Comparison between an intraocular lens with extended depth of focus (Tecnis Symfony® ZXR00) and a new monofocal intraocular lens with enhanced intermediate vision (Tecnis Eyhance® ICB00)

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Introduction

- Cataracts are a major cause of vision loss[1]
- Patients' expectations about **correcting presbyopia** & desire for **intermediate distances without glasses** is increasing[2]
- More than 1/3 of patients receiving multifocal IOLs experience Visual symptoms: **halo, glare and starbursts**[3]
- Increasing interest that can enhance the performance of monofocal IOLs and reduce the undesirable photic phenomena of multifocal IOLs[4]

1. Korean J Ophthalmol. 2020;34(6):439–445
2. J Cataract Refract Surg V 46. 2020;378–387
3. J Refract Surg. 2019;35:434–440
4. Asia Pac J Ophthalmol (Phila). 2021 Sep 28

- **Extended depth of focus(EDOF) IOL**
  - Single continuous focus range for most distances
  - Various overlapping(diffractive) focus points

  → produce continuous extended focus with low levels of glare and halos

- **Tecnis Symfony® ZXR00[1]**
  - Hydrophobic-acrylic IOL with an achromatic diffractive surface
  - Aspheric anterior surface / Diffractive posterior square edge

- **Tecnis Eyhance® ICB00[2]**
  - Sufficient distant visual acuity(VA) and improved intermediate VA
  - Dysphotopsia similar to monofocal IOL
  - No diffractive rings and zones

1. Asia Pac J Ophthalmol (Phila). 2021 Sep 28
2. J Cataract Refract Surg. 2021 May 26

Purpose

- To compare the visual results and optical qualities between EDOF IOL(Tecnis Symfony® ZXR00) monofocal intraocular lens with enhanced intermediate vision IOL(Tecnis Eyhance® ICB00)

Methods

- Single center, retrospective, comparative study
- April 2020 ~ February 2021 (174 eyes from 174 patients)
- All operation conducted by single expert surgeon

Results

- Preoperative characteristics of patients per group

Parameter	Symfony ZXR00	Eyhance ICB00	*P* Value
Eyes, n	72	102	N/A
Female, n	38 (53%)	57 (56%)	0.361
Right eye, n	37 (51%)	53 (52%)	0.398
Age, y	59.6 ± 10.6 (49 to 70)	65.2 ± 8.2 (45 to 82)	<0.001*
UDVA (LogMAR)			
Mean ± SD	0.53 ± 0.37	0.55 ± 0.35	0.771
Range	0.16 to 0.9	0.2 to 0.9	
CDVA (LogMAR)			
Mean ± SD	0.30 ± 0.30	0.33 ± 0.32	0.382
Range	0.00 to 0.60	0.01 to 0.65	
MRSE (D)			
Mean ± SD	−1.38 ± 2.98	−0.74 ± 2.45	0.134
Range	−4.36 to 1.60	−3.19 to 1.71	

CDVA indicates corrected distance visual acuity; D, diopter; LogMAR, logarithm of the minimum angle of resolution; MRSE, manifest refraction spherical equivalent; N/A, not applicable; SD, standard deviation; UDVA, uncorrected distance visual acuity.

*$P < 0.001$.

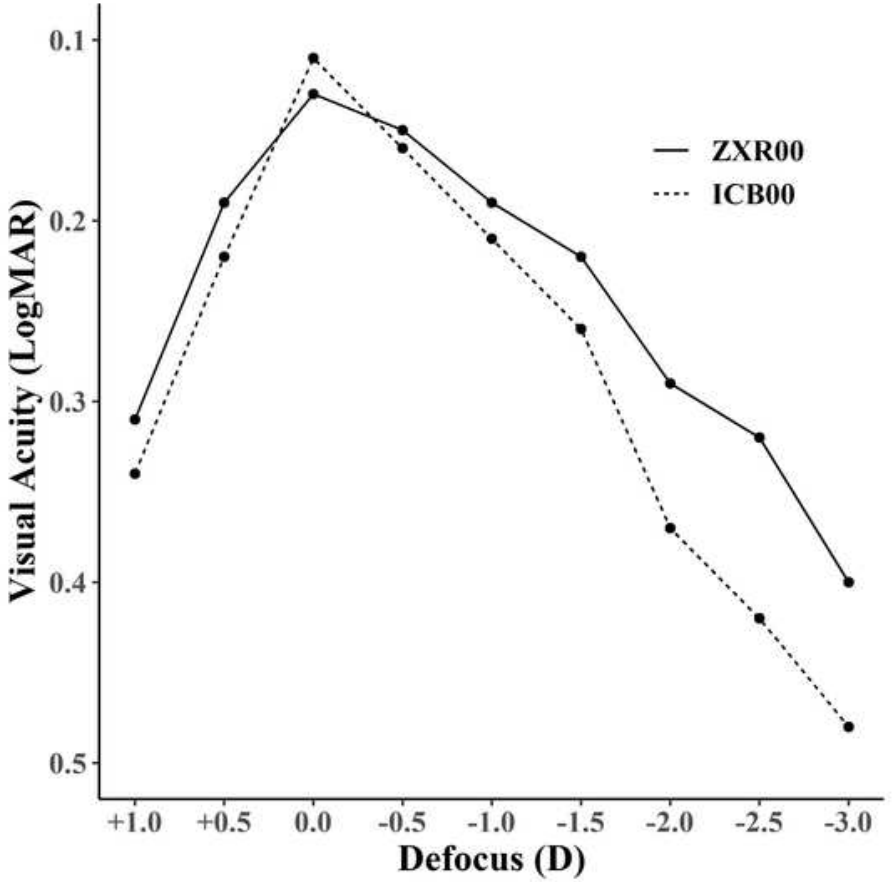
- Postperative visual outcomes, after 3 months of the surgery

Parameter	Symfony ZXR00	Eyhance ICB00	*P* Value
UDVA (LogMAR)			
Mean ± SD	0.13 ± 0.13	0.11 ± 0.10	0.163
Range	0 to 0.26	0.01 to 0.21	
CDVA (LogMAR)			
Mean ± SD	0.05 ± 0.08	0.03 ± 0.05	0.253
Range	0 to 0.13	0 to 0.08	
UIVA (LogMAR)			
Mean ± SD	0.22 ± 0.12	0.26 ± 0.09	0.105
Range	0.10 to 0.34	0.16 to 0.36	
UNVA (LogMAR)			
Mean ± SD	0.32 ± 0.11	0.42 ± 0.11	<0.001*
Range	0.21 to 0.43	0.31 to 0.53	
Target SE (D)			
Mean ± SD	−0.35 ± 0.19	−0.32 ± 0.20	0.395
Range	−0.54 to −0.16	−0.52 to −0.12	
MRSE (D)			
Mean ± SD	−0.22 ± 0.50	−0.22 ± 0.40	0.993
Range	−0.72 to 0.28	−0.62 to 0.18	
Mean prediction error (D)			
Mean ± SD	0.12 ± 0.53	0.10 ± 0.39	0.720
Range	−0.41 to 0.65	−0.29 to 0.49	
Mean absolute error (D)			
Mean ± SD	0.36 ± 0.29	0.31 ± 0.21	0.121
Range	0.09 to 0.77	0.10 to 1.52	
RE within ± 0.5 D, n	65 (90%)	94 (92%)	0.211

CDVA indicates corrected distance visual acuity; D, diopter; LogMAR, logarithm of the minimum angle of resolution; MRSE, manifest refraction spherical equivalent; n, number; RE, refractory error; SD, standard deviation; SE, spherical equivalent; UIVA, uncorrected intermediate visual acuity; UNVA, uncorrected near visual acuity; UDVA, uncorrected distance visual acuity.

*$P < 0.001$

- Mean monocular defocus curves of ZXR00 and ICB00



ZXR00 : defocus curve smoothness c large landing area

- Optical quality parameters assessed by OQAS®

  with a pupil diameter of 4.0mm after 3 months of the surgery

Parameter	Symfony ZXR00	Eyhance ICB00	*P* value
OSI	2.08 ± 0.92 (1.00 to 4.30)	1.22 ± 0.37 (0.76 to 2.20)	<0.001
MTF cutoff (c/deg)	24.29 ± 9.08 (11.47 to 46.73)	27.29 ± 4.82 (17.22 to 40.12)	<0.001
Strehl ratio	0.14 ± 0.05 (0.08 to 0.26)	0.18 ± 0.03 (0.11 to 0.23)	<0.001

D indicates diopters; MTF, modulation transfer function; OQAS, optical quality analysis system; OSI, objective scatter index; SD, standard deviation.

Discussion

- Earlier studies: monocular UIVA[1,2,3]
  - ZXR00 : 0.12, 0.14, 0.15, 0.24, 0.26, and 0.28
  - ICB00 : 0.11, 0.21, 0.28, 0.31, 0.39, 0.40, and 0.45

- In the current study, UIVA
  - ZXR00 : 0.22 ±0.12
  - ICB00 : 0.26 ±0.09

- Monocular UDVA, CDVA, and UIVA results were similar for ZXR00 and ICB00 at 3 months.

1. Ophthalmol.2018;256:1913–1922.
2. J Cataract Refract Surg V 46. 2020;378–387.
3. Int Ophthalmol.2021;41:273–282.

- Prior studies : monocular UNVA[1,2,3]
  - ZXR00 : 0.17, 0.27,0.34, 0.35, and 0.38
  - ICB00 : 0.43, 0.46, 0.47, and 0.50

- In the present study UNVA values
  - ZXR00 : 0.32 ± 0.11
  - ICB00 : 0.42 ± 0.11

- UNVA was better in the ZXR00 group ($p < 0.001$).

1. Ophthalmol.2018;256:1913–1922.
2. J Cataract Refract Surg V 46. 2020;378–387.
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- Two studies conducted comparative evaluations of ZXR00 and ICB00[1]
  - 3 months after surgery
  - monocular & binocular UIVA, binocular UNVA, contrast sensitivity rates, glare and halos
    → similar in both groups,
  - only monocular UNVA was superior in the ZXR00 group[1]

- Another study comparing both groups 6 months after surgery[2]
  - binocular UIVA and contrast sensitivity rates were similar
  - ZXR00 : **superior binocular UNVA,** but **higher levels of halos and glare**

- Limitation
  - Retrospective design & lack of randomization
  - Contrast sensitivity test & subjective measurements not carried out
  - Monocular vision only, not binocular
  - Age : ZXR00 group is younger
    - Young patients tend to require for more near vision

1. J Cataract Refract Surg. 2021 Jun 7
2. J Cataract Refract Surg. 2021 May 26.

Conclusion

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- Both groups had comparable distance and intermediate vision.
- ZXR00 provided remarkable near vision & defocus curve smoothness.
- ICB00 achieved better optical quality.