatic aberration

ANALYSIS AND CONCLUSIONS

Longitudinal chromatic aberration is driven by two major processes, refraction and diffraction, and this aberration can be fully compensated in some IOLs.

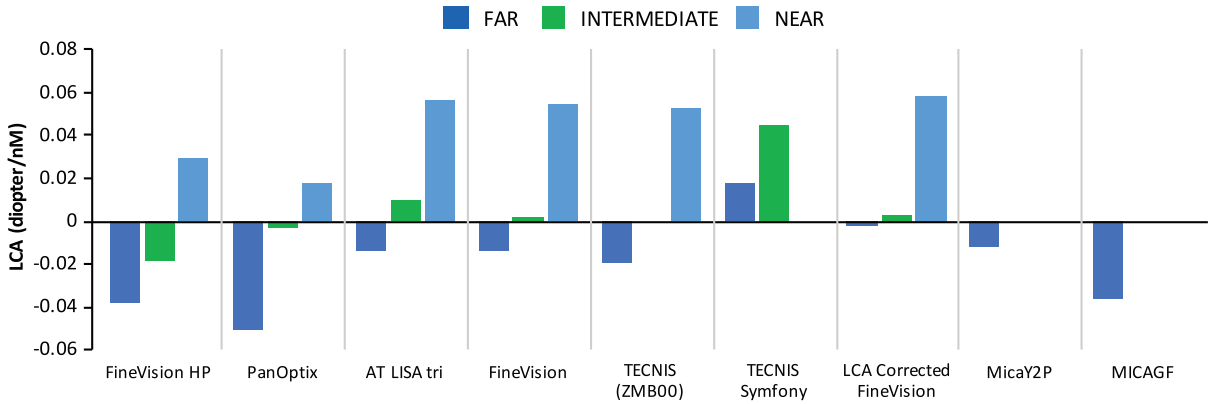
Although the results were not extrapolated to clinical relevance, this study still suggests a potential new performance metric to characterize multifocal IOLs and their different foci.

STUDY RESULTS

CHROMATIC ABERRATIONS

- Most optical systems present chromatic aberration quantified along the optical axis by the longitudinal chromatic aberration (LCA), which is controlled by the biomaterial Abbe number and diffractive effects
- The chromatic properties of the different IOLs are shown in **Figure 1**; histogram bars in the positive range of the graph correspond to foci that exhibited less power in blue light than in red light, and vice versa for the bars in the negative range
- In most cases, the LCA related to the foci dedicated to far vision was found to be negative and directly linked to the Abbe number of the lens biomaterial
- The only exception was the Symfony® IOL, which exhibited a modified, positive LCA for both foci
- In some cases (FineVision, PanOptix®, and AT LISA® tri 839MP), the LCA could be fully compensated
- Chromatic aberration reduction can improve the image quality of any optical system under polychromatic light, but improvement of vision quality by LCA reduction has not yet been demonstrated in the eye

Figure 1. Chromatic properties of the eight IOLs tested. A negative value indicates a refractive dominant process, while a positive value is associated with a diffractive dominant process. A value close to zero indicates a compensation of LCA.



**AT LISA® tri 839MP IOL and FineVision IOLs are not FDA approved*

Ray Propagation Imaging and Optical Quality Evaluation of Different Intraocular Lens Models

Bench Performance

Son et al. *PLoS One.* 2020;15:e0228342

OVERVIEW

STUDY DESIGN
Laboratory study to qualitatively visualize and assess the ray propagation behavior of different multifocal lens models at 3.0 and 4.5 mm pupil sizes

STUDY SITE(S)
Single center in Germany

PATIENTS
Not applicable; laboratory-based study

METHODOLOGY
Propagation of light rays visualized with water bath; optical performance evaluated by measuring modulation transfer function

IOL TYPE(S)
AcrySof® IQ PanOptix®; AcrySof® IQ ReSTOR® SN6AD1; AcrySof® IQ SN60WF; TECNIS Symfony® ZXR00

KEY ENDPOINT(S)
Optical quality evaluation; optical quality parameters (including modulation transfer function [MTF] and through-focus response [TFR]); ray propagation imaging

ANALYSIS AND CONCLUSIONS

In this laboratory study, ReSTOR® SN6AD1 and TECNIS Symfony® ZXR00 showed two defined foci for distance and near vision, while PanOptix® showed three distinct foci for distance, intermediate, and near vision.

The authors suggested that the imaging technique used in this study may be helpful to researchers and surgeons in understanding the optical properties of multifocal IOLs and examining the trajectory course of incident light rays with varying pupil sizes.

STUDY RESULTS

OPTICAL PARAMETERS

- AcrySof® IQ PanOptix® (**Figure 1**)
  - The ray propagation of PanOptix® demonstrated three distinct foci (distance, intermediate, and near) at both 3.0 and 4.5 mm pupil sizes
  - At a 3.0 mm aperture, PanOptix® allocated the highest amount of light energy to the distance focus (MTF = 0.371), followed by the near (MTF = 0.172) and intermediate focus (MTF = 0.164)
  - At a 4.5 mm aperture, the distance focus (MTF = 0.221) obtained the most light energy compared to the near (MTF = 0.084) or intermediate (MTF = 0.106) focus
- TECNIS Symfony® ZXR00 (**Figure 2**)
  - At a 3.0 mm aperture, Symfony® allocated more light energy to the near (MTF = 0.364) than to the distance (MTF = 0.330) focus, while it became more far-dominant at a 4.5 mm aperture (MTF = 0.376 for distance focus, MTF = 0.302 for near focus)
- AcrySof® IQ ReSTOR® SN6AD1
  - Pixel values obtained from ray propagation as well as TFR showed two clear peaks at a 3.0 mm pupil size, with a higher amount of light energy allocated to the distance (MTF = 0.450) than to the near (MTF = 0.259) focus
  - With increasing pupil size, ReSTOR® exhibited an even more distance-dominant light distribution behavior, with MTF value for distance focus (MTF = 0.321) reaching almost three-fold of that for near focus (MTF = 0.114)
- AcrySof® IQ SN60WF
  - At both pupil sizes, the incident light rays were refracted to a single focal point
  - TFR only showed a slight decrease in the MTF value at a 4.5 mm pupil size (MTF = 0.701) compared to the value at 3.0 mm (MTF = 0.790)

Figure 1. Optical ray propagation and through-focus response of PanOptix® at 3.0 mm (**A, B**) and 4.5 mm (**C, D**) pupil sizes.

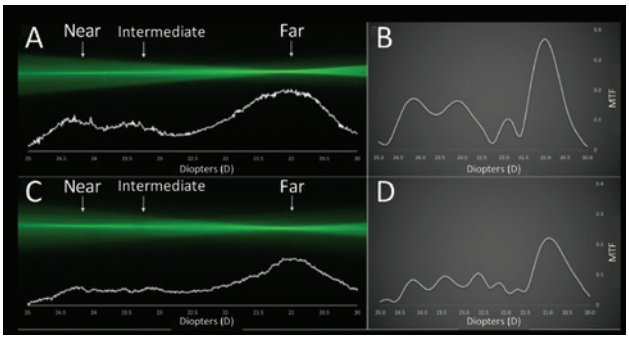
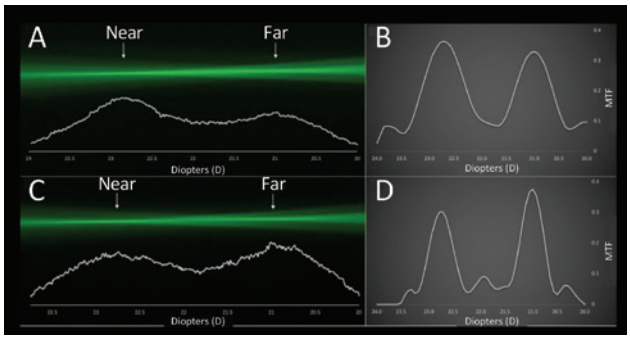


Figure 2. Optical ray propagation and through-focus response of TECNIS Symfony® at 3.0 mm (**A, B**) and 4.5 mm (**C, D**) pupil sizes



Evaluation of Quality of Life After Implantation of a New Trifocal Intraocular Lens

Visual Acuity

Patient-Reported Outcomes

Akman et al. *J Cataract Refract Surg.* 2019;45:130-134

OVERVIEW

STUDY DESIGN

Prospective noncomparative case series to evaluate vision-related quality of life (QOL) with PanOptix® IOL, 3 months post-surgery

STUDY SITE(S)

Single center in Turkey

PATIENTS

Forty-eight (48) patients

METHODOLOGY

Bilateral cataract surgery (including a subgroup of 14 patients with a ≥3-month interval between surgery in first eye and fellow eye)

IOL TYPE(S)

AcrySof® IQ PanOptix®

KEY ENDPOINT(S)

Vision-related QOL (National Eye Institute Visual Function Questionnaire-14 (VF-14)); binocular uncorrected distance (UDVA), intermediate (UIVA), and near (UNVA) visual acuities, refractive changes

ANALYSIS AND CONCLUSIONS

With mean values of 1.00 or lower for each question, results of the VF-14 showed that patients had a high vision-related QOL following implantation of PanOptix®.

Binocular implantation was associated with improvement in vision-related QOL, with significant differences in doing fine handwork and using a personal computer, when compared with monocular implantation.

STUDY RESULTS

QUALITY OF LIFE

- Three months after PanOptix® IOL implantation, the most difficult tasks for patients were reading small print, driving at night, and doing fine handwork
  - For these tasks, mean values of the VF-14 (which included 4 extra questions important for evaluating trifocal IOLs) were 0.94 ± 0.81 (SD), 0.89 ± 0.68, and 0.64 ± 0.67, respectively
- Although these were the items with the highest mean values, the scores were lower than 1.00, indicating only a little or no difficulty during these activities
- Binocular implantation was associated with improvement in vision-related QOL when compared with monocular implantation, with significant differences in doing fine handwork such as sewing (p=0.02) and using a computer (p=0.03) (Figure 1)
- When patients were informed about correct use of illumination during near activities, they reported performing much better

VISUAL OUTCOMES

- Values for visual acuity pre- and postoperatively were, respectively:
  - Binocular UDVA (LogMAR), 0.35 ± 0.07 and 0.05 ± 0.04 (p=0.01)
  - Binocular UIVA (LogMAR), 0.74 ± 0.27 and 0.11 ± 0.08 (p=0.01)
  - Binocular UNVA (LogMAR) , 0.79 ± 0.21 and 0.09 ± 0.04 (p=0.01)
- Values for refraction preop and postop were, respectively:
  - Refractive sphere (D), 0.49 ± 2.24 and -0.08 ± 0.42 (p=0.01)
  - Refractive cylinder (D), -0.28 ± 0.51 and -0.32 ± 0.18 (p=0.06)

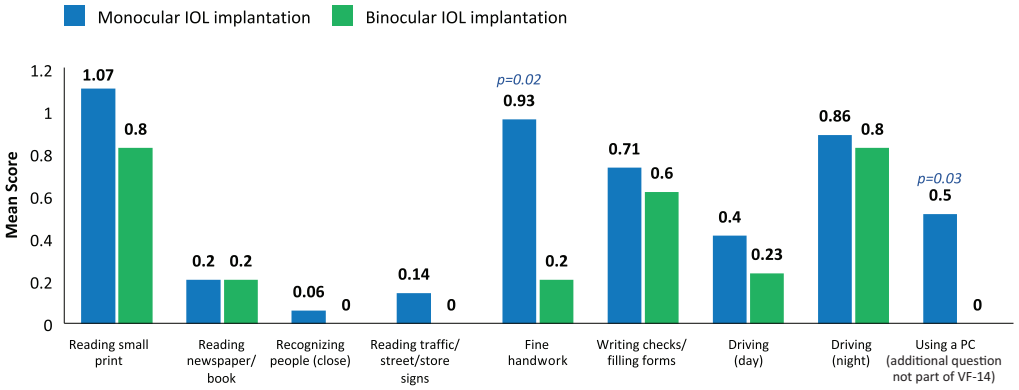


Figure 1. Sample of National Eye Institute Visual Function Questionnaire-14 (VF-14) scores (plus additional questions important for evaluating trifocal IOLs) at 3 months post-PanOptix® IOL implantation (patients with ≥3 months between first and fellow eye surgeries (n=14)). "Using a PC" not included in VF-14 Questionnaire. Adapted from Akman et al. *J Cataract Refract Surg.* 2019;45:130-134.

Visual Function after Implantation of a Presbyopia-Correcting Trifocal Intraocular Lens

Visual Acuity

Contrast Sensitivity

Alfonso et al. *Ophthalmic Res.* 2019;7:1-13

OVERVIEW

STUDY DESIGN
Retrospective study to evaluate distance, intermediate, and near visual performance in patients implanted with PanOptix®

STUDY SITE(S)
Single center in Spain

PATIENTS
Eighty (80) eyes of 40 patients

METHODOLOGY
IOL performance evaluated 6 months after femtosecond laser-assisted cataract surgery assisted with capsular tension ring (CTR)

IOL TYPE(S)
AcrySof® IQ PanOptix®

KEY ENDPOINT(S)
Binocular best corrected distance visual acuity (CDVA), best distance-corrected near visual acuity (DCNVA), best distance-corrected intermediate visual acuity (DCIVA), contrast sensitivity under photopic conditions, and defocus curves

ANALYSIS AND CONCLUSIONS

The visual performance obtained with bilateral implantation of the PanOptix® IOL was good at far, intermediate, and near distances; of note, the defocus curve showed a wide range of useful vision for intermediate distances, particularly at 50 cm.

Further studies analyzing visual outcomes with a large sample and a longer follow-up would be desirable to assess the safety and stability of this procedure, including use of femtosecond laser surgery and CTR.

STUDY RESULTS

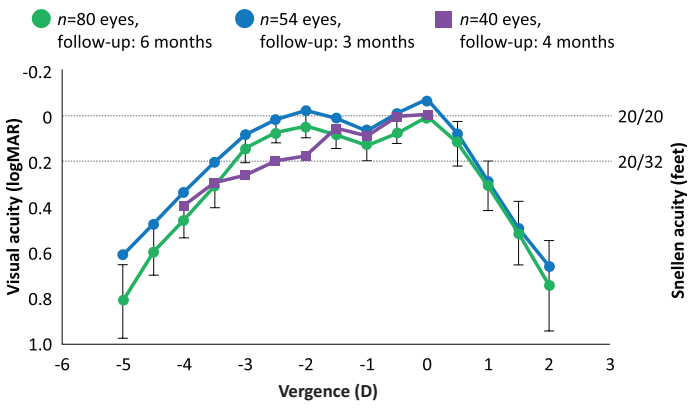
VISUAL ACUITY

- Six months post-surgery, the mean binocular CDVA and DCNVA were 0.94 ± 0.10 and 0.85 ± 0.13, respectively
- At distance, all patients showed a cumulative binocular distance-corrected visual acuity of 0.8 or better; about 80% of patients had a value of 1.0 (20/20)
- At near and intermediate distances, all patients showed a cumulative distance-corrected visual acuity of 0.5 (20/40) or better at 30 to 70 cm; 50 cm corresponded to the highest percentage of patients with larger values of visual acuity
- Defocus curve showed a wide range of useful vision with two peaks of best visual acuity at distance (0 D of vergence) and at 50 cm (about 2 D of vergence, 50) **(Figure 1)**

OTHER VISUAL OUTCOMES

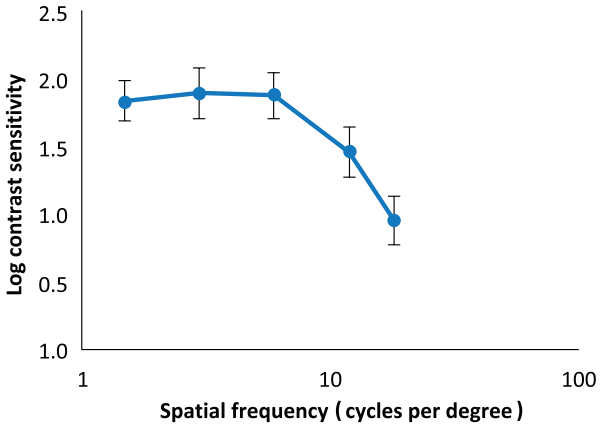
- In relation to the postoperative residual refractive error, study results revealed a postoperative spherical equivalent mean of –0.06 ± 0.33 D, ranging from 0.75 to –1.13 D
- Binocular distance contrast sensitivity was within normal limits **(Figure 2)**

Figure 1. Mean defocus curve 6 months post-IOL implantation.



For comparison the figure includes mean values previously reported by Monaco et al (open squares) and Kohnen et al (open circles)

Figure 2. Distance photopic binocular contrast sensitivity 6 months post-PanOptix IOL implantation.



Visual And Refractive Outcomes In Hyperopic Pseudophakic Patients Implanted With A Trifocal Intraocular Lens

Alfonso et al. *Clin Ophthalmol.* 2019;13:2261-2268

OVERVIEW

STUDY DESIGN

Retrospective nonrandomized study to assess visual and refractive results after bilateral implantation of a trifocal IOL in patients with hyperopia

STUDY SITE(S)

Single center in Spain

PATIENTS

Two-hundred fourteen (214) eyes of 107 patients; stratified by low-moderate and high hyperopia

METHODOLOGY

IOL performance evaluated 6 months after bilateral cataract surgery

IOL TYPE(S)

AcrySof® IQ PanOptix®

KEY ENDPOINT(S)

Refractive error to assess predictability; corrected distance visual acuity (CDVA) and uncorrected distance visual acuity (UDVA) to assess efficacy and safety

ANALYSIS AND CONCLUSIONS

This study showed that bilateral implantation of PanOptix® in hyperopic eyes provided satisfactory vision and good accuracy with respect to postoperative refractive error, with similar outcomes seen for low-moderate and high hyperopic eyes.

The authors concluded that future studies should include evaluation of the quality of vision at different distances, under different lighting conditions, a patient satisfaction questionnaire, and a comparison with other types of trifocal IOLs.

STUDY RESULTS

VISUAL ACUITY

- Six months postoperatively, the low-moderate hyperopia group had a monocular distance Snellen decimal UDVA of 0.82±0.21 and a CDVA and 0.97±0.05, while the values in the high hyperopia group were 0.78±0.19 and 0.94±0.09, respectively
- In the low-moderate hyperopia group, 75.23% of eyes achieved a CDVA of 20/20 and 100% of eyes achieved 20/25, while the values in the high hyperopia group were 60.95% and 94.29%, respectively (**Figure 1**)
- The percentage of eyes with UDVA within 1 line of CDVA was similar for the low-moderate and the high hyperopia groups (61% and 58%, respectively)

REFRACTIVE OUTCOMES

- Mean postoperative spherical equivalent was -0.25±0.36 D and -0.24±0.42 D for the low-moderate and high hyperopia groups, respectively
- For postoperative spherical equivalent, 43.12% (n=47) of eyes in the low-moderate group and 37.74% (n=40) of eyes in high hyperopia group were in the range of −0.13 to +0.13D
- In the low-moderate group, 81% of eyes (n=88) were within ±0.50 D and 99% (n=108) were within ±1.00 D; these values were 78% (n=82) and 95% (n=100), respectively, in the high hyperopic group (**Figure 2**)
- Postoperative refractive cylinder was similar between both groups: 92% (n=100) and 99% (n=108) of low-moderate hyperopic eyes were within ±0.50D and ±1.00D, respectively; these values were 83% (n=87) and 99% (n=104), respectively, in the high hyperopia group

Figure 1. Cumulative monocular UDVA and CDVA for low-moderate and high hyperopia groups at 6 months postoperatively.

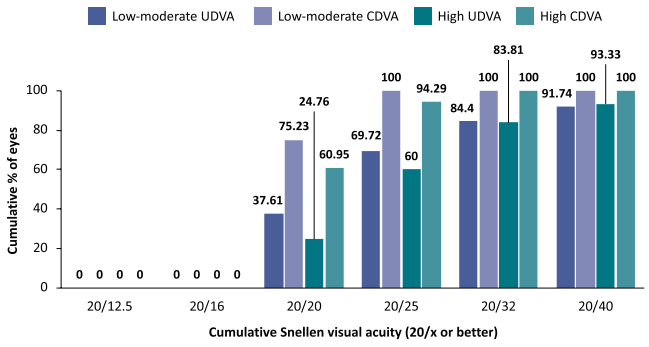
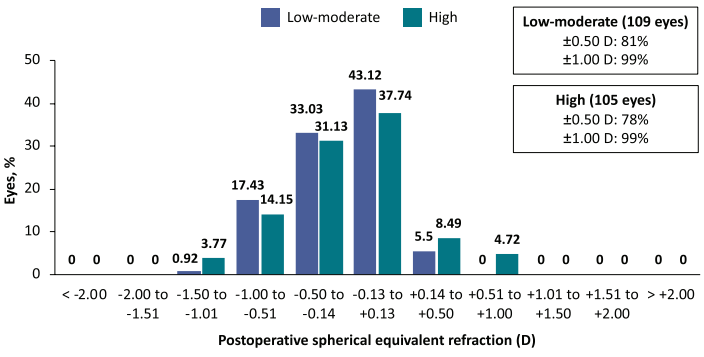


Figure 2. Postoperative spherical equivalent refraction (D) for low-moderate and high hyperopia groups at 6 months postoperatively.



Clinical Outcomes with a Diffractive Trifocal Intraocular Lens

Alió et al. *Eur J Ophthalmol.* 2018;28:419-424

Visual Acuity
Contrast Sensitivity
Visual Phenomena
Patient-Reported Outcomes

OVERVIEW

STUDY DESIGN
Prospective consecutive case-series study to evaluate clinical and visual outcomes with PanOptix® IOL (6 month follow-up period)

STUDY SITE(S)
Single center in Spain

PATIENTS
Fifty-two (52) eyes of 26 patients

METHODOLOGY
Bilateral cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®

KEY ENDPOINT(S)
Visual acuity, defocus curve, contrast sensitivity, near activity visual questionnaire (NAVQ), internal aberrations

ANALYSIS AND CONCLUSIONS

The PanOptix® IOL enhanced visual function with acceptable intermediate and near vision after cataract surgery, with good contrast sensitivity and an improvement in the near activity visual questionnaire.

These results are consistent with other PanOptix® studies as well as studies with other bifocal and trifocal IOLs. The authors noted that future investigations are required to confirm the findings of this study and ascertain long-term outcomes following PanOptix® implantation.

STUDY RESULTS

VISUAL ACUITY

- Uncorrected, corrected distance, and uncorrected near visual acuities improved with PanOptix® (P≤ 0.02).
- Distance corrected near visual acuity was 0.13 ± 0.10, 0.13 ± 0.13, and 0.13 ± 0.08 LogMAR at 1, 3, and 6 months after surgery, respectively (p = 0.82)
- Distance corrected intermediate visual acuities were 0.09 ± 0.13, 0.13 ± 0.15, and 0.12 ± 0.12 LogMAR at 1, 3, and 6 months, postoperatively
- Defocus curve showed a visual acuity equal or better to 0.30 LogMAR between defocus levels of +0.50 to –3.00 D **(Figure 1)**

OTHER VISUAL OUTCOMES

- Binocular contrast sensitivity was 1.86 ± 0.15 log units
- NAVQ scores for subjective satisfaction with near vision were 67.18 ± 20.64 preoperatively and 20.21 ± 9.20 three months after surgery (0 = completely satisfied; 100 = completely unsatisfied) (P< 0.01)
- The light distortion index was reduced significantly when the measurement was done in binocular conditions (p = 0.03) **(Table 1)**; in comparison to previous reports, light distortion indices with PanOptix® were higher than those reported for a mono-focal IOL and lower than those for a trifocal IOL (AT LISA 839M)

Figure 1. Mean defocus curve at 1 and 6 months following PanOptix® IOL implantation. Adapted from Alió JL et al. *Eur J Ophthalmol* 2018;28:419-424.

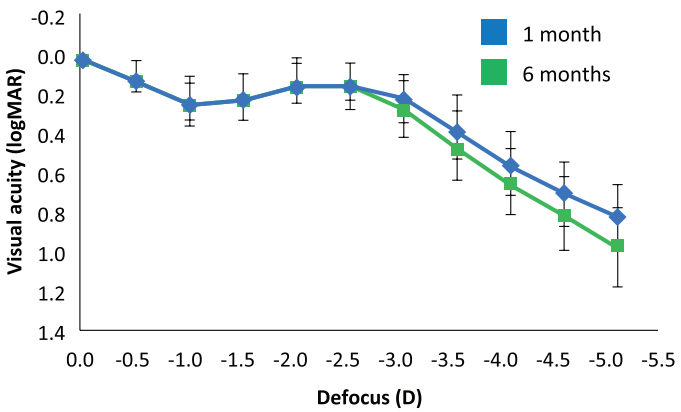


Table 1. Mean values of light distortion analyzer indices 6 months after PanOptix® IOL implantation.

Parameter	Monocular mean ± SD (Range)	Binocular mean ± SD (Range)	P-value
DI, %	36.8 ± 18.5 (17.98 to 81.65)	23.81 ± 11.6 (17.98 to 81.65)	0.03
BFCR, mm	47.11 ± 11.11 (74 to 34.7)	39.05 ± 9.24 (56 to 26)	0.05
BFCI, mm	0.44 ± 0.32 (1.22 to 0.06)	0.20 ± 0.17 (0.05 to 0.50)	0.07

SD: standard deviation; DI: distortion index; BFCR: best-fit circle radius; BFCI: best-fit circle irregularity.

Results of a Clinical Evaluation of a Trifocal Intraocular Lens in Japan

Bissen-Miyajima et al. ***Jpn J Ophthalmol.*** **2020;64:140-149**

Visual Acuity
Contrast Sensitivity
Visual Phenomena
Patient-Reported Outcomes

OVERVIEW

STUDY DESIGN
Prospective multicenter clinical study to evaluate the effectiveness and safety of a new IOL after cataract removal in patients living in Japan

STUDY SITE(S)
Two centers in Japan

PATIENTS
One hundred thirty-five (135) eyes of 68 patients

METHODOLOGY
IOL performance evaluated 6 months after cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®

KEY ENDPOINT(S)
Visual acuity at distance, intermediate (60 cm) and near (40 cm); contrast sensitivity; quality-of-life questionnaires

ANALYSIS AND CONCLUSIONS

This study demonstrated that PanOptix® provides equally good uncorrected visual acuity at distance, intermediate, and near, and decreases spectacle dependence in daily life.

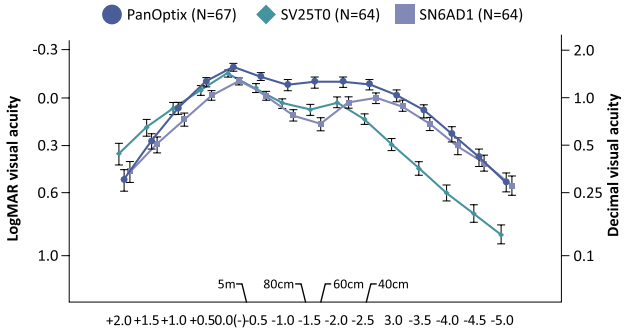
The investigators noted that patients frequently report mild-to-moderate glare and halos, and should be informed about these before implantation.

STUDY RESULTS

VISUAL ACUITY

- At 6 months postoperatively, 97.1% of the first eyes and 97.0% of the second eyes had a decimal best-corrected distance visual acuity of 1.0 or better
- Under binocular conditions, a decimal BCDVA of 1.0 (20/20) or better was obtained in all eyes at 1 month and 98.5% at 6 months postoperatively
- Both the distance-corrected intermediate visual acuity at 60 cm and near visual acuity at 40 cm achieved a mean value of 0.0 logMAR, equivalent to a decimal visual acuity of 1.0 (20/20) after 1 week, and maintained the same level until 6 months postoperatively
- Compared to bifocal IOLs (ReSTOR® 3.0 and ReSTOR® 2.5), the PanOptix® binocular defocus curve visual acuity of 0.00 logMAR (decimal visual acuity of 1.0) was achieved across an extended range of distance, from approximately + 0.5D to − 3.0D of defocus (**Figure 1**)

Figure 1. Comparison of binocular defocus curves at 6 months postoperatively with PanOptix® and two bifocal IOLs (SN6AD1 and SV25T0, data previously reported).

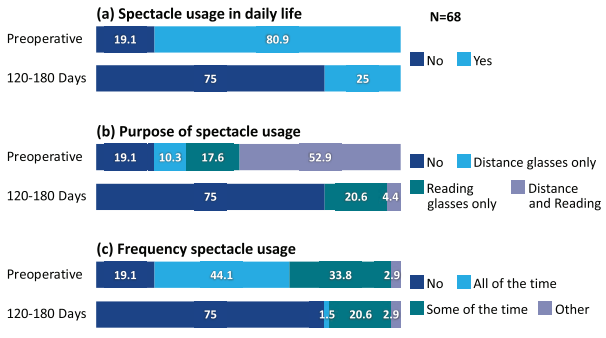


SN6AD1: Tinted Aspheric Multifocal IOL with +3.0 Diopter Near Add Power (bifocal)
SV25T0: Tinted Aspheric Multifocal IOL with +2.5 Diopter Near Add Power (bifocal)

OTHER OUTCOMES

- The contrast sensitivities at distance and near were within the normal range and at a comparable level of previous bifocal IOLs
- Preoperatively, the percentage of patients who reported any use of spectacles was 80.9%, whereas, at 6 months postoperatively this percentage was 25.0%; 1 patient (1.5%) required spectacles at all times and 20.6% some of the time, with the primary purpose of reading (**Figure 2**) in this population of Japanese subjects
- Night vision disturbances were reported in 31.3% of patients, mild-to-moderate glare in 65.7%, and halos in 70.1%; only 1.5% of patients reported severe glare and halos

Figure 2. Spectacle use with PanOptix®.



A Comparative Evaluation of a New Generation of Diffractive Trifocal and Extended Depth of Focus Intraocular Lenses

Visual Acuity
Contrast Sensitivity
Visual Phenomena
Patient-Reported Outcomes

Cochener et al. *J Refract Surg.* 2018;34:507-514

OVERVIEW

STUDY DESIGN
Prospective, randomized, comparative study to evaluate the performance of two diffractive trifocal IOLs and one extended depth of focus (EDOF) IOL

STUDY SITE(S)
One center in France

PATIENTS
One-hundred twenty (120) eyes of 60 patients

METHODOLOGY
IOL performance evaluated 6 months after bilateral cataract surgery. Trifocal IOLs were targeted at emmetropia. EDOF IOL was targeted at micromonovision or emmetropia

IOL TYPE(S)*
AcrySof® IQ PanOptix®; FineVision Micro F; TECNIS Symfony® (EDOF)

KEY ENDPOINT(S)
Primary: binocular and monocular uncorrected distance (UDVA), intermediate (UIVA), and near (UNVA) visual acuity; secondary: quality of vision, contrast sensitivity, aberrometry

ANALYSIS AND CONCLUSIONS

PanOptix® and TECNIS Symfony® provided good visual acuity at all distances, a high likelihood of spectacle independence, and were associated with visual symptoms that had little or no impact on patients' daily functioning.

Vision at distance and intermediate was comparable between the lenses tested, although the diffractive trifocal IOL performed better at near, and there were no differences in visual symptoms and aberrometry among groups. The EDOF IOL was targeted for micromonovision (better near vision) or emmetropia (better intermediate vision), while the trifocal IOL was targeted for emmetropia, which may have confounded the near vision results.

STUDY RESULTS

VISUAL ACUITY

- Monocular and binocular UNVA were statistically and significantly better for the trifocal lens than for the EDOF IOL 6 months after IOL implantation (P=0.002)
- The percentage of patients with J2 (> 20/32) UNVA was 52.5% monocularly and 70.0% binocularly for TECNIS Symfony®, and 81.5% monocularly and 100% binocularly for PanOptix®
- There was no significant difference in binocular UIVA between groups; visual acuity was better than 0.6 (20/32) in 55.0% and 52.6% of patients with TECNIS Symfony® and PanOptix®, respectively **(Figure 1)**

OTHER VISUAL OUTCOMES

- Contrast sensitivity was comparable for the IOLs with an expected decrease in contrast sensitivity for the IOLs without correction versus with correction
- For each IOL, the profile was smooth from far to near; however, with PanOptix®, slight humps at the principal foci could be identified **(Figure 2)**
- Fewer than 1% of patients in each IOL group experienced night-time visual disturbances, dry eye, halos, or glare
- Overall, spectacle independence was achieved in 90% of the TECNIS Symfony® group and 89% of the PanOptix® group

Figure 1. Distribution of UIVA 6 months after implantation. Adapted from Cochener et al. *J Refract Surg.* 2018;34:507-514.

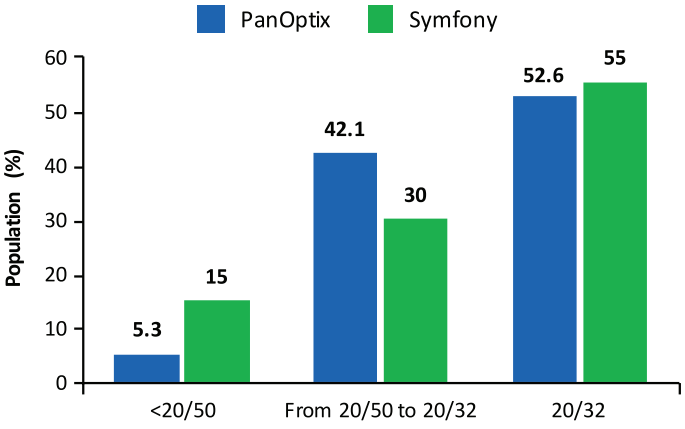
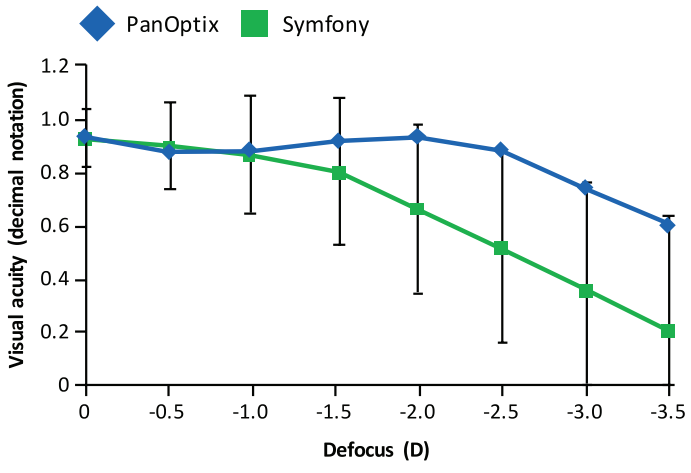


Figure 2. Mean defocus curve 6 months after implantation. Adapted from Cochener et al. *J Refract Surg.* 2018;34:507-514.



*FineVision Micro F IOL is not FDA approved; data on non-FDA approved devices are not shown in results

Comparison of Visual Outcomes after Bilateral Implantation of a Diffractive Trifocal IOL and Blended Implantation of an Extended Depth of Focus IOL with a Diffractive Bifocal IOL

Visual Acuity

Contrast Sensitivity

de Medeiros et al. *Clin Ophthalmol.* 2017;11:1911-1916

OVERVIEW

STUDY DESIGN

Prospective, nonrandomized, consecutive study to compare visual outcomes and contrast sensitivity between PanOptix® and blended implantation of TECNIS Symfony® ZXR00/ TECNIS® ZMB00

STUDY SITE(S)

One center in Brazil

PATIENTS

Forty (40) eyes of 20 patients

METHODOLOGY

IOL performance evaluated 30-80 days after bilateral cataract surgery

IOL TYPE(S)

AcrySof® IQ PanOptix®; TECNIS Symfony® ZXR00 (dominant eye) and TECNIS® ZMB00 (non-dominant eye)

KEY ENDPOINT(S)

Uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), uncorrected near visual acuity (UNVA), and uncorrected intermediate visual acuity (UIVA); contrast sensitivity; visual defocus curve

ANALYSIS AND CONCLUSIONS

Bilateral implantation of PanOptix® and blended implantation of TECNIS Symfony® ZXR00/ TECNIS® ZMB00 both promoted good quality of vision for long, intermediate, and short distances.

The blended implantation group had better performance for very short distances and for intermediate and long distances ≥−1.50 D of vergence, while PanOptix® had a better performance for UIVA at 60 cm and for UNVA at 40 cm.

STUDY RESULTS

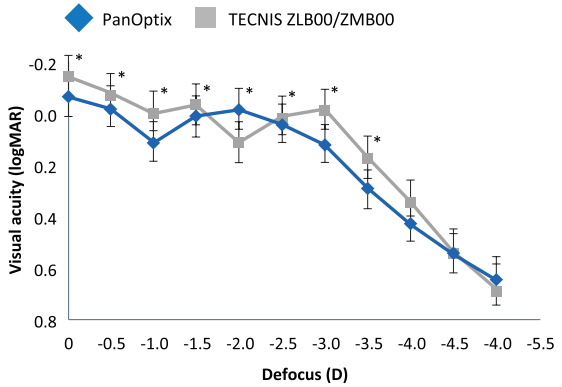
VISUAL ACUITY

- Overall, postoperative UDVA and CDVA was better in the TECNIS Symfony® ZXR00/ TECNIS® ZMB00 blended implantation group than in the PanOptix® bilateral implantation group
- Specifically, visual acuity outcomes for the PanOptix® and TECNIS groups were, respectively:
  - UDVA: 0.01 and −0.096 LogMAR (P<0.01)
  - CDVA: −0.07 and −0.16 LogMAR (P<0.01)
  - UIVA: 0.14 and 0.20 LogMAR (P<0.01)
  - UNVA −0.03 and 0.11 LogMAR (P<0.01)
- In the binocular defocus curve, the TECNIS® group showed peaks at -3.0 D and -1.50 D, while PanOptix® showed peaks at -2.0 D and 0.0 D, and maintained a plateau from -2.50 D to -1.50 D **(Figure 1)**

CONTRAST SENSITIVITY

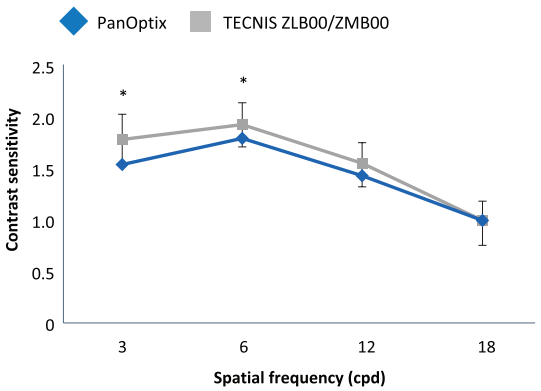
- Contrast sensitivity under photopic conditions without glare was better at a low frequency (3 and 6 cycles / degree [cpd]) for the TECNIS® group (P<0.01); at high frequencies (12 and 18 cpd), there were no statistically significant differences (Figure 2)
- Under photopic conditions with glare, the PanOptix® group performed better at 3 cpd (P=0.0233) and the TECNIS® group performed better at 6 cpd (P=0.036)
- Under mesopic conditions without glare, TECNIS® group performed better at the frequencies of 1.5 (P<0.01), 6 (P=0.0117), and 12 (P<0.01) cpd

Figure 1. Binocular defocus curve 30-80 days post-IOL implantation. Adapted from de Medeiros et al. *Clin Ophthalmol.* 2017;11:1911-1916.



**Statistically significant difference (P<0.05)*

Figure 2. Contrast sensitivity, photopic without glare, 30-80 days post-IOL implantation.



**Statistically significant difference (P<0.05)*

Through-Focus Vision Performance and Light Disturbances of 3 New IOLs for Presbyopia Correction

Visual Acuity
Contrast Sensitivity
Visual Phenomena
Patient-Reported Outcomes

Escandón-García et al. *J Ophthalmol.* 2018:6165493

OVERVIEW

STUDY DESIGN
Prospective, non-randomized case series to assess visual performance and light disturabances in two trifocal IOLs (PanOptix®; FineVision Pod F) and one extended depth of focus (EDOF) IOL

STUDY SITE(S)
Single center in Portugal

PATIENTS
Ninety (90) eyes of 45 patients (23 FineVision patients, 15 Symfony® patients, and 7 PanOptix® patients)

METHODOLOGY
IOL performance evaluated between 1 and 3 months after bilateral cataract surgery

IOL TYPE(S)*
AcrySof® IQ PanOptix®; FineVision Pod F; TECNIS Symfony® EDOF IOL

KEY ENDPOINT(S)
Through-focus visual acuity, contrast sensitivity, light disturbances, subjective quality of vision

ANALYSIS AND CONCLUSIONS

The AcrySof® IQ PanOptix® trifocal IOL provided better performance at near distance, while the extended depth of focus (EDOF) IOL TECNIS Symfony® performed better at intermediate distance (1m).

Objective dysphotopsia measured with a light distortion analyzer was not significantly different between the TECNIS Symfony® EDOF IOL and the PanOptix® trifocal IOL

STUDY RESULTS

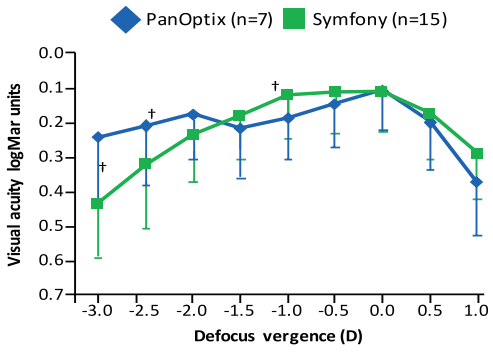
VISUAL ACUITY

- Postoperative uncorrected distance visual acuity was 0.08 ± 0.12 LogMAR for the whole sample, and there were no statistically significant differences between the IOL groups
- The IOLs performed similarly for all vergences, except for superiority for PanOptix® over TECNIS Symfony® EDOF IOL at near vision (−2.5 D/0.4 m [P=0.007]), and superiority of TECNIS Symfony® at intermediate vision (−1.00 D/1m [P=0.030]) **(Figure 1)**

OTHER VISUAL OUTCOMES

- Differences in contrast sensitivity between IOLs were not significantly different at any spatial frequency under either photopic or scotopic conditions **(Figure 2)**
- Light distortion analysis showed that the EDOF IOL had larger values for the light distortion index (34.6 ± 16.0) compared with the trifocal IOL, but this difference was not statistically significant
- Subjective response to a quality of vision questionnaire showed a significantly worse performance for the EDOF IOL compared to the trifocal IOL in the bothersome subscale (P<0.05)

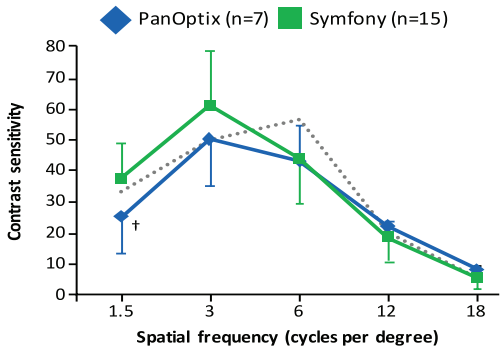
Figure 1. Defocus curves for IOLs examined in the study 1-3 months post-IOL implantation. Adapted from Escandón-García et al. *J Ophthalmol.* 2018:6165493.



†Statistically significantly different at 0.05 level (Kruskal-Wallis).

**FineVision Pod F IOL is not FDA approved; data on non-FDA approved devices are not shown in results.*

Figure 2. Contrast sensitivity function under photopic conditions 1-3 months post-IOL implantation. Dashed line represents the lower limit of normality. Adapted from Escandón-García et al. *J Ophthalmol.* 2018:6165493.



†Statistically significantly different at 0.05 level (Kruskal-Wallis)

Short Term Visual Outcomes of a New Trifocal Intraocular Lens

García-Pérez et al. *BMC Ophthalmol.* 2017;17:72

Visual Acuity
Contrast Sensitivity
Visual Phenomena
Patient-Reported Outcomes

OVERVIEW

STUDY DESIGN
Prospective case series evaluating visual function in patients undergoing bilateral implantation of PanOptix® IOL

STUDY SITE(S)
Single center in Spain

PATIENTS
One hundred-sixteen (116) eyes of 58 patients

METHODOLOGY
Bilateral cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®

KEY ENDPOINT(S)
Monocular defocus curve; monocular and binocular uncorrected visual acuity (MUVA, BUVA); binocular contrast sensitivity (1 month post-surgery); visual satisfaction questionnaire (Catquest 9-SF; 9-12 months post-surgery)

ANALYSIS AND CONCLUSIONS

The PanOptix® IOL provides good short-term visual outcomes, with good intermediate performance and excellent patient-reported satisfaction. Visual function is similar in different lighting conditions, suggesting a low pupillary dependence.

The study findings suggest that PanOptix® represents an option for patients who wish to be spectacle-free after cataract surgery with a good range of vision and a low rate of visual disturbances.

STUDY RESULTS

VISUAL ACUITY

- Mean BUVA in photopic conditions was 0.03 ± 0.046 LogMAR for far, 0.12 ± 0.143 LogMAR for intermediate and 0.02 ± 0.099 LogMAR for near distances
- All patients achieved a BUVA better than 0.3 LogMAR (20/40 Snellen equivalent) for distance and near vision and 94.8% of patients for intermediate vision
- Mesopic BUVA values were similar to photopic values
- Best visual acuity was reached at a vergence of 0.00D; visual acuity dropped slightly at −1.00 D and peaked again at −2.00D **(Figure 1)**

OTHER VISUAL OUTCOMES

- PanOptix® had very good contrast sensitivity values 1 month after surgery, with mean photopic values of 2.05, 1.97, 1.79 and 1.56 for 3, 6, 12 and 18 cpd respectively; there were no significant difference compared to mesopic values **(Figure 2)**
- For patient-evaluated outcomes, 96.6% of patients were "very satisfied" or "quite satisfied" with their sight after surgery, and only 2 patients (3.4%) were "fairly dissatisfied"
- Three patients (5.1%) reported the need for spectacle correction for certain activities; all other patients (94.8%) reported never using spectacle correction
- Based on a questionnaire, 19 patients (32.8%) reported seeing halos often or always with low illumination and 6 patients (10.3%) reported glare

Figure 1. Monocular distance-corrected defocus curve 1 month after PanOptix® IOL implantation. Adapted from García-Pérez et al. BMC Ophthalmol. 2017;17:72.

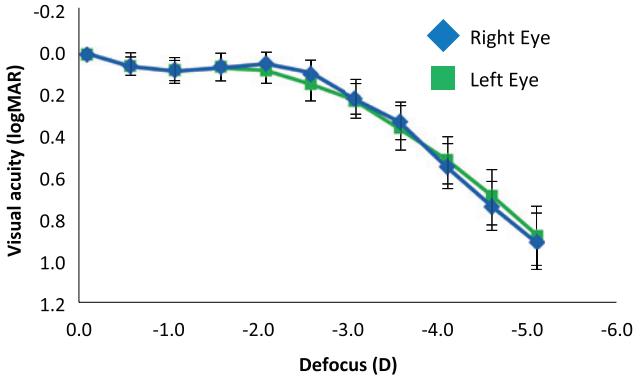
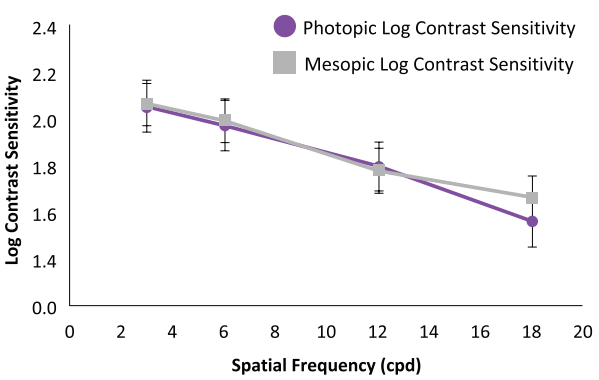


Figure 2. Mean binocular contrast sensitivity function in photopic and mesopic conditions 1 month after PanOptix® IOL implantation.



Subjective Perception Of Trifocal IOL Performance, Including Toric Models

Visual Acuity

Patient-Reported Outcomes

Hamdi. *Clin Ophthalmol.* 2019;13:1955-1961

OVERVIEW

STUDY DESIGN

Prospective observational study to assess patients' perception of the performance of a trifocal IOL

STUDY SITE(S)

Single center in Saudi Arabia

PATIENTS

Sixty (60) eyes of 35 patients

METHODOLOGY

IOL performance evaluated after cataract surgery; 25 (62.5%) patients had bilateral and 10 (37.5%) patients had unilateral implantation

IOL TYPE(S)

AcrySof® IQ PanOptix®

KEY ENDPOINT(S)

Refractive outcomes; visual acuity (uncorrected distance visual acuity [UDVA]; corrected distance visual acuity [CDVA]; uncorrected intermediate visual acuity [UIVA]; uncorrected near visual acuity [UNVA]; distance-corrected near visual acuity [DCNVA]); spectacle independence, patient satisfaction questionnaire

ANALYSIS AND CONCLUSIONS

This study of patients' subjective perception of the performance of PanOptix® showed that this IOL was associated with a very high level of satisfaction, and this satisfaction was reflected in diverse visual activities.

This level of satisfaction was achieved regardless of gender, IOL model or even unilateral implantation, and was also achieved regardless the age of the patients or preoperative eye status.

STUDY RESULTS

VISUAL ACUITY/REFRACTIVE OUTCOMES

- Postoperative refractive and visual results after a mean duration of follow-up of 2.5 months are shown in **Table 1**
- In mean ± SD values, spherical equivalent was -0.03 ± 0.5 D, while for visual acuity (LogMAR), UDVA was 0.09 ± 0.1, CDVA was 0.05 ± 0.1, UIVA was 0.05 ± 0.9, UNVA 0.05 ± 0.09, and DCNVA was 0.04 ± 0.8

PATIENT-REPORTED OUTCOMES

- On a scale of 0% worst to 100% best, patients reported 85.7 ± 16.5 for level of satisfaction, 96.0 ± 10.6 for spectacle independence, 95.4 ± 9.8 for near activities (reading), 97.7 ± 6.4 for intermediate activities (computer use), 90.2 ± 10.1 for quantity of distance activities (night driving), 88.0 ± 12.1 for quality of distance activities (night symptoms), and 92.6 ± 11.9 for facial care (make-up for females and shaving for males) (**Table 2**)
- For most comparisons between: eyes implanted with non-toric and toric IOLs, between males and females, or between bilateral and unilateral implantation, there were no statistically significant differences (P>0.05)
  - An exception was for eyes implanted with non-toric and toric models that had a statistically significant difference (P<0.05) in steep K and corneal cylinder
  - Similarly there was a significant difference between males and females for steep K (P<0.05)

Table 1. Postoperative refractive and visual results.

	Mean	± SD	Range (min-max)
Sphere (D)	0.2	0.6	−0.5–4.0
Cylinder (D)	−0.35	0.48	−2.25–0
Spherical equivalent (D)	−0.03	0.5	−1.0–3.25
UDVA (LogMAR)	0.09	0.1	0–0.5
CDVA (LogMAR)	0.05	0.1	0–0.5
UIVA (LogMAR)	0.05	0.9	0–0.4
UNVA (LogMAR)	0.05	0.09	0–0.4
DCNVA (LogMAR)	0.04	0.8	0–0.4

CDVA, corrected distance visual acuity; DCNVA, distance-corrected near visual acuity; UDVA, uncorrected distance visual acuity; UIVA, uncorrected intermediate visual acuity; UNVA, uncorrected near visual acuity.

Table 2. Subjective impressions about various activities.

	No.	Mean	± SD	Range (min-max)
Satisfaction (/eye)	60	85.7	16.5	40–100
Spectacle independence (/patient)	35	96.0	10.6	60–100
Reading (/patient)	35	95.4	9.8	60–100
PC use (/patient)	35	97.7	6.4	80–100
Night driving (/patient)	35	90.2	10.1	80–100
Night symptoms (/patient)	35	88.0	12.1	60–100
Facial care (/patient)	35	92.6	11.9	60–100

Effect of Spherical Equivalent Error on Visual Acuity at Various Distances in Eyes with a Trifocal IOL

Hayashi K et al. *J Cataract Refract Surg.* 2019;35:274-279

OVERVIEW

STUDY DESIGN
Exploratory study to examine the effect of the manifest refraction spherical equivalent (MRSE) error on distance visual acuity in eyes implanted with a PanOptix® IOL (≥6 months post-surgery)

STUDY SITE(S)
Single center in Japan

PATIENTS
Sixty (60) eyes of 30 patients **(Table 1)**

METHODOLOGY
Bilateral cataract surgery; surgery on second eye performed ≈2 days after surgery on first eye

IOL TYPE(S)
AcrySof® IQ PanOptix®

KEY ENDPOINT(S)
Corrected visual acuity from far to near distances measured using an all-distance vision tester after simulating spherical equivalent error by adding spherical lenses with refractive powers of +1.00, +0.50, 0.00, -0.50, and -1.00 D

ANALYSIS AND CONCLUSIONS

In eyes implanted with the PanOptix® IOL, MRSE error of slight myopia significantly improved near visual acuity but worsened distance visual acuity. Conversely, MRSE error of slight hyperopia worsened both distance and near visual acuity.

Although PanOptix® should be targeted for emmetropia, slight myopia led to a better outcome than slight hyperopia in this study.

STUDY RESULTS

VISUAL ACUITY

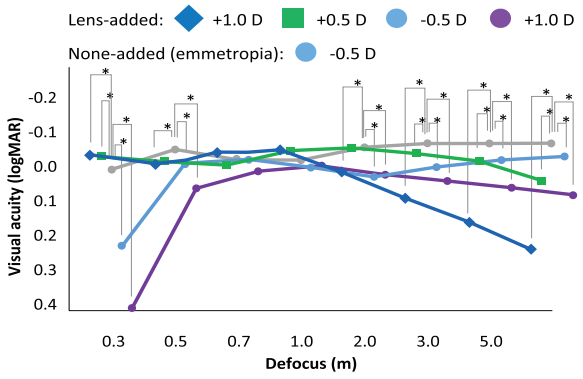
- Mean visual acuity at all distances differed significantly among the spherical lens added groups ($p \leq 0.0374$)
- Mean distance visual acuity at infinity, 5 m, and 3 m was significantly worse in all lens added groups (+1.00, +0.50, -0.50, and -1.00 D) than in the no lens added group (0.00 D; $p < 0.0001$) (Figure 1)
- Mean intermediate visual acuity at 1 m and 0.7 m did not differ significantly between each of the lens added groups and the no lens added group
- Mean near visual acuity at 0.3 m was significantly better in the +1.00 and +0.50 D groups and significantly worse in the -0.50 and -1.00 D groups than in the no lens group ($p \leq 0.0044$)
- In the +0.50 D (-0.50 D myopia) group, mean LogMAR visual acuity of 0 was achieved at far, intermediate, and near distances, except for far visual acuity at infinity
- In the +1.00 D (-1.00 D myopia) group, mean LogMAR visual acuity reached 0 at near and intermediate distances
- In the -0.50 D (+0.50 D hyperopia) group, mean LogMAR visual acuity reached 0 at far and intermediate distances
- In the -1.00 D (+1.00 D hyperopia) group, mean LogMAR visual acuity of 0 was achieved only at intermediate distance

Table 1. Characteristics of study patients (N=30)

Characteristic	Mean ± SD
Age, y	67.4 ± 5.08
Sex (M/F), n	8/22
Corneal astigmatism, D	0.49 ± 0.33
MRSE, D	-0.11 ± 0.31
Pupillary diameter, mm	3.43 ± 0.68
Uncorrected LogMAR visual acuity	0.01 ± 0.09
Corrected LogMAR visual acuity	-0.10 ± 0.06

IOL. intraocular lens; SD, standard deviation; D, diopters; MRSE, manifest refraction spherical equivalent value; LogMAR, logarithm of the minimum angle of resolution

Figure 1. Mean monocular visual acuity at all distances, ≥6 months post-PanOptix® IOL implantation. Adapted from Hayashi K et al. *J Cataract Refract Surg.* 2019;35:274-279



**Significant difference between the added and non-added groups*

Comparison of Visual Outcomes Between Bilateral Trifocal Intraocular Lenses and Combined Bifocal Intraocular Lenses With Different Near Addition

Visual Acuity

Visual Aberrations

Hayashi et al. *Jpn J Ophthalmol.* 2019;63:429-436

OVERVIEW

STUDY DESIGN

Nonrandomized, prospective study to compare outcomes in patients implanted bilaterally with a trifocal IOL with patients implanted with bifocal IOLs having different near addition in each eye

STUDY SITE(S)

Single center in Japan

PATIENTS

Seventy-eight (78) patients; trifocal group (n=32) and combined bifocal group (n=46)

METHODOLOGY

IOL performance evaluated 3 months after bilateral cataract surgery

IOL TYPE(S)

AcrySof® IQ PanOptix®; AcrySof® IQ ReSTOR® models SN6AD1 (+3.0 D addition in dominant eye) and SN6AD3 (+4.0D addition in nondominant eye)

KEY ENDPOINT(S)

Binocular visual acuity at different distances, binocular contrast visual acuity with and without glare; near stereoacuity; incidence of patients reporting halo symptoms

ANALYSIS AND CONCLUSIONS

Bilateral implantation of trifocal PanOptix® provided significantly better binocular visual acuity at far to intermediate distances and comparable near visual acuity compared with combined implantation of bifocal IOLs with +3.0D and +4.0D addition.

Contrast visual acuity and stereoacuity were also significantly better with PanOptix®, but the incidence of halo symptoms tended to be worse with the trifocal IOL than with the combined bifocal IOLs.

STUDY RESULTS

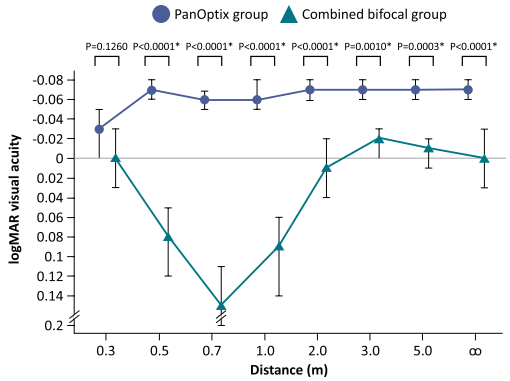
VISUAL ACUITY

- Mean binocular uncorrected and corrected distance and intermediate visual acuities at far to intermediate distances (∞, 5.0, 3.0, 2.0, 1.0, 0.7, and 0.5 m) were significantly better in the PanOptix® group than in the combined bifocal group (P≤0.0325) (**Figures 1 and 2**)
- Mean binocular uncorrected and corrected near near visual acuities at 0.3 m did not differ significantly between groups (**Figures 1 and 2**)
- Distance corrected mean binocular contrast visual acuity under photopic and mesopic conditions was significantly better in the PanOptix® group at contrast levels above 10% mesopic and 2.5% photopic (P≤0.0426)
- Mean binocular glare visual acuity under photopic or mesopic conditions was also significantly better in the PanOptix® group except at 100% contrast (P≤0.0345)
- Mean near stereoacuity was significantly better in the PanOptix® group (53.1 ± 16.6 arc sec) than in the combined bifocal group (110.7 ± 122.3 arc sec) (P=0.0101)

VISUAL SYMPTOMS

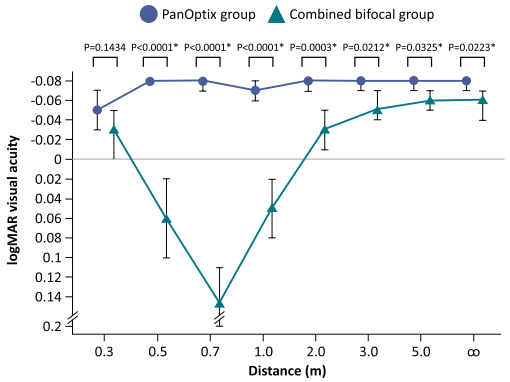
- The overall incidence of halo symptoms was significantly lower in the PanOptix® group (65.6%) than in the combined bifocal group (80.4%) (P=0.0162)
- However, the incidence of moderate halo symptoms was significantly greater in the PanOptix® group (34.4%) than in the combined bifocal group (15.2%) (P=0.0482)

Figure 1. Comparison of mean (± SD) binocular uncorrected visual acuity at far to near distances expressed in logMAR scale at 3 months postoperatively.



**P-value indicates a significant difference between the two groups.*

Figure 2. Comparison of mean (± SD) binocular corrected visual acuity at far to near distances expressed in logMAR scale at 3 months postoperatively.



**P-value indicates a significant difference between the two groups.*

Visual Outcomes and Safety After Bilateral Implantation of a Trifocal Presbyopia Correcting IOL in a Korean Population: a Prospective Single-Arm Study

Visual Acuity | Contrast Sensitivity | Patient-Reported Outcomes

Kim et al. *BMC Ophthalmol.* 2020;20:288

OVERVIEW

STUDY DESIGN
Clinical, prospective, multicenter, single-arm study to investigate the 3-month postoperative performance and safety after implantation of a trifocal IOL in a Korean population.

STUDY SITE(S)
Four (4) centers in South Korea

PATIENTS
Eighty-eight (88) eyes of 44 patients

METHODOLOGY
IOL performance evaluated 3 months after bilateral cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®

KEY ENDPOINT(S)
Binocular defocus curve; binocular best corrected distance visual acuity (BCDVA); monocular/binocular uncorrected VA (UCVA) at distance (4 m), intermediate (60 cm), and near (40 cm); contrast sensitivity under photopic conditions with/without glare; subjective outcomes, including satisfaction and spectacle independence

ANALYSIS AND CONCLUSIONS

This study showed that Korean patients who received PanOptix® had <0.1 logMAR for binocular UCVA at all distances, with high subject satisfaction and spectacle independence by 3 months postoperative.

STUDY RESULTS

VISUAL ACUITY

- At 3 months after implantation of PanOptix®, the binocular defocus curve showed mean visual acuity of 0.1 logMAR (20/25 Snellen) or better between + 0.50 and − 2.50 D (**Figure 1**)
- Mean binocular BCDVA decreased from approximately 0.1 logMAR before implantation to 0.0 logMAR (20/20 Snellen) at month 1 and month 3 after implantation
- By month 3, binocular UCVA was 0.3 logMAR or better at distance (4 m), intermediate (60 cm), and near (40 cm); similarly, monocular UCVA improved from month 1 to month 3
- All subjects had BCDVA 20/40 or better at month 3 compared with the preoperative visit (**Figure 2**); most subjects had 20/40 vision or better at month 3 for binocular UCDVA (100%), UCIVA (100%), and UCNVA (96%)

CONTRAST SENSITIVITY/PATIENT-REPORTED OUTCOMES

- Mean photopic best corrected contrast sensitivity was similar for conditions with or without glare, and was highest for 6 cycles per degree
- At near and intermediate distances, 84 and 77% of subjects reported good/excellent satisfaction, and 84 and 91% of subjects reported spectacle independence, respectively
- Two subjects reported being "very dissatisfied" with surgery results because of events such as mild posterior capsule opacification, visual impairment, and dry eye

Figure 1. Binocular defocus curves 1 and 3 months after implantation of PanOptix®. Error bars represent 90% confidence intervals.

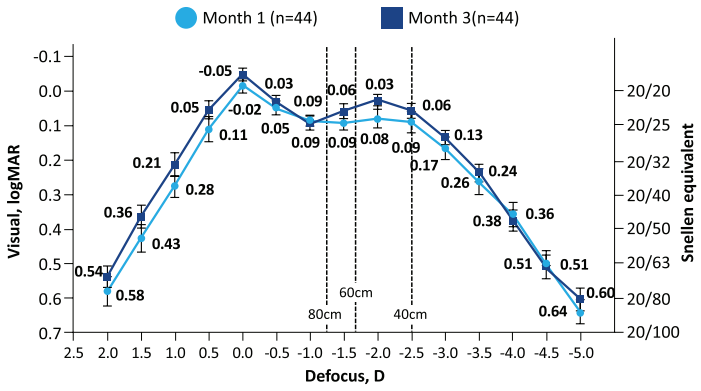
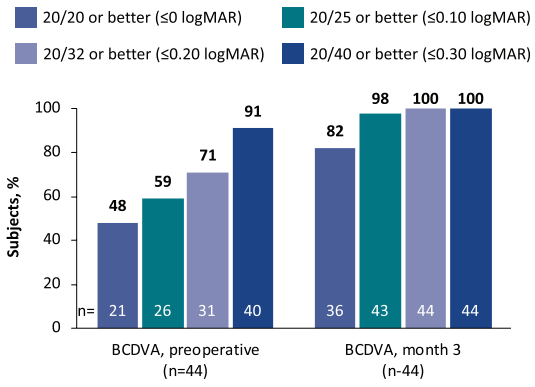


Figure 2. Percentages of subjects with 20/40 vision or better for best-corrected distance visual acuity (BCDVA) before implantation and 3 months after implantation of PanOptix®.



Innovative Trifocal (Quadrifocal) Presbyopia-Correcting IOLs: 1-Year Outcomes From an International Multicenter Study

Kohnen et al. *J Cataract Refract Surg.* 2020 Apr 30. Online ahead of print

OVERVIEW

STUDY DESIGN

Prospective, single-arm, nonmasked, nonrandomized study to evaluate visual outcomes and safety of the AcrySof IQ PanOptix® toric IOL over a 1-year period

STUDY SITE(S)

Seventeen (17) sites in Europe, Australia, and South America

PATIENTS

One hundred and forty-nine (149) patients

METHODOLOGY

IOL performance evaluated 6 and 12 months after bilateral cataract surgery

IOL TYPE(S)

AcrySof® IQ PanOptix® Trifocal IOL

KEY ENDPOINT(S)

Binocular uncorrected distance VA (UDVA; 4 m), monocular corrected distance VA (CDVA), binocular distance corrected intermediate VA (DCIVA; 60 and 80 cm), binocular uncorrected near VA (UNVA; 40 cm), and binocular defocus curves, and adverse event (AE) monitoring

ANALYSIS AND CONCLUSIONS

The authors concluded that the PanOptix® Trifocal IOL provided good VA outcomes through 1 year of post follow-up with diverse population of patients.

PanOptix® provided good visual acuity at all tested distances, including intermediate (60 cm), and the binocular defocus curve demonstrated visual acuity of 0.1 logMAR (20/25 Snellen) or better from near to intermediate distance.

STUDY RESULTS

VISUAL ACUITY

- At 12 months, mean ± SD binocular UDVA at 4 m was 0.02±0.11 logarithm of the minimum angle of resolution (logMAR) (**Figure 1 A and B**)
  - 99% of patients (n=143/145) had binocular UDVA of 0.3 logMAR (20/40 Snellen) or better
  - 70% of patients (n=101/145) had binocular UDVA of 0.04 logMAR (20/20 Snellen) or better
- At 12 months, mean ± SD monocular CDVA was 0.01±0.13 logMAR for the first eye and 0.01±0.10 logMAR for the second eye
  - ≥70% of patients had monocular CDVA of 0.04 logMAR (20/20 Snellen) or better in the first (n=102/145) and second eye (n=106/145)
- Binocular DCIVA was 0.04±0.12 and 0.08±0.14 logMAR at 60 and 80 cm, respectively; and binocular UNVA was 0.07±0.11 logMAR
  - Binocular DCIVA of 0.3 logMAR (20/40 Snellen) or better was achieved by 98% of patients (n=142/145) at 60 cm and 96% of patients (n=139/145) at 80 cm and binocular DCIVA of 0.04 logMAR (20/20 Snellen) or better was achieved by 51% of patients (n=74/145) at 60 cm and 44% of patients (n=64/145) at 80 cm
- At 6 months, mean binocular defocus curve VA at distance (0.00 diopter [D]), intermediate (−1.50 D), and near (−2.50 D) was −0.04±0.11, 0.07±0.13, and 0.07±0.13 logMAR, respectively (**Figure 2**)

SAFETY PROFILE

- Serious ocular AE rates were ≤1.4% in first and second eyes. Posterior capsulotomy rates were 3.4% (first eye) and 2.7% (second eye)

Figure 1. Visual acuity under photopic conditions for PanOptix®. Mean binocular visual acuity (**A**) and cumulative distribution of binocular visual acuity (**B**) at 12 months in patients who received the study intraocular lens; n=145. Error bars represent 90% CIs.

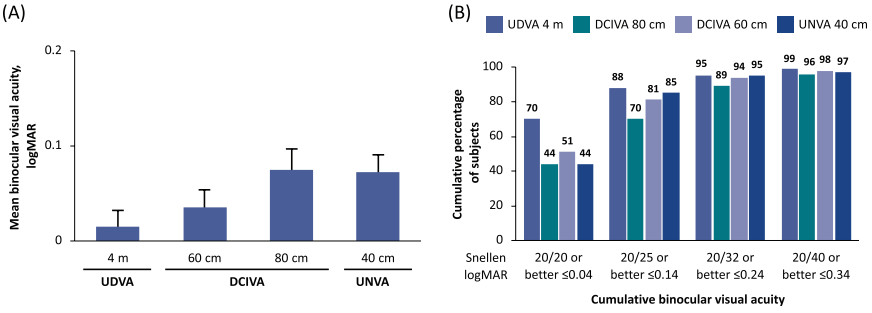
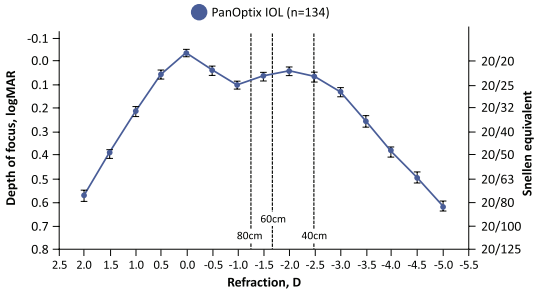


Figure 2. Binocular Defocus curve for PanOptix®. Visual acuity in logMAR and Snellen equivalent at 6 months is shown (best case analysis set, n=134). Data reflect mean and 90% CIs.



DCIVA, distance corrected intermediate visual acuity; UDVA, uncorrected distance visual acuity; UNVA, uncorrected near visual acuity.

Impact of Light Conditions on Reading Ability Following Multifocal Pseudophakic Corrections

Labiris et al. *Clin Ophthalmol.* 2018;12:2639-2646

OVERVIEW

STUDY DESIGN

Prospective, non-randomized, clinic-based trial to examine the impact of light conditions on reading performance following bilateral pseudophakic multifocal presbyopic correction

STUDY SITE(S)

One center in Greece

PATIENTS

One-hundred fifty (150) eyes of 75 patients

METHODOLOGY

Reading performance evaluated after IOL implantation based on minimal reading speed at 80 words/min for the following light intensities (25, 50, and 75 Foot-Candles [FC]) and temperatures (3,000, 4,000, and 6,000 K)

IOL TYPE(S)

AcrySof® IQ PanOptix®; ReSTOR® +2.50 bifocal; AcrySof IQ SF60WF monofocal (control group)

KEY ENDPOINT(S)

Bilateral noncorrected visual capacity assessed with the Greek version of the MNREAD acuity chart (MNREAD-GR) validated for Greek populations

ANALYSIS AND CONCLUSIONS

Multifocal pseudophakic corrections improve reading ability; however, they present variable efficacy according to the light conditions both in terms of intensity and light temperatures.

Patients who received trifocal IOLs had the best light intensity-independent reading ability, but performance was reduced at a cooler light temperature; therefore the cold lighting of modern working settings will not optimize near-vision capacity in these patients.

STUDY RESULTS

BACKGROUND

- Reading ability, and generally visual performance depends heavily on light conditions, including intensity and temperature
- Light color temperatures above 5,000 K are considered cold colors, such as ice white, whereas color temperatures from 2,700 to 3,000 K are considered warm colors, like yellow, white, or red
- A higher (cooler) color temperature is preferable in working spaces, as it can promote concentration
- Specific guidelines have been issued regarding the best lighting conditions for working, educational and private facilities, but no lighting guidelines have been issued for monofocal or multifocal pseudophakic patients

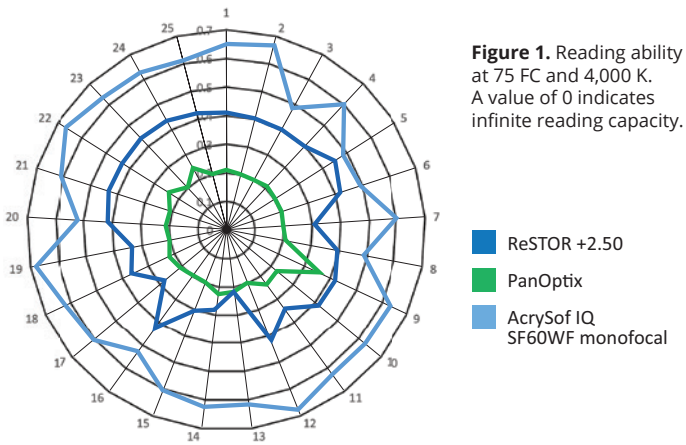


Figure 1. Reading ability at 75 FC and 4,000 K. A value of 0 indicates infinite reading capacity.

READING PERFORMANCE

- AcrySof IQ SF60WF monofocal IOL (without spectacles) provided poor reading ability; this can be improved significantly with cold, intense lighting (75 FC, 6,000 K)
- ReSTOR® +2.50 bifocal IOLs provided variable reading ability, ranging from average in warm, dim lighting (25 FC/3,000 K) to almost flawless in cold, intense lighting (75 FC/6,000 K)
- PanOptix® trifocal IOLs provided provide superior reading capacity in comparison to the rest of the groups; this ability was light intensity-independent for temperatures at 3,000 and 4,000 K, but was reduced at a temperature of 6,000 K that was independent of the light intensity
- **Figure 1** shows reading ability at optimal conditions for PanOptix® patients (75 FC and 4,000 K); even under optimal conditions for ReSTOR® +2.50 and control patients (75 FC and 6,000 K), PanOptix® patients presented closer to 0 (infinite reading capacity)

Multicenter Visual Outcomes Comparison of 2 Trifocal Presbyopia-Correcting Intraocular Lenses: 6-Month Postoperative Results

Visual Acuity

Contrast Sensitivity

Lapid-Gortzak et al. *J Cataract Refract Surg.* 2020 Jun 9. Online ahead of print

OVERVIEW

STUDY DESIGN

Prospective, parallel-group, randomized, double-masked study to evaluate visual performance of the PanOptix® and AT LISA tri 839MP trifocal IOLs

STUDY SITE(S)

Fifteen (15) sites in Australia, Europe, and South America

PATIENTS

One hundred and eighty-two (182) patients

METHODOLOGY

Lens performance was assessed 6 months after bilateral cataract extraction and lens implantation

IOL TYPE(S)*

AcrySof® IQ PanOptix®, AT LISA® tri 839MP

KEY ENDPOINT(S)

Binocular uncorrected distance (UDVA, 4 m), intermediate (UIVA, 60 cm), near (UNVA, 40 cm) VAs, binocular defocus curves, and photopic and mesopic contrast sensitivity with and without glare

ANALYSIS AND CONCLUSIONS

Authors conclude that the results of this study showed improved visual performance at near and intermediate distances with the PanOptix® IOL.

STUDY RESULTS

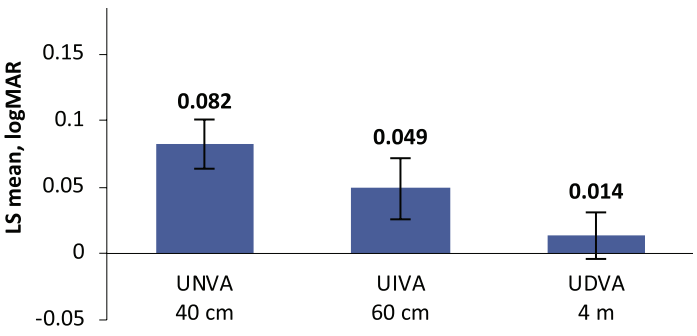
VISUAL ACUITY

- PanOptix® patients demonstrated binocular UIVA (60 cm, mean logMAR = 0.049) and binocular UDVA (4 m, mean logMAR = 0.014) 6 months postoperatively (**Figure 1**)
- Mean defocus curve from 0.00 to -3.00 D ranged from 0.1 to 0.0 logMAR for PanOptix® (**Figure 2**)
  - Binocular distance corrected VA was better than 20/20 Snellen equivalent with PanOptix® based on the defocus curve
- Binocular contrast sensitivity values were acceptable for PanOptix® at all spatial frequencies under photopic and mesopic conditions with or without glare, and in agreement with prior optical bench studies
- Manifest refraction spherical equivalent (mean ± SD) with PanOptix® was 0.020±0.382 in the first implanted eye and −0.013±0.353 in the second implanted eye

SAFETY PROFILE

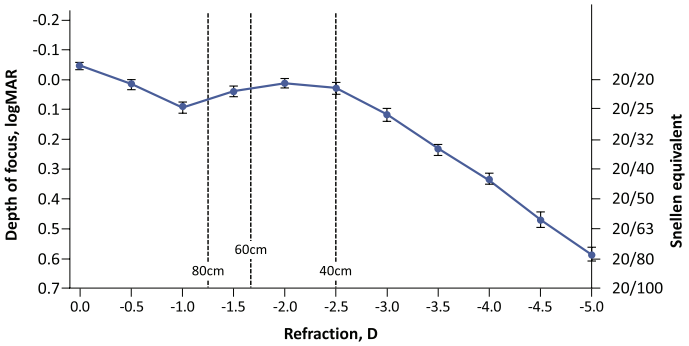
- Five PanOptix® patients reported halos, which commenced within 1 to 2 weeks after implantation and resolved without intervention in all but 1 subject
- One subject reported bilateral postoperative glare; in addition, 1 event of retinal tear and 2 events of retinal degeneration were reported
- No serious AEs were reported with PanOptix®

Figure 1. Uncorrected near, intermediate, and distance binocular visual acuity at month 6 for PanOptix® (best-case analysis set, n=86). Error bars represent 90% CI. Adapted from Lapid-Gortzak et al. *J Cataract Refract Surg.* 2020 Jun 9. Online ahead of print.



LS, least squares; UDVA, uncorrected distance visual acuity; UIVA, uncorrected intermediate visual acuity; UNVA, uncorrected near visual acuity

Figure 2. Depth of focus. Mean defocus curves at month 6 for PanOptix® (best-case analysis set, n=86). Error bars represent 90% CI. Adapted from Lapid-Gortzak et al. *J Cataract Refract Surg.* 2020 Jun 9. Online ahead of print.



**AT LISA® tri 839MP is not FDA approved; data on non-FDA approved devices are not shown in results.*

Correlation and Predictability of Ocular Aberrations and the Visual Outcome after Quadrifocal IOL Implantation: a Retrospective Longitudinal Study

Lee et al. *BMC Ophthalmology*. 2019;19:188

OVERVIEW

STUDY DESIGN
A retrospective longitudinal study to evaluate the correlating and predicting factors of visual outcome after implantation of PanOptix®

STUDY SITE(S)
Single center in Taiwan

PATIENTS
One hundred-twenty (73) eyes of 73 patients (only right eye evaluated)

METHODOLOGY
IOL performance evaluated 1 and 6 months after bilateral cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®

KEY ENDPOINT(S)
Corrected distance visual acuity (CDVA), near corrected visual acuity (NCVA), Tracey refraction spherical equivalent (TRSE), angle alpha, spherical aberration (SA), trefoil, internal higher order aberration (HOA) and total HOA

ANALYSIS AND CONCLUSIONS

The angle alpha preoperatively and postoperatively was correlated with postoperative visual acuity; a smaller angle alpha could positively predict better far and near visual outcomes in patients who had implantation of PanOptix®.

A large angle alpha may relate to IOL decentration, worse postoperative visual acuity, more visual disturbance and poor patient satisfaction.

STUDY RESULTS

CORRELATION OF PREOPERATIVE ABERRATIONS TO POSTOPERATIVE VISUAL PERFORMANCE

- CDVA one month postoperatively was significantly better than the preoperative status (0.09 ± 0.10, P < 0.001), and insignificant improvement was found six months postoperatively
- Preoperative TRSE, angle alpha, and SA were significantly and negatively correlated with postoperative CDVA one month and six months postoperatively as well as NCVA 6 months postoperatively
- Preoperative corneal HOA was negatively correlated with the CDVA one month postoperatively, while the trefoil and internal HOA were negatively associated with NCVA 6 months postoperatively
- Overall, preoperative angle alpha could predict all postoperative visual performances **(Table 1)**

CORRELATION OF POSTOPERATIVE ABERRATIONS TO POSTOPERATIVE VISUAL PERFORMANCE

- For postoperative ocular aberrations, TRSE, angle alpha, and SA were significantly and negatively correlated with CDVA and NDVA six months postoperatively
- Trefoil, internal HOA and total HOA were also negatively associated with NCVA
- For postoperative status, both a smaller TRSE and angle alpha could positively predict a better outcome for CDVA and NCVA six months postoperatively, while the smaller trefoil could positively predict a better outcome for NCVA

Table 1. Predictability of preoperative ocular aberrations to postoperative visual performance. Adapted from Lee et al. BMC Ophthalmology. 2019;19:188. *Denotes significant predictability between ocular aberrations and visual outcome.

	CDVA 1 month postoperatively		CDVA 6 months postoperatively		NCVA 6 months postoperatively	
Ocular aberrations	AUC	P	AUC	P	AUC	P
TRSE	0.455	0.514	0.499	0.991	0.489	0.885
Angle alpha	0.715	0.002*	0.733	0.001*	0.651	0.042*
Coma	0.652	0.027*	0.628	0.077	0.540	0.077
Trefoil	0.630	0.059	0.547	0.518	0.527	0.718
SA	0.679	0.009*	0.591	0.211	0.645	0.049*
Cornea HOA	0.422	0.255	0.497	0.967	0.555	0.456
Internal HOA	0.491	0.893	0.520	0.785	0.586	0.248
Total HOA	0.485	0.832	0.520	0.787	0.596	0.242
DLI	0.488	0.858	0.475	0.729	0.418	0.269

AUC, area under curve; DLI dysfunctional lens indexes; HOA, higher order aberration; SA, spherical aberration; TRSE, Tracey refraction spherical equivalent.

Effect of Active Evaluation on the Detection of Negative Dysphotopsia after Sequential Cataract Surgery: Discrepancies between Incidences of Unsolicited and Solicited Complaints

Makhotkina et al. *Acta Ophthalmol.* 2018;96:81-87

OVERVIEW

STUDY DESIGN
Retrospective cohort study to evaluate the incidence of negative dysphotopsia) after sequential cataract surgery (follow-up at 2 to 4 months post-surgery

STUDY SITE(S)
Single center in the Netherlands

PATIENTS
One hundred-ninety (190) eyes of 95 patients

METHODOLOGY
Bilateral sequential cataract surgery

IOL TYPE(S)*
Multiple, implanted in 190 eyes. Includes 161 eyes implanted with a monofocal IOL (AcrySof® SN60WF), 12 eyes implanted with a trifocal IOL (AcrySof® IQ PanOptix®, n=2 eyes; FineVision Micro F, n=10 eyes)

KEY ENDPOINT(S)
Incidence of negative dysphotopsia assessed by retrospective review of medical records and patient interviews

ANALYSIS AND CONCLUSIONS

The incidence of unsolicited negative dysphotopsia after sequential cataract surgery appears to be a substantial under-estimation of complaints identified in active interviewing. In most cases, symptoms were not bothersome to patients.

Most of the implants in this study (85%) were with the AcrySof® SN60WF IOL. Given the small proportion of patients implanted with trifocal IOLs in the study (12 eyes [6%]), other studies may provide greater insight into the visual disturbance profile of trifocal IOL technology.

STUDY RESULTS

VISUAL PHENOMENA

- In the full study population (N=190 eyes, including 161 eyes with AcrySof® SN60WF), unsolicited complaints of negative dysphotopsia were reported by eight patients (8%), and two of them had a resolution of symptoms within 1 month of follow-up
- Eighteen patients (19%) reported negative dysphotopsia at the time of the interview
- Two patients reported bothersome negative dysphotopsia, and one of them was successfully treated with implantation of a supplementary IOL in the ciliary sulcus

PATIENT DIFFERENCES

- Patients with negative dysphotopsia were younger than patients without dysphotopsia (p = 0.045) and had shorter axial eye length (p = 0.04), a tendency for higher IOL power (p = 0.09) and a higher corrected distance visual acuity (CDVA) (p = 0.001) **(Table 1)**
- No significant or clinically relevant difference was found regarding preoperative corrected distance visual acuity, anterior chamber depth, total corneal refractive power, total corneal spherical aberration or pupil diameter.

Table 1. Differences between patients with and without negative dysphotopsia in 190 eyes implanted with an IOL (includes only 12 eyes implanted with a trifocal IOL). Overall, 161 eyes received AcrySof® SN60WF; 2 eyes received trifocal AcrySof® IQ PanOptix®; 10 eyes received trifocal FineVision Micro F; 12 eyes received toric AcrySof® IQ SN6AT3-6; 1 eye received spherical SN60AT; 2 eyes received 3-piece spherical AcrySof® MN60MA; 2 eyes received bifocal AcrySof® ReSTOR® SN6AD1. Adapted from Makhotkina NY et al. Acta Ophthalmol. 2018;96:81-87.

Mean ± SD	Patients without negative dysphotopsia (N = 75)	Patient with negative dysphotopsia (N = 20)	P-value (CI)
Age, y	73 ± 9	68 ± 10	0.045 (0.11; 9.51)
IOL, D	20 ± 4	22 ± 3	0.09 (-3.83; 0.30)
Axial length, mm	24.1 ± 1.7	23.5 ± 0.9	0.04 (0.02; 1.2)
Post CDVA, LogMAR	-0.01 ± 0.05	-0.05 ± 0.05	0.001 (0.02; 0.07)

CI, confidence interval; CDVA, corrected distance visual acuity; IOL, intra-ocular lens; post, postoperative.

**FineVision Micro F IOL is not FDA approved; data on non-FDA approved devices are not shown in results*

Comparison of Visual Quality and Subjective Outcomes Among Three Trifocal IOLs and One Bifocal IOL

Visual Acuity
Contrast Sensitivity
Patient-Reported Outcomes

Martinez de Carneros-Llorente et al. *J Cataract Refract Surg.* 2019;45:587-594

OVERVIEW

STUDY DESIGN
Prospective case series to compare visual quality and subjective outcomes between PanOptix®, AT LISA® tri 839MP, FineVision, and TECNIS ZLB00 IOLs

STUDY SITE(S)
One center in Spain

PATIENTS
Three-hundred twenty (320) eyes of 160 patients

METHODOLOGY
IOL performance evaluated 6 months after bilateral cataract surgery

IOL TYPE(S)*
AcrySof® IQ PanOptix®; AT LISA® tri 839MP; FineVision; TECNIS ZLB00

KEY ENDPOINT(S)
Uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), and distance-corrected near visual acuity (DCNVA); reading speed; contrast sensitivity; National Eye Institute Visual Function Questionnaire-25 (NEI VQF-25)

ANALYSIS AND CONCLUSIONS

The PanOptix® IOL provided better intermediate distance vision than the bifocal IOL TECNIS ZLB00 without compromising distance or near vision.

PanOptix® yielded differences in visual performance, especially in intermediate and near vision at medium and low contrast.

STUDY RESULTS

VISUAL ACUITY
- Six months postoperatively, there were no statistically significant between-group differences in UDVA, CDVA, and DCNVA
- The defocus curves at 100%, 50%, and 15% contrast showed PanOptix® had better intermediate performance than bifocal TECNIS ZLB00 and comparable outcomes at far and near distances **(Figure 1)**
- Visual acuity in the PanOptix® group was significantly better than in the bifocal group with a defocus of -1.00 D (P<0.01) and a defocus of -1.50 D and -2.00 D (P<0.02) (**Figure 1**)

OTHER VISUAL OUTCOMES
- There were no statistically significant between-group differences in contrast sensitivity function under photopic and mesopic conditions (**Figure 2**)
- There were no statistically significant differences in the postoperative NEI VFQ-25 questionnaire scores between the 4 IOL groups
- No between-group differences were found in binocular reading acuity, maximum reading speed, reading speed at 0.4 logRAD, or critical print size

Figure 1. Monocular distance-corrected defocus curves 6 months post-IOL implantation. Adapted from Martinez de Carneros-Llorente et al. *J Cataract Refract Surg.* 2019;45:587-594.

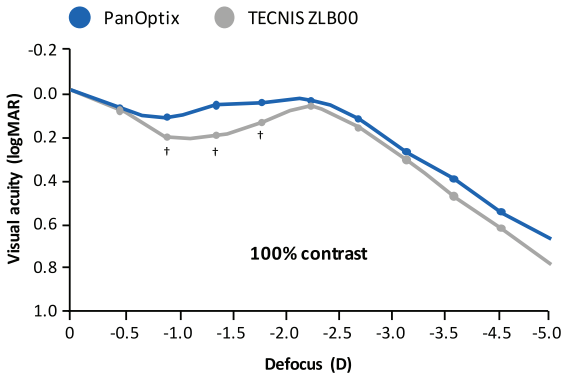
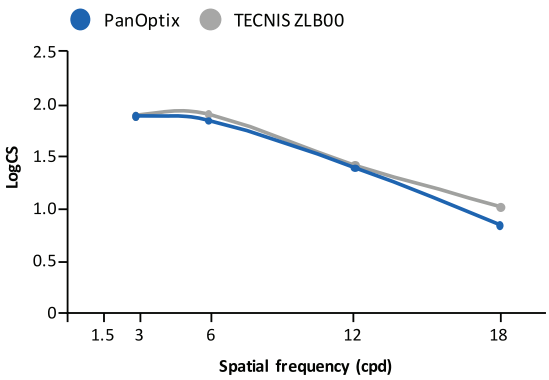


Figure 2. Monocular distance contrast sensitivity function under photopic conditions 6 months post-IOL implantation. Adapted from Martinez de Carneros-Llorente et al. *J Cataract Refract Surg.* 2019;45:587-594.



†Statistically significant difference between PanOptix® and TECNIS ZLB00

**AT LISA® tri 839MP IOL and FineVision IOL are not FDA approved; data on non-FDA approved devices are not shown in results*

Comparative Analysis of Visual Outcomes, Reading Skills, Contrast Sensitivity, and Patient Satisfaction with Two Models of Trifocal Diffractive IOLs and an Extended Range of Vision IOL

Visual Acuity
Contrast Sensitivity
Visual Phenomena
Patient-Reported Outcomes

Mencucci et al. Graefes Arch *Clin Exp Ophthalmol*. 2018;256:1913-1922

OVERVIEW

STUDY DESIGN
Non-randomized prospective series of cases to compare visual performance between PanOptix®, AT LISA® tri 839MP, and TECNIS Symfony® IOLs

STUDY SITE(S)
One center in Italy

PATIENTS
One-hundred twenty (120) eyes of 60 patients (40 eyes for each IOL group)

METHODOLOGY
IOL performance evaluated 3 months after bilateral cataract surgery

IOL TYPE(S)*
AcrySof® IQ PanOptix®; AT LISA® tri 839MP; TECNIS Symfony®

KEY ENDPOINT(S)
Visual results, photopic and mesopic contrast sensitivity, binocular reading skills, and patient satisfaction; intermediate visual acuity (VA) was measured at 80 cm for all IOLs, plus at 60 cm for PanOptix®. Comparisons of mesopic intermediate VA were made between PanOptix® at 60 cm and AT LISA® and Symfony® at 80 cm

ANALYSIS AND CONCLUSIONS

PanOptix® and TECNIS Symfony® provided very good visual performance at all distances, with a 100% overall satisfaction and a high level of spectacle independence.

While PanOptix® provided better near visual acuity, TECNIS Symfony® provided higher binocular visual acuity outcomes at intermediate (80cm) distances in mesopic conditions and better contrast sensitivity.

STUDY RESULTS

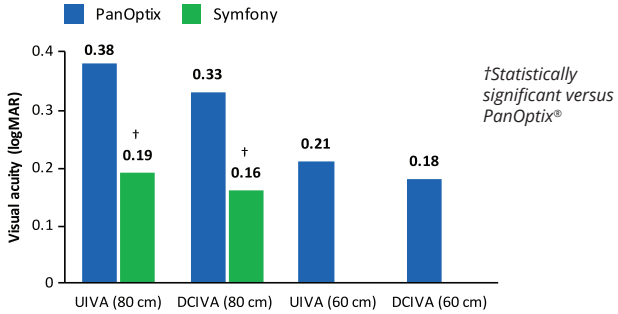
VISUAL ACUITY

- Monocular and binocular uncorrected distance visual acuity (UDVA) and corrected distance visual acuity (CDVA) under photopic and mesopic conditions were not significantly different for the IOLs after follow-up at 3 months
- Under photopic conditions, PanOptix® showed better near-visual outcomes compared with TECNIS Symfony®
- Significant differences were mainly seen under mesopic conditions at 80 cm for uncorrected intermediate visual acuity (UIVA) and distance-corrected intermediate visual acuity (DCIVA), with Symfony® performing significantly better than PanOptix® (**Figure 1**)
- PanOptix® performed significantly better at 60 cm vs 80 cm for UIVA and DCIVA; and performed better than Symfony® at 80 cm

OTHER VISUAL OUTCOMES

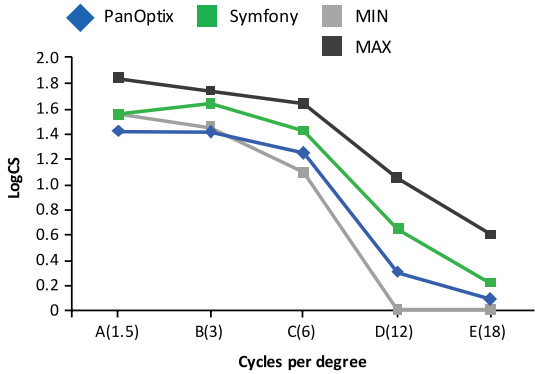
- All groups achieved contrast sensitivity results within the physiologic contrast sensitivity range set for the measuring device for normal subjects of similar age; as expected, contrast sensitivity was lower under mesopic condition, especially at low spatial frequencies (**Figure 2**)
- Reading skills were not significantly different between the IOL models (P>0.05)
- The patient self-evaluation revealed a perception of halos in 70% of patients and glare in 50% of patients in each group
- Patients in the Symfony® group reported a slightly higher frequency of usage of reading glasses (40% needed reading glasses for some activities, vs. 33% of patients implanted with a trifocal IOL

Figure 1. Mesopic monocular intermediate visual outcomes 3 months post-IOL implantation. Data derived from Mencucci et al. *Graefes Arch Clin Exp Ophthalmol*. 2018;256:1913-1922.



*AT LISA® tri 839MP IOL is not FDA approved; data on non-FDA approved devices are not shown in results

Figure 2. Mesopic contrast sensitivity 3 months post-IOL implantation. Adapted from Mencucci et al. *Graefes Arch Clin Exp Ophthalmol.* 2018;256:1913-1922.



Visual and Patient-Reported Outcomes of a Diffractive Trifocal IOL Compared with Those of a Monofocal IOL

Visual Acuity
Visual Phenomena
Patient-Reported Outcomes

Modi et al. *Ophthalmology*. 2020; In press

OVERVIEW

STUDY DESIGN
Prospective, non-randomized, parallel-group, assessor-masked study to evaluate the effectiveness and safety of a trifocal intraocular lens (IOL), TFNT00, versus a monofocal IOL, SN60AT

STUDY SITE(S)
Multiple study centers in the US

PATIENTS
Two hundred and forty-three (243) patients

METHODOLOGY
Participants selected their preferred IOL, which was sequentially implanted into each eye following removal of bilateral cataract by phacoemulsification with a clear corneal incision

IOL TYPE(S)
AcrySof® IQ PanOptix®, AcrySof® NATURAL

KEY ENDPOINT(S)
Mean photopic monocular best-corrected distance visual acuity (BCDVA; 4 m), distance-corrected near visual acuity (DCNVA; 40 cm) at 6 months postoperatively (co-primary), mean monocular distance-corrected intermediate visual acuity (DCIVA; 66 cm), proportion of who were spectacle free in the past 7 days (secondary), binocular visual acuities, defocus curve (supportive), and safety outcomes

ANALYSIS AND CONCLUSIONS

The authors report that PanOptix® exhibited superior monocular DCNVA and DCIVA to a spherical monofocal IOL, with comparable monocular BCDVA.

Binocular visual acuity was 20/25 or better for distance to near (+0.5D to -2.5D), resulting in high levels of spectacle independence; less than 5% of patients were very bothered by the photic visual disturbances.

STUDY RESULTS

MONOCULAR VISUAL ACUITY
- After 6 months postoperative follow-up the study demonstrated:
  - Non-inferiority of PanOptix® (n=129) to SN60AT (n=114) in mean photopic monocular BCDVA (95% UCL of the difference was <0.1 logMAR margin)
  - Superiority in mean photopic monocular DCNVA (difference of 0.42 logMAR; P<0.001) and DCIVA (difference of 0.26 logMAR; P<0.001

BINOCULAR VISUAL ACUITY
- Binocular visual acuity was 20/25 or better for distance to near (+0.5D to -2.5D)
- Both the TFNT00 and SN60AT groups achieved a mean binocular BCDVA better than 0.0 logMAR at Month 6 (-0.062 [95% CI -0.074, -0.051] versus -0.086 [95% CI -0.098, -0.074], respectively)
  - The observed difference in favor of SN60AT compared with PanOptix® for mean binocular BCDVA was not clinically relevant (corresponding to 1 letter)
- PanOptix® exhibited a clinically, significantly better mean DCIVA compared with SN60AT (<0.0 logMAR and >0.2 logMAR, respectively), and a mean DCNVA approximately 4 logMAR lines better than that of SN60AT (0.05 logMAR and 0.40 logMAR, respectively)

DEFOCUS CURVE
- The binocular defocus curve for PanOptix® showed greater visual acuity for defocus range of -1.00 D to -2.50 D (difference of 4 lines of logMAR at -2.50 D).

SAFETY
- Starbursts, halos, and glare were the most frequently rated "severe" symptoms with PanOptix®; however, less than 5% of patients were very bothered at Month 6.
  - Mean binocular contrast sensitivity was reduced for PanOptix® compared with SN60AT groups at 6, 12, and 18 cycles per degree (cpd) in photopic conditions with/without glare and at 6 and 12 cpd in mesopic conditions with/without glare

PATIENT-REPORTED OUTCOMES
- The proportion of recipients reporting being "satisfied" or "very satisfied" with their vision at Month 6 was similar between PanOptix® and SN60AT groups (95.3% and 90.9%, respectively)
- 80.5% of patients receiving PanOptix® reported "never" requiring glasses vs 8.2% for SN60AT

Visual Performance After Bilateral Implantation of 2 New Presbyopia-Correcting IOLs: Trifocal vs Extended Range of Vision

Visual Acuity
Visual Phenomena
Patient-Reported Outcomes

Monaco et al. *J Cataract Refract Surg.* 2017;43:737-747

OVERVIEW

STUDY DESIGN
Prospective case series comparing visual outcomes and quality of vision of 2 diffractive multifocal IOLs with those of a monofocal IOL

STUDY SITE(S)
One center in Italy

PATIENTS
One hundred-twenty (120) eyes of 60 patients

METHODOLOGY
IOL performance evaluated 4 months after bilateral cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®; TECNIS Symfony® ZXR00; AcrySof® SN60WF monofocal

KEY ENDPOINT(S)
Primary: monocular distance-corrected near visual acuity (DCNVA); other outcomes included monocular uncorrected (UDVA) and corrected (CDVA) distance visual acuities; binocular defocus curves; aberrometry; and results of quality-of-vision questionnaires

ANALYSIS AND CONCLUSIONS

The study data suggest that both multifocal IOLs (PanOptix® and Symfony®) may be good options for patients with intermediate vision requirements, whereas the PanOptix® IOL might be preferable for patients with near vision requirements.

The significant perception of visual side effects indicates that patients still must be counseled about these effects before a multifocal IOL is implanted.

STUDY RESULTS

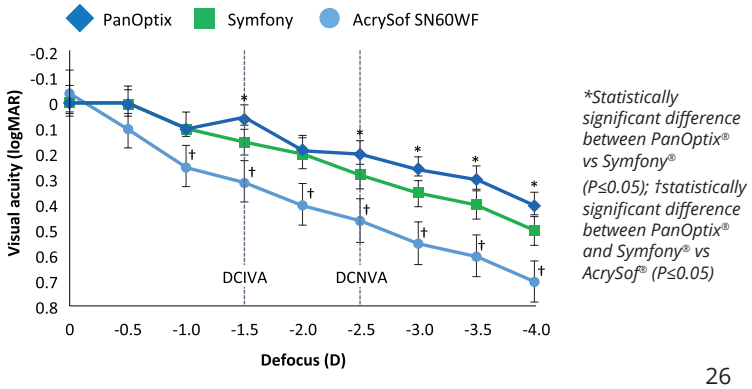
VISUAL ACUITY

- DCNVA was significantly better in the PanOptix® group than in the Symfony® group at 4 months post-implantation; both multifocal IOL groups had better results than the monofocal group
- No differences were found in UDVA and CDVA between PanOptix® and Symfony® or compared to the AcrySof® SN60WF monofocal group
- For distance-corrected intermediate visual acuity both PanOptix® and Symfony® had better results than the monofocal group
- When mean binocular visual acuity with correction for distance vision was measured 4 months postoperatively, results were statistically significantly better with PanOptix® than with Symfony® for a vergence of -1.5 D and from -2.5 D to -4.0 D **(Figure 1)**
- In addition, visual acuity was significantly better in the PanOptix® and Symfony® groups than in the AcrySof® SN60WF monofocal group for defocus vergences from -1.0 D to -4.0 D **(Figure 1)**

OTHER VISUAL OUTCOMES

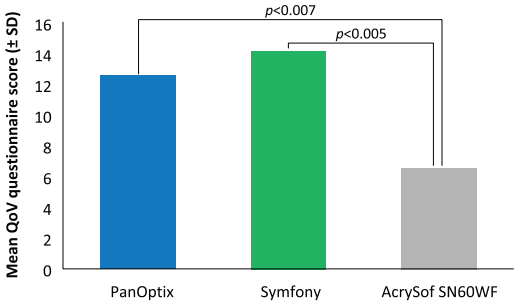
- Intragroup comparison of the total higher-order aberrations, point-spread function, modulation transfer function, and retinal straylight were not statistically different
- Both PanOptix® and Symfony® groups wore spectacles for significantly less time than the monofocal group for general purposes and for near and intermediate tasks
  - 100% of PanOptix® and Symfony® patients said they never wore spectacles for intermediate tasks (e.g., computer use), compared with 15% of monofocal IOL patients
- The quality-of-vision questionnaire results showed no differences in dysphotopsia between the PanOptix® and Symfony® groups; however, the results were significantly higher than in the monofocal group **(Figure 2)**

Figure 1. Distance-corrected mean binocular visual acuity 4 months after IOL implantation.



**Statistically significant difference between PanOptix® vs Symfony® (P≤0.05); †statistically significant difference between PanOptix® and Symfony® vs AcrySof® (P≤0.05)*

Figure 2. Quality of vision questionnaire score 4 months after IOL implantation. Figure adapted from data presented in Monaco G et al. *J Cataract Refract Surg.* 2017;43:737-747



Visual Quality and Patients' Satisfaction with a Trifocal IOL and Its Novel Toric Version

Rementería-Capelo et al. *J Cataract Refract Surg.* 2019. Epub ahead of print.

Visual Acuity
Contrast Sensitivity
Patient-Reported Outcomes

OVERVIEW

STUDY DESIGN
Prospective case series to assess and compare the visual quality and subjective outcomes of a trifocal IOL and its novel toric version

STUDY SITE(S)
One center in Spain

PATIENTS
Two hundred-fifty (250) eyes of 125 patients

METHODOLOGY
IOL performance evaluated 3 months after bilateral cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®; PanOptix® Toric

KEY ENDPOINT(S)
Monocular and binocular uncorrected and corrected distance, intermediate and near visual acuity, binocular defocus curves, binocular contrast sensitivity, Catquest 9-SF patient satisfaction questionnaire

ANALYSIS AND CONCLUSIONS

No significant differences were seen between the toric and non-toric version of PanOptix® with respect to monocular distance, intermediate, and near visual acuity or for scores on the patient satisfaction questionnaire.

After correct implantation and alignment, visual quality and patient satisfaction with PanOptix® Toric IOL were excellent and can be considered as directly comparable to the non-toric version of PanOptix®.

STUDY RESULTS

VISUAL ACUITY

- Three months after surgery, no differences between PanOptix® designs were observed for monocular visual outcomes at distance, intermediate, and near vision **(Table 1)**
- Bifocal defocus curves for both PanOptix® designs were almost overlapping, and no statistically significant differences were found for any vergence; a visual acuity of 0.1 LogMAR or better was achieved between +0.50 and -2.5 D for both groups **(Figure 1)**

OTHER VISUAL OUTCOMES

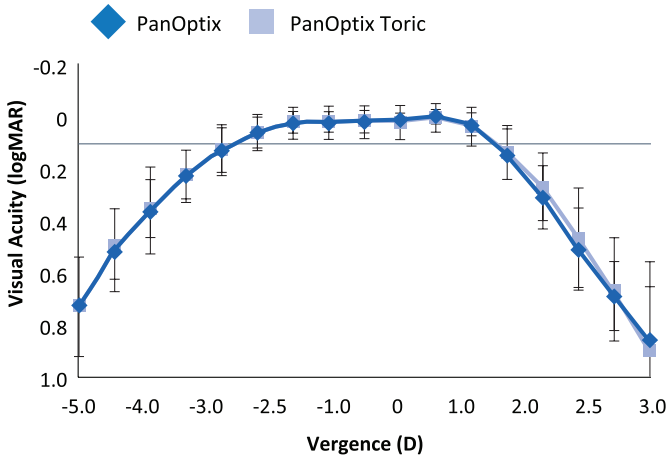
- No differences in contrast sensitivity were found between either PanOptix® design; thus toricity does not seem to induce a worsening of visual quality for the PanOptix® platform
- The scores reported in the Catquest 9-SF questionnaire showed high rates of patient satisfaction with both PanOptix® designs; there were no differences between groups for any variable, including daily life difficulty and satisfaction with current vision

Table 1. Monocular visual acuity values 3 months after bilateral cataract surgery.

	PanOptix® n=166	PanOptix® Toric n=84	P-value
CDVA	0.04 ± 0.06	0.06 ± 0.07	0.09
UDVA	0.06 ± 0.07	0.07 ± 0.10	0.12
DCIVA	0.21 ± 0.10	0.24 ± 0.17	0.07
UIVA	0.20 ± 0.10	0.23 ± 0.20	0.06
DCNVA	0.05 ± 0.08	0.05 ± 0.09	0.49
UNVA	0.05 ± 0.07	0.07 ± 0.12	0.16

UDVA, uncorrected distance visual acuity; CDVA, corrected distance visual acuity; UIVA, uncorrected intermediate visual acuity; UNVA, uncorrected near visual acuity; D, diopters. Data are presented as mean ± SD.

Figure 1. Binocular defocus curves 3 months after bilateral cataract surgery.



Automated Refraction after Trifocal and Trifocal Toric IOL implantation

Rementería-Capelo et al. *Eur J Ophthalmol.* 2020;1120672120914848

OVERVIEW

STUDY DESIGN
Cross-sectional study to analyze the correlation between automated refraction and manifest refraction after implantation of a trifocal IOL or its toric version

STUDY SITE(S)
Single center in Spain

PATIENTS
One hundred and five (105) eyes of 105 patients

METHODOLOGY
Patients received trifocal (n=62) or trifocal toric (n=43) IOLs; 3 months after surgery, automated refraction was employed as starting point for obtaining the manifest refraction; refractions were compared using vector analysis (M, J0, J45)

IOL TYPE(S)
AcrySof® IQ PanOptix®, AcrySof® IQ PanOptix® Toric

KEY ENDPOINT(S)
Automated refraction and manifest refraction measurements were analyzed and compared using the vector analysis

ANALYSIS AND CONCLUSIONS

The PanOptix® IOL and its toric version showed similar automated refraction results between them, with a slight trend to more negative amounts of cylinder and spherical equivalent (M) of about −0.50 D.

The authors recommend that clinicians confirm all parameters of the refraction with manifest refraction.

STUDY RESULTS

COMPARING AUTOMATED AND MANIFEST REFRACTION

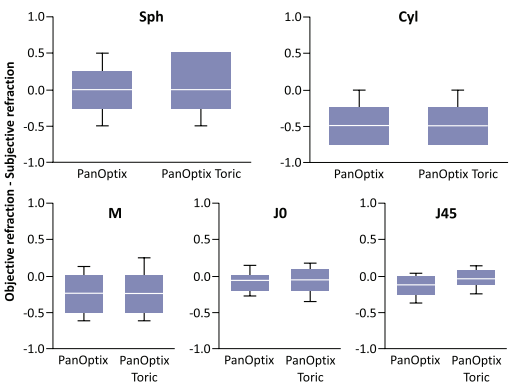
- The only parameter for which there was no statistically significant (P=0.38) difference between AR and MR was the sphere in the PanOptix® group (**Table 1**)
- The greatest differences between automated refraction and manifest refraction measurements were seen in the cylinder and the spherical equivalent (M)
- Cylinder values:
  - PanOptix®: -0.60 ± 0.36 D with automated refraction and -0.17 ± 38 D with manifest refraction (P<0.001)
  - PanOptix® Toric, the values were: -0.49 ± 0.31 D with automated refraction and -0.05 ± 0.21 D with manifest refraction (P<0.001)
- M values
  - PanOptix®: -0.23 ± 0.31 D with automated refraction and -0.03 ± 0.16 D with manifest refraction (P<0.001)
  - PanOptix® Toric: -0.13 ± 0.40 D with automated refraction and 0.01 ± 0.12 D with manifest refraction (P<0.001)
- Comparing PanOptix® and PanOptix® Toric groups, the differences for the sphere, cylinder, M, J0, and J45 measured with AR and MR were similar, and no statistically significant differences were found (P>0.05 for all cases) (**Figure 1**)
- For the PanOptix® group, intraclass correlation coefficients were: 0.51 (sphere), 0.64 (cylinder), 0.42 (M), 0.62 (J0), and 0.37 (J45)
- For the PanOptix® Toric group, the intraclass correlation coefficients were: 0.39 (sphere), 0.61 (cylinder), 0.39 (M), 0.53 (J0), and 0.09 (J45)

Table 1. Averaged values ± standard deviations of the sphere, cylinder, M, J0, and J45 3 months after surgery for both methods of refraction: AR and MR

	Method	Sphere	Cylinder	M	J0	J45
PanOptix®	AR	0.07 ± 0.34	−0.60 ± 0.36	−0.23 ± 0.31	−0.12 ± 0.24	−0.16 ± 0.17
	MT	0.06 ± 0.19	−0.17 ± 0.38	−0.03 ± 0.16	−0.04 ± 0.18	−0.03 ± 0.10
P		0.38	<0.001	<0.001	<0.001	<0.001
PanOptix® Toric	AR	0.17 ± 0.42	−0.49 ± 0.31	−0.13 ± 0.40	−0.08 ± 0.23	−0.04 ± 0.15
	MR	0.03 ± 0.17	−0.05 ± 0.21	0.01 ± 0.12	−0.03 ± 0.11	0.00 ± 0.01
P		0.03	<0.001	<0.001	<0.001	<0.001

AR: automated refraction; MR: manifest refraction.
Values are expressed in diopters (D). p values reflected are those for the comparison between AR and MR for each of the groups.

Figure 1. Difference between automated refraction (AR) and manifest refraction (MR) for sphere (Sph), cylinder (Cyl), spherical equivalent (M), and power vectors of astigmatism (J0 and J45) of both groups (PanOptix® and PanOptix® Toric).



Comparison of Clinical Outcomes of Three Trifocal Intraocular Lenses

Ribeiro et al. *J Cataract Refract Surg.* 2020 Apr 15. Online ahead of print

Visual Acuity
Contrast Sensitivity
Patient-Reported Outcomes

OVERVIEW

STUDY DESIGN
Prospective randomized study to compare the clinical outcomes obtained after implantation of 1 of 3 models of trifocal diffractive IOLs

STUDY SITE(S)
Single center in Portugal

PATIENTS
Ninety (90) eyes of 45 patients

METHODOLOGY
IOL performance 3 months after bilateral cataract surgery

IOL TYPE(S)*
AcrySof® IQ PanOptix®, FineVision POD F, RayOne Trifocal

KEY ENDPOINT(S)
Visual acuity, refraction, defocus curve, and contrast sensitivity outcomes; quality-of-vision questionnaire to evaluate frequency, severity, and discomfort of different visual symptoms

ANALYSIS AND CONCLUSIONS

This study showed that the PanOptix® trifocal IOL provided functional levels of distance, intermediate, and near visual acuity, high levels of spectacle independence and induced a significant positive impact on quality of life.

STUDY RESULTS

VISUAL ACUITY

- Postoperative binocular uncorrected intermediate visual acuity of 0.10 logMAR or better was found in 14 (93.33%) PanOptix® patients (**Figure 1**)
- Postoperative binocular uncorrected near visual acuity of 0.10 logMAR or better was found in 13 (86.67%) patients (**Figure 1**)
- Overall, 23 (76.67%) of eyes implanted with PanOptix® had a postoperative spherical equivalent within ±0.50 D
- There was no loss of visual acuity for defocus levels simulating intermediate vision, with the best level of visual acuity achieved at 4 m (0.00 D of defocus) and for near vision at 33 cm (-3.00 D of defocus) (**Figure 2**)

CONTRAST SENSITIVITY/QUALITY OF VISION

- The contrast sensitivity data for PanOptix® were consistent with those obtained in previous studies
- Quality of vision scores associated with disturbing visual symptoms in general were low similar to prior publications compared to the RayOne group (P=0.048)

Figure 1. Three-month postoperative binocular uncorrected distance (UDVA), intermediate (UIVA) and near visual acuity (UNVA) for PanOptix®. Ribeiro et al. *J Cataract Refract Surg*. 2020 Apr 15. Online ahead of print.

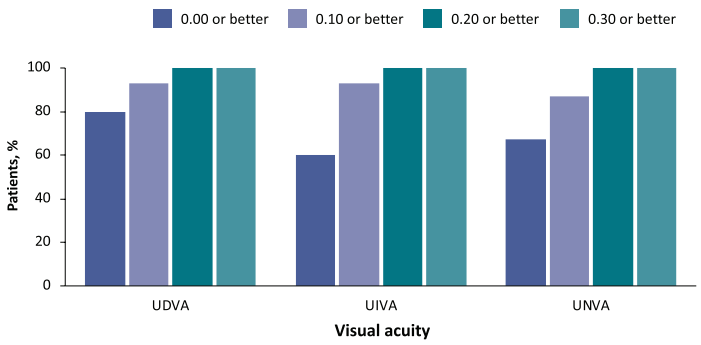
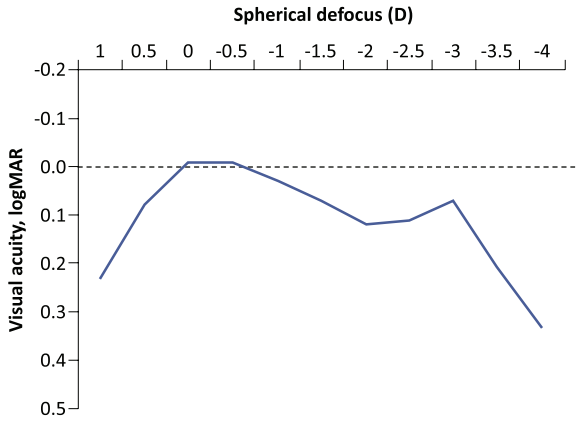


Figure 2. Mean 3-month postoperative binocular defocus curve for PanOptix®. Ribeiro et al. *J Cataract Refract Surg.* 2020 Apr 15. Online ahead of print.



**FineVision POD F and RayOne Trifocal IOLs are not FDA approved; data on non-FDA approved devices are not shown in results.*

Comparison of Visual and Refractive Outcomes of 2 Trifocal Intraocular Lenses

Ribeiro et al. *J Cataract Refract Surg.* 2020;46:694-699

Visual Acuity

Contrast Sensitivity

Patient-Reported Outcomes

OVERVIEW

STUDY DESIGN

Double-arm, randomized, prospective case series to compare clinical outcomes after cataract surgery and bilateral implantation of 2 diffractive trifocal toric IOLs

STUDY SITE(S)

Single center in Portugal

PATIENTS

One hundred twenty (120) eyes of 60 patients

METHODOLOGY

IOL performance 3 months after bilateral cataract surgery

IOL TYPE(S)*

AcrySof® IQ PanOptix® and FineVision POD F toric IOLs

KEY ENDPOINT(S)

Visual and refractive outcomes, contrast sensitivity, IOL misalignment, and quality of vision questionnaire); surgically induced astigmatic changes evaluated by vector analysis

ANALYSIS AND CONCLUSIONS

This study demonstrated that the PanOptix® toric IOL provided functional levels of distance, intermediate, and near visual acuity and a predictable refractive correction leading to high levels of spectacle independence, quality of vision and patient satisfaction.

STUDY RESULTS

VISUAL ACUITY

- Three months after PanOptix® implantation, mean distance-corrected intermediate visual acuity was 0.04 ± 0.09 logMAR at 60 cm and 0.06 ± 0.10 logMAR at 80 cm, while uncorrected values at 60 cm and 80 cm were 0.05 ± 0.08 logMAR and 0.07 ± 0.09 logMAR, respectively (**Table 1**)
- Uncorrected distance visual acuity was 0.06 ± 0.11 logMAR, and corrected distance visual acuity was 0.03 ± 0.09 logMAR (**Table 1**)
- Uncorrected near visual acuity was 0.05 ± 0.10 logMAR, and distance-corrected near visual acuity was 0.02 ± 0.11 logMAR (**Table 1**)
- The PanOptix defocus curve demonstrated good visual acuity from distance to near and were in accordance with previous reports (**Figure 1**)

OTHER OUTCOMES

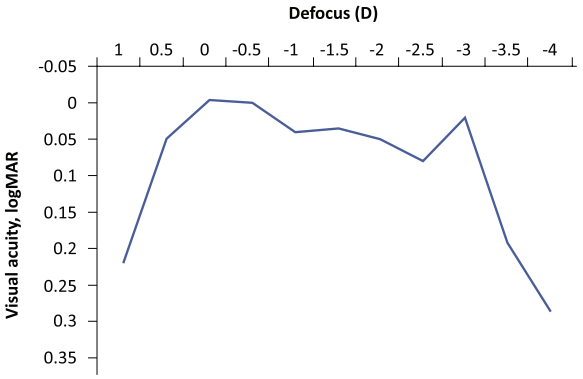
- Mean IOL axis misalignment was 1.59 degrees ± 2.15 degrees in PanOptix® patients and mean magnitude of error of astigmatic correction was -0.09 D
- The contrast sensitivity results for PanOptix® were consistent with those reported in other studies evaluating PanOptix® and other presbyopia mitigating IOLs
- The incidence of photic phenomena with the PanOptix® trifocal toric IOL was low
- All patients implanted with PanOptix® achieved spectacle independence, reporting they "never" wear spectacles for any of the distances evaluated

Table 1. Mean 3-month postoperative data for visual acuity with the PanOptix® toric IOL. Adapted from Ribeiro et al. *J Cataract Refract Surg.* 2020;46:694-699.

Parameter	PanOptix®
UDVA (logMAR)	0.06 ± 0.11
CDVA (logMAR)	0.03 ± 0.09
UIVA at 60 cm (logMAR)	0.05 ± 0.08
DCIVA at 60 cm (logMAR)	0.04 ± 0.09
UIVA at 80 cm (logMAR)	0.07 ± 0.09
DCIVA at 80 cm (logMAR)	0.06 ± 0.10
UNVA (logMAR)	0.05 ± 0.10
DCNVA (logMAR)	0.02 ± 0.11

CDVA, corrected distance visual acuity; DCIVA. distance-corrected intermediate visual acuity; DCNVA, distance-corrected near visual acuity; UDVA, uncorrected distance visual acuity; UIVA, uncorrected intermediate visual acuity; UNVA, uncorrected near visual acuity.

Figure 1. Binocular photopic defocus curves for the PanOptix® toric IOL. Adapted from Ribeiro et al. *J Cataract Refract Surg.* 2020;46:694-699.



**FineVision POD F toric IOL is not FDA approved; data on non-FDA approved devices are not shown in results.*

Comparison of 9 Modern IOL Power Calculation Formulas for the PanOptix® IOL

Shajari et al. *J Cataract Refract Surg.* 2018;44:942

OVERVIEW

STUDY DESIGN
Retrospective case series to evaluate the accuracy of nine formulas for IOL power calculation of the PanOptix® IOL

STUDY SITE(S)
Single center in Germany

PATIENTS
Seventy-five (75) eyes of 38 patients having cataract surgery with insertion of a PanOptix® IOL over 15 months **(Table 1)**

METHODOLOGY
Cataract surgery with preoperative biometry using IOL Master 500 to calculate IOL power

IOL TYPE(S)
AcrySof® IQ PanOptix®

KEY ENDPOINT(S)
Differences in mean absolute prediction error among the 9 formulas for IOL power calculation

ANALYSIS AND CONCLUSIONS

The most accurate predictions of actual postoperative refraction were achieved using the Barrett Universal II, Hill-RBF, Olsen, or T2 formula. The lowest mean absolute prediction error was obtained with the Barrett Universal II (0.294 D).

This study is the first published comparison of the performance of formulas predicting postoperative refractive outcome after implantation of the PanOptix® IOL, providing surgeons with a basis for formula selection.

STUDY RESULTS

PREDICTION ERROR FOR EACH FORMULA

- The Barrett Universal II and Hill-RBF had the lowest mean absolute error (MAE), whereas the highest MAEs were seen using the Holladay 2 and Hoffer Q **(Table 2)**
- The differences in absolute errors between the formulas were statistically significant ($P < 0.001$)
- With a Bonferroni correction, the Hill-RBF had statistically significant lower absolute error than the Hoffer Q ($P=0.001$), Holladay 1 ($P = 0.006$), Holladay 2 ($P=0.003$), and SRK/T ($P=0.0001$)
- The Barrett Universal II outperformed the Hoffer Q ($P=0.002$) and SRK/T ($P=0.001$)

PERCENTAGE OF EYES WITHIN SPECIFIED RANGE

- The Olsen and Barrett Universal II formulas showed the highest percentages of eyes within a prediction error of ±0.25 D, whereas the lowest percentages of eyes within this prediction error target were seen with third-generation formulas
- Sixty eyes (80%) were within a prediction error of ±0.50 D using the Barrett Universal II, Haigis, Hill-RBF, and Olsen
- The Hill-RBF resulted in the highest percentage of eyes within a prediction error of ±1.00 D

Table 1. Study population characteristics (N=75 eyes).

Parameter	Value
Female, %	54.5
Eye used, % Left Right	 50.7 49.3
Mean age (y) ± SD	63.6 ± 9.2
Mean AL (mm) ± SD	23.80 ± 1.27
Mean ACD (mm) ± SD	3.29 ± 0.43
Mean K value (D) ± SD	42.60 ± 1.79
Mean WTW distance (mm) ± SD	12.03 ± 0.42
Mean IOL power (D) ± SD	21.19 ± 3.32

ACD, anterior chamber depth; AL, axial length; IOL intraocular lens; K, average keratometry; WTW, white-to-white

Table 2. Mean absolute error for each formula. Adapted from Shajari et al. *J Cataract Refract Surg.* 2018;44:942.

Formula	MAE	Optimized Lens Constants
Barrett Universal II	0.294	Lens factor=2.10
Haigis	0.382	a0, a1, a2=1.562, 0.4, 0.1, respectively
Hill-RBF	0.332	A-constant=119.33
Hoffer Q	0.410	Personalized ACD=5.800
Holladay 1	0.381	Surgeon factor=2.042
Holladay 2	0.399	ACD=5.67
Olsen	0.339	ACD=4.81
SRK/T	0.393	A-constant=119.408
T2	0.351	A-constant=119.345

ACD, anterior chamber depth; RBF, radial basis function; SRK/T, Sanders-Retzlaff-Kraff/theoretical

Influence of Angle κ and Higher-Order Aberrations on Visual Quality Employing Two Diffractive Trifocal IOLs

Velasco-Barona et al. *J Ophthalmol.* 2019;2019:7018937

OVERVIEW

STUDY DESIGN
Prospective, randomized, comparative, and controlled study to estimate the association between angle kappa (κ) distance and higher-order aberrations (HOAs) with postoperative visual acuity after presbyopia-mitigating IOL implantation

STUDY SITE(S)
Single center in Mexico

PATIENTS
Forty-three (43) eyes of 43 patients

METHODOLOGY
IOL performance evaluated 6 months after cataract surgery

IOL TYPE(S)*
AcrySof® IQ PanOptix®, AT LISA® tri 839MP

KEY ENDPOINT(S)
Angle κ distance (extrapolated distance that overlapped the center of the pupil and the corneal reflex); total and internal aberrations; uncorrected distance visual acuity (UDVA), uncorrected near visual acuity (UNVA), and uncorrected intermediate visual acuity (UIVA)

ANALYSIS AND CONCLUSIONS

This study showed that patients implanted with PanOptix® had excellent postoperative visual performance at all distances after 6 months.

No significant correlation was observed between postoperative visual acuity and angle κ distance, suggesting that the influence of angle κ has no significant effect on visual acuity when using these trifocal IOLs.

STUDY RESULTS

VISUAL ACUITY AND ANGLE KAPPA

- At 6 months postoperatively, UDVA for PanOptix® was 0.092 ± 0.10, UIVA was 0.173 ± 0.18, UNVA was 0.068 ± 0.04, and angle κ distance was 0.337 ± 0.15 mm (**Table 1**)

OTHER OUTCOMES

- Pearson correlation coefficient and linear regression analyses were obtained between angle κ distance and UDVA, UNVA, and UIVA, showing a nonsignificant mild inverse correlation (**Table 2**)
- A Pearson correlation coefficient was also obtained between angle κ distance and total HOAs and internal aberrations, showing a mild nonsignificant positive correlation
- The correlation coefficient between HOAs and the Strehl ratio for PanOptix® was -0.768 (P<0.0001)

Table 1. Mean visual acuity and angle κ values per group at the six-month follow-up visit.

Parameter	Value	PanOptix®
UDVA (logMAR)	Mean ± SD Range	0.092 ± 0.10 0–0.39
UIVA (logMAR)	Mean ± SD Range	0.173 ± 0.18 0–0.91
UNVA (logMAR)	Mean ± SD Range	0.068 ± 0.04 0–0.09
Angle κ distance (mm)	Mean ± SD Range	0.337 ± 0.15 0.10–0.62

Angle κ, angle kappa; UDVA, uncorrected distance visual acuity; UIVA, uncorrected intermediate visual acuity; UNVA, uncorrected near visual acuity.

Table 2. Correlation between angle κ distance and UDVA, UNVA, and UIVA.

	r	95% CI	R2	P-value†
PanOptix® (n=23) UDVA (logMAR) UIVA (logMAR) UNVA (logMAR)	 0.127 −0.279 −0.095	 −0.52, −0.31 −0.62, 0.16 −0.49, 0.33	 0.016 0.077 −0.009	 0.573 0.208 0.671

UDVA, uncorrected distance visual acuity; UIVA, uncorrected intermediate visual acuity; UNVA, uncorrected near visual acuity.
†Pearson correlation coefficient (r)

** AT LISA® tri 839MP is not FDA approved; data on non-FDA approved devices are not shown in results.*

Comparison Between Bilateral Implantation of a Trifocal IOL and Blended Implantation of Two Bifocal IOLs

Visual Acuity

Contrast Sensitivity

Vilar et al. *Clin Ophthalmol.* 2017;11:1393-1397

OVERVIEW

STUDY DESIGN

Prospective, nonrandomized, consecutive study to assess visual outcomes and performance of PanOptix® compared with blended implantation of two bifocal IOLs

STUDY SITE(S)

One center in Brazil

PATIENTS

Forty (40) eyes of 20 patients

METHODOLOGY

IOL performance evaluated 1 month after bilateral cataract surgery

IOL TYPE(S)

AcrySof® IQ PanOptix®; ReSTOR® SV25T0 (dominant eye) and ReSTOR® SN6AD1 (non-dominant eye)

KEY ENDPOINT(S)

Binocular uncorrected and corrected distance visual acuity at 4 m (UDVA, CDVA); uncorrected intermediate at 60 cm (UIVA) and near at 40 cm (UNVA) visual acuity; contrast sensitivity; visual defocus curve

ANALYSIS AND CONCLUSIONS

Both lens combinations were able to provide good near, intermediate and distance vision, with the PanOptix® group showing significantly better performance at intermediate distances and better contrast sensitivity under photopic conditions.

More studies are needed to analyze different criteria and to increase the number of patients to improve statistical power.

STUDY RESULTS

VISUAL ACUITY

- CDVA, UDVA, UIVA, and UNVA were significantly greater with PanOptix® compared with blended implantation of bifocal ReSTOR® IOLs **(Table 1)**
- Binocular defocus curves showed the PanOptix® group achieved statistically significantly better visual acuity than the ReSTOR® group from -2.0 D to plano and at -3.5 D **(Figure 1)**

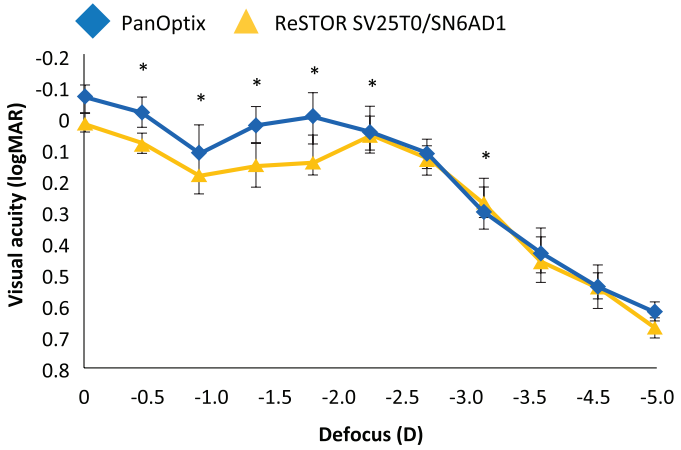
CONTRAST SENSITIVITY

- The PanOptix® group showed better results for photopic contrast sensitivity without glare at 6 (P=0.046), 12 (P<0.01) and 18 cycles / degree (cpd) (P<0.01)
- There were no significant differences for photopic contrast sensitivity with glare between groups at 3, 6 and 12 cpd; at 18 cpd, the PanOptix® group was better (P<0.01)
- Mesopic contrast sensitivity without glare showed no significant difference between groups
- Mesopic contrast sensitivity with glare showed that the blended group performed better at 3 (P<0.01), 6 (P=0.014) and 12 cpd (P<0.01); at 1.5 cpd, the PanOptix® group was better (P=0.023)

Table 1. Binocular uncorrected and corrected distance visual acuity 1 month post-IOL implantation. Adapted from Vilar C et al. *Clin Ophthalmol.* 2017;11:1393-1397

Parameter	PanOptix®	ReSTOR®	P-value
UDVA	0.01 ± 0.04 (−0.04 to 0.10)	0.08 ± 0.05 (−0.02 to 0.16)	<0.01*
UIVA	0.14 ± 0.05 (0.06–0.22)	0.22 ± 0.06 (0.12–0.34)	<0.01*
UNVA	−0.03 ± 0.04 (−0.1 to 0.06)	0.07 ± 0.03 (0.04–0.12)	<0.01*
CDVA	0.01 ± 0.06 (−0.10 to 0.16)	0.04 ± 0.06 (−0.06 to 0.14)	<0.01†

Figure 1. Binocular distance-corrected defocus curve 1 month post-IOL implantation. *P<0.05. Adapted from Vilar C et al. *Clin Ophthalmol.* 2017;11:1393-1397.



Comparison of Mix-and-Match Implanted Bifocal IOLs and Bilateral Implanted Trifocal IOLs After Femtosecond Laser–Assisted Cataract Surgery

Visual Acuity
Contrast Sensitivity
Patient-Reported Outcomes

Yesilirmak et al. *J Refract Surg.* 2019;35:559-564

OVERVIEW

STUDY DESIGN
To compare mix-and-match implanted bifocal IOLs and bilateral implanted trifocal IOLs after femtosecond laser–assisted cataract surgery

STUDY SITE(S)
One center in Turkey

PATIENTS
Seventy (70) eyes of 35 patients

METHODOLOGY
IOL performance evaluated 6 months after bilateral cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®; ReSTOR® (+2.50 D in the dominant eye and +3.00 D in the non-dominant eye)

KEY ENDPOINT(S)
Visual acuities, manifest refraction, defocus curve, contrast sensitivity, quality of life measured by the Visual Function Index (VF-14), and spectacle independence

ANALYSIS AND CONCLUSIONS

The study suggested that bilateral implanted PanOptix® IOLs provided better intermediate and near vision, defocus curve, and contrast sensitivity compared to mix-and-match implanted ReSTOR® IOLs.

However, similar vision-related quality of life and spectacle independence were achieved with PanOptix® and ReSTOR® IOLs.

STUDY RESULTS

VISUAL ACUITY

- There was no difference in uncorrected or corrected distance visual acuity outcomes between groups (P>0.05), but uncorrected intermediate visual acuity and uncorrected near visual acuity outcomes were significantly better in the PanOptix® group (P<0.01) 6 months after implantation **(Table 1)**
- Correspondingly, the binocular defocus curve of the PanOptix® IOLs showed significantly better visual acuity between -1.00 and -3.00 diopters compared to the ReSTOR® IOLs (P<0.05) **(Figure 1)**

OTHER VISUAL OUTCOMES

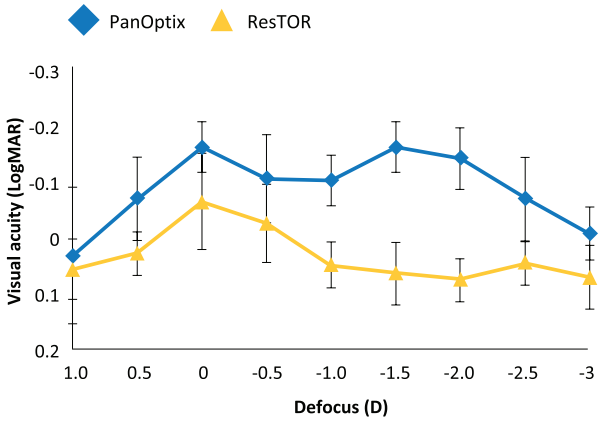
- The PanOptix® group showed higher contrast sensitivity scores than the ReSTOR® group for 12 and 18 cycles per degree (cpd) spatial frequencies in photopic conditions and for 18 cpd in mesopic conditions (P<0.05)
- No difference was observed between IOL groups with respect to post-op spherical equivalent and refractive cylinder **(Table 1)**
- The average VF-14 score was similar between groups (96.84 ± 2.82 in the PanOptix® group and 96.62 ± 2.40 in the ReSTOR® group)
- None of the patients in either IOL group required spectacles 6 months after surgery

Table 1. Comparison of 6-month postoperative visual outcomes between groups. Adapted from Yesilirmak et al. *J Refract Surg.* 2019;35:559-564

Outcome	ReSTOR®	PanOptix®	P-value
UDVA (LogMAR)	-0.06 ± 0.08	-0.14 ± 0.05	0.08
CDVA (LogMAR)	-0.07 ± 0.08	-0.14 ± 0.05	0.12
UIVA (LogMAR)	0.25 ± 0.16	0.03 ± 0.05	<0.01
UNVA (LogMAR)	0.07 ± 0.05	0.00 ± 0.00	<0.01
Spherical equivalent (D)	-0.14 ± 0.23	-0.10 ± 0.17	0.51
Refractive cylinder (D)	-0.36 ± 0.30	-0.31 ± 0.22	0.51

UDVA, uncorrected distance visual acuity; CDVA, corrected distance visual acuity; UIVA, uncorrected intermediate visual acuity; UNVA, uncorrected near visual acuity; D, diopters. Data are presented as mean ± SD.

Figure 1. Mean defocus curve 6 months after implantation. Adapted from Yesilirmak et al. *J Refract Surg.* 2019;35:559-564



Comparison of Visual Results and Quality of Vision After Bilateral Implantation of Trifocal Intraocular Lenses Versus Bifocal Intraocular Lenses

Zamora de la Cruz et al. *Rev Mex Oftalmol (Eng).* 2018;92:62-69

Visual Acuity
Contrast Sensitivity
Visual Phenomena
Patient-Reported Outcomes

OVERVIEW

STUDY DESIGN
Prospective, observational, longitudinal study to compare visual results between ReSTOR® +2.50 bifocal IOL and PanOptix® trifocal IOL

STUDY SITE(S)
One center in Mexico

PATIENTS
Twenty-four (24) eyes of 12 patients (7 ReSTOR® patients and 5 PanOptix® patients)

METHODOLOGY
IOL performance evaluated 6 months after bilateral cataract surgery

IOL TYPE(S)
AcrySof® IQ PanOptix®; ReSTOR® +2.50 bifocal

KEY ENDPOINT(S)
Best-corrected visual acuity, contrast sensitivity under photopic conditions, monocular defocus curve, Visual Function Questionnaire-25 (VFQ-25)

ANALYSIS AND CONCLUSIONS

Far visual acuity was good in both groups, while differences in intermediate and near visual acuity were clinically and statistically significant in favor of the PanOptix® IOL.

Patient ratings from the VFQ-25 questionnaire were high for both lenses and not significantly different, suggesting that both IOLs have good acceptance among patients.

STUDY RESULTS

VISUAL ACUITY
- Average visual acuity was good in both groups; at intermediate and near distances; statistically significant differences were observed in favor of PanOptix® for intermediate and near vision (P<0.004 and P<0.002, respectively) **(Figure 1)**
- PanOptix® provided good visual acuity from 4 m to 30 cm, as shown in the defocus curve **(Figure 2)**
- The defocus curve of ReSTOR® +2.5 and PanOptix® demonstrated differences in particular at the near vision range **(Figure 2)**

OTHER VISUAL OUTCOMES
- There was no significant difference in contrast sensitivity between groups at any given frequency
- All patients with ReSTOR® +2.5 and PanOptix® reported glare/halos in the immediate postoperative period, which eventually disappeared; measurement of point spread function showed no evidence of objective halos in either group
- Values were high for most subscales of the VFQ-25, and no significant differences were observed between either IOL group with respect to the subscale scores or overall score

Figure 1. Mean defocus curve 6 months post-IOL implantation.

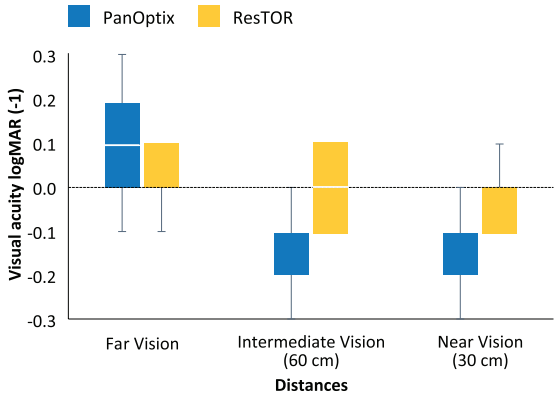
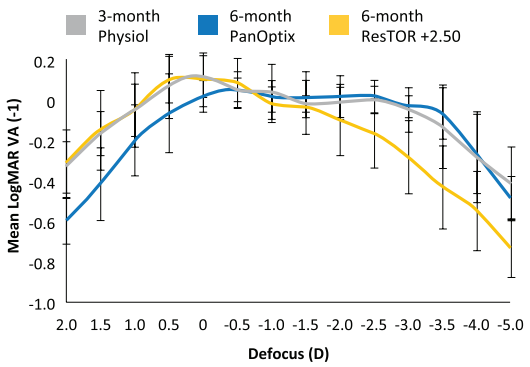


Figure 2. Multifocal defocus curve 6 months after implantation. Adapted from Zamora de la Cruz et al. *Rev Mex Oftalmol (Eng).* 2018;92:62-69.



Data for the FineVision IOL curve were obtained from another study conducted at the same time at the Instituto de Oftalmología Fundación Conde de Valenciana.

Multifocal Intraocular Lenses and Extended Depth of Focus Intraocular Lenses

Clinical Literature Review

Breyer et al. *Asia Pac J Ophthalmol (Phila).* 2017;6:339-349

OVERVIEW

STUDY DESIGN

Non-systematic review of the literature assessing the optical aspects and clinical consequences of multifocal and extended depth of focus IOLs to help surgeons find appropriate solutions for their patients

ANALYSIS AND CONCLUSIONS

The wide variety of multifocal IOLs and EDOF IOLs, their optics, and their respective impact on our patients' quality of vision must be fully understood to choose the appropriate IOL for each individual

In addition, surgeons should assess their patient's personality and visual needs to help them better achieve their goals for spectacle independence and a high degree of satisfaction with the IOL

STUDY RESULTS

VISUAL ACUITY

- Information of the defocus curve over a specific range can be condensed into a single value by calculating the area under the defocus curve, representing a metric for the average visual acuity over the considered interval, called the multifocal IOL capacity
- Strong correlations between clinical LogMAR defocus curves and in vitro modulation transfer function (MTF) through-focus curves from optical bench measurements allow the prediction of postoperative defocus curves from MTF values

OTHER VISUAL OUTCOMES

- Halos are inevitable with multifocal and EDOF IOLs, but because of their subjective nature, a valid quantitative assessment of postoperative photopsia is hard to obtain
- One study found some evidence that diffractive multifocal IOL patients tended to tolerate less halo and glare compared with refractive ones; however, a meta-analysis did not find significant differences between refractive and diffractive multifocal IOLs with respect to halo incidence rates, showing the need for further investigation

GUIDANCE FOR SURGEONS

- Surgeons should obtain a complete picture of a patient's predominant visual needs
- If manual or computer work is an integral part of a patient's lifestyle, good intermediate vision should be supported by the IOL
- If spectacle-free reading ability is strongly desired, a multifocal IOL with a corresponding near addition might be the lens of choice
- If both distances need to be supported, a trifocal IOL would be suitable
- Multifocal IOL defocus curves and capacities can provide the surgeon with helpful information for this decision process
- During preoperative consultation, the patient must be informed about the possibility of halo and glare and the expected intensity for each specific lens type

Efficacy and Safety of Extended Depth of Focus Intraocular Lenses in Cataract Surgery: A Systematic Review and Meta-Analysis

Liu et al. *BMC Ophthalmol.* 2019;19:198

Visual Acuity
Contrast Sensitivity
Visual Phenomena
Patient-Reported Outcomes

OVERVIEW

STUDY DESIGN
Systematic review and meta-analysis to evaluate the efficacy and safety of diffractive extended depth of focus (EDOF) IOLs in cataract surgery

STUDY SITE(S)
Not applicable (review article)

PATIENTS
Nine (9) studies with a total of 1336 eyes

METHODOLOGY
IOL performance evaluated 3 to 29 months after cataract surgery; data from literature of clinical controlled studies (randomized or nonrandomized from 2000 to 2019)

IOL TYPE(S)*
Trifocal (AcrySof® IQ PanOptix®, AT LISA® tri 839MP, FineVision); monofocal (TECNIS ZCB00, AcrySof® SN60WF); EDOF (TECNIS Symfony® ZXR00)

KEY ENDPOINT(S)
Primary outcomes: binocular uncorrected distance visual acuity (UDVA), uncorrected intermediate visual acuity (UIVA), uncorrected near visual acuity (UNVA), defocus curves, contrast sensitivity; secondary outcomes: halos, spectacle independence, postoperative complications

ANALYSIS AND CONCLUSIONS

This systematic review demonstrated that diffractive EDOF IOLs provided better intermediate and near VAs than monofocal IOLs, but worse near VAs than trifocal IOLs. Diffractive EDOF performed better than trifocal IOls but worse than monofocal IOLs for contrast sensitivity. Halo incidence and spectacle independence of EDOF IOLs were similar to those of trifocal IOLs.

This meta-analysis has several limitations such as substantial between-study heterogeneity and only 3 of 9 studies were randomized controlled trial; the authors concluded that additional clinical trials with randomized, controlled study designs and adequate duration are needed to clarify the tradeoffs between diffractive EDOF IOLs and other presbyopia-mitigating IOLs.

STUDY RESULTS

PRIMARY OUTCOMES

- Compared with monofocal IOLs, EDOF IOLs provided comparable UDVA (weighted mean difference [WMD]: 0.01, 95% CI: − 0.06 to 0.08, P=0.81), better UIVA (WMD: -0.17, 95% CI: − 0.26 to − 0.08, P=0.0001) and better UNVA (WMD: -0.17, 95% CI: − 0.21 to − 0.12, P<0.00001) (**Figure 1**)
- Compared with trifocal IOLs, EDOF IOLs showed no significant differences in UDVA (WMD: -0.01, 95% CI: − 0.03 to 0.01, P=0.34) or UIVA (WMD: -0.03, 95% CI: − 0.07 to 0.01, P=0.12), but performed worse in UNVA (WMD: 0.10, 95% CI: 0.07 to 0.13, P<0.0001) (**Figure 1**)
- With respect to defocus curves, visual acuity was significantly better with EDOF IOLs than with monofocal IOLs in the defocus levels from − 1.0 to − 4.0 D, and significantly better in trifocal IOL group than in EDOF IOL group from − 2.5 to − 4.0 D

SECONDARY OUTCOMES

- Compared with monofocal IOLs, EDOF IOLs were associated with reduced contrast sensitivity and more frequent halos, while compared with trifocal IOLs, they had better contrast sensitivity and no significant difference in halos
- Patients with EDOF IOLs achieved higher spectacle independence (RR: 2.81, 95% CI: 1.06 to 7.46, P=0.04) than patients with monofocal IOLs, but no significant difference was observed between EDOF IOLs and trifocal IOLs (**Figure 2**)
- Serious postoperative complications were rare, with no adverse events were reported in most studies.

Figure 1. Forest plot of binocular uncorrected distance visual acuity. Adapted from Liu et al. *BMC Ophthalmol*. 2019;19:198.

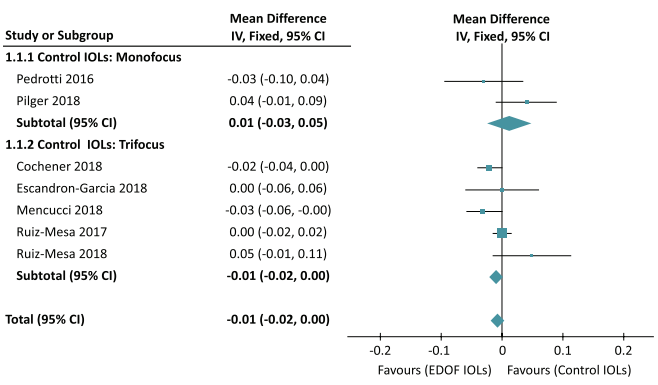
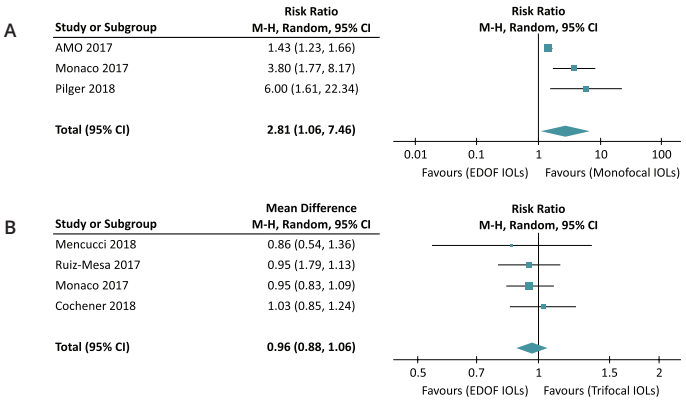


Figure 2. Forest plot of spectacle independence. (**A**) EDOF and monofocal IOLs, (**B**) EDOF and trifocal IOLs. Adapted from Liu et al. *BMC Ophthalmol.* 2019;19:198.



AcrySof IQ PanOptix IOL Versus Extended Depth of Focus IOL and Trifocal IOL: A Clinical Overview

Clinical Literature Review

Sudhir et al. *Asia Pac J Ophthalmol (Phila).* 2019;8:335-349†

OVERVIEW

STUDY DESIGN*

Systematic review of the literature to provide an overview of the clinical performance of the PanOptix® IOL and other trifocal and extended depth of focus IOLs (AT LISA® tri 839MP, TECNIS Symfony® and Fine Vision Micro F)

ANALYSIS AND CONCLUSIONS

A systematic review of the clinical evidence suggests that good visual outcomes, along with a high degree of spectacle independence, are generally achieved in patients implanted with PanOptix® or TECNIS Symfony® IOLs.

However, each IOL has benefits and limitations, which along with patients' needs and clinical conditions are important factors to consider while selecting an IOL to achieve best possible postoperative outcomes.

STUDY RESULTS

TOTAL STUDIES ANALYZED

- After a literature search, 12 and 9 studies were included in this analysis for PanOptix® and TECNIS Symfony®, respectively

VISUAL ACUITY

- The defocus curves for both the IOLs showed distinct patterns consistent with their optical designs
- For PanOptix®, studies consistently showed a good visual acuity over a wide range of defocus levels (+0.50 D to +3.0 D)
- There was no significant difference among the IOLs for distance vision
- PanOptix® performed better for uncorrected intermediate visual acuity (60 cm) and near vision compared with TECNIS Symfony®

CONTRAST SENSITIVITY

- Contrast sensitivity under both photopic and mesopic conditions was similar between the PanOptix® and TECNIS Symfony® IOLs, and was found to be within the expected normal range
- Lack of agreement between the contrast sensitivity tests used makes it difficult to directly compare outcomes of different studies

VISUAL PHENOMENA

- Halos, glare, and difficulty in nighttime driving were the most frequently reported visual side effects for all IOLs
- A relatively higher frequency or a greater degree of bother for photic phenomena is reported with TECNIS Symfony® than with PanOptix®
- In the majority of PanOptix® patients photic disturbances had no impact on their daily life, and these disturbances were reported to decrease with time

PATIENT-REPORTED OUTCOMES

- High patient satisfaction and spectacle independence were reported with PanOptix® and TECNIS Symfony®

**AT LISA® tri 839MP IOL and FineVision Micro F IOL are not FDA approved; data on non-FDA approved devices are not shown in results*

†Supported by Alcon Laboratories for medical writing

AcrySof® IQ PanOptix® Family of Trifocal IOLs

IMPORTANT PRODUCT INFORMATION

CAUTION: Federal (USA) law restricts this device to the sale by or on the order of a physician.

INDICATIONS

The AcrySof® IQ PanOptix® Trifocal IOLs include AcrySof® IQ PanOptix® and AcrySof® IQ PanOptix® Toric and are indicated for primary implantation in the capsular bag in the posterior chamber of the eye for the visual correction of aphakia in adult patients, with less than 1 diopter of pre-existing corneal astigmatism, in whom a cataractous lens has been removed. The lens mitigates the effects of presbyopia by providing improved intermediate and near visual acuity, while maintaining comparable distance visual acuity with a reduced need for eyeglasses, compared to a monofocal IOL. In addition, the AcrySof® IQ PanOptix® Toric Trifocal IOL is indicated for the reduction of residual refractive astigmatism.

WARNINGS/PRECAUTIONS: Careful preoperative evaluation and sound clinical judgment should be used by the surgeon to decide the risk/benefit ratio before implanting a lens in a patient with any of the conditions described in the Directions for Use labeling. Physicians should target emmetropia, and ensure that IOL centration is achieved.

For the AcrySof® IQ PanOptix® Toric Trifocal IOLs, the lens should not be implanted if the posterior capsule is ruptured, if the zonules are damaged, or if a primary posterior capsulotomy is planned. Rotation can reduce astigmatic correction; if necessary lens repositioning should occur as early as possible prior to lens encapsulation.

Some visual effects may be expected due to the superposition of focused and unfocused multiple images. These may include some perceptions of halos or starbursts, as well as other visual symptoms. As with other multifocal IOLs, there is a possibility that visual symptoms may be significant enough that the patient will request explant of the multifocal IOL. A reduction in contrast sensitivity as compared to a monofocal IOL may be experienced by some patients and may be more prevalent in low lighting conditions. Therefore, patients implanted with multifocal IOLs should exercise caution when driving at night or in poor visibility conditions.

Patients should be advised that unexpected outcomes could lead to continued spectacle dependence or the need for secondary surgical intervention (e.g., intraocular lens replacement or repositioning).

As with other multifocal IOLs, patients may need glasses when reading small print or looking at small objects. Posterior capsule opacification (PCO), may significantly affect the vision of patients with multifocal IOLs sooner in its progression than patients with monofocal IOLs. Prior to surgery, physicians should provide prospective patients with a copy of the Patient Information Brochure available from Alcon informing them of possible risks and benefits associated with the AcrySof® IQ PanOptix® Trifocal IOLs.

ATTENTION: Reference the Directions for Use labeling for each IOL for a complete listing of indications, warnings and precautions.

Acrysof® IQ Restor® Family of Intraocular Lenses Important Product Information

CAUTION: Federal (USA) law restricts this device to the sale by or on the order of a physician.

INDICATIONS: The AcrySof® IQ ReSTOR® Posterior Chamber Intraocular Lens (IOL) is intended for primary implantation for the visual correction of aphakia secondary to removal of a cataractous lens in adult patients with and without presbyopia, who desire near, intermediate and distance vision with increased spectacle independence. The lens is intended to be placed in the capsular bag.

WARNINGS / PRECAUTIONS: Careful preoperative evaluation and sound clinical judgment should be used by the surgeon to decide the risk/benefit ratio before implanting a lens in a patient with any of the conditions described in the Directions for Use labeling. Physicians should target emmetropia, and ensure that IOL centration is achieved. Care should be taken to remove viscoelastic from the eye at the close of surgery.

Some patients may experience visual disturbances and/or discomfort due to multifocality, especially under dim light conditions. As with other multifocal IOLs, visual symptoms may be significant enough that the patient will request explant of the multifocal IOL. Spectacle independence rates vary with all multifocal IOLs; as such, some patients may need glasses when reading small print or looking at small objects.

Clinical studies with the AcrySof® ReSTOR® lens indicated that posterior capsule opacification (PCO), when present, developed earlier into clinically significant PCO. Prior to surgery, physicians should provide prospective patients with a copy of the Patient Information Brochure available from Alcon for this product informing them of possible risks and benefits associated with the AcrySof® IQ ReSTOR® IOLs.

Studies have shown that color vision discrimination is not adversely affected in individuals with the AcrySof® Natural IOL and normal color vision. The effect on vision of the AcrySof® Natural IOL in subjects with hereditary color vision defects and acquired color vision defects secondary to ocular disease (e.g., glaucoma, diabetic retinopathy, chronic uveitis, and other retinal or optic nerve diseases) has not been studied. Do not resterilize; do not store over 45° C; use only sterile irrigating solutions such as BSS® or BSS PLUS® Sterile Intraocular Irrigating Solutions.

ATTENTION: Reference the Directions for Use labeling for a complete listing of indications, warnings and precautions.

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