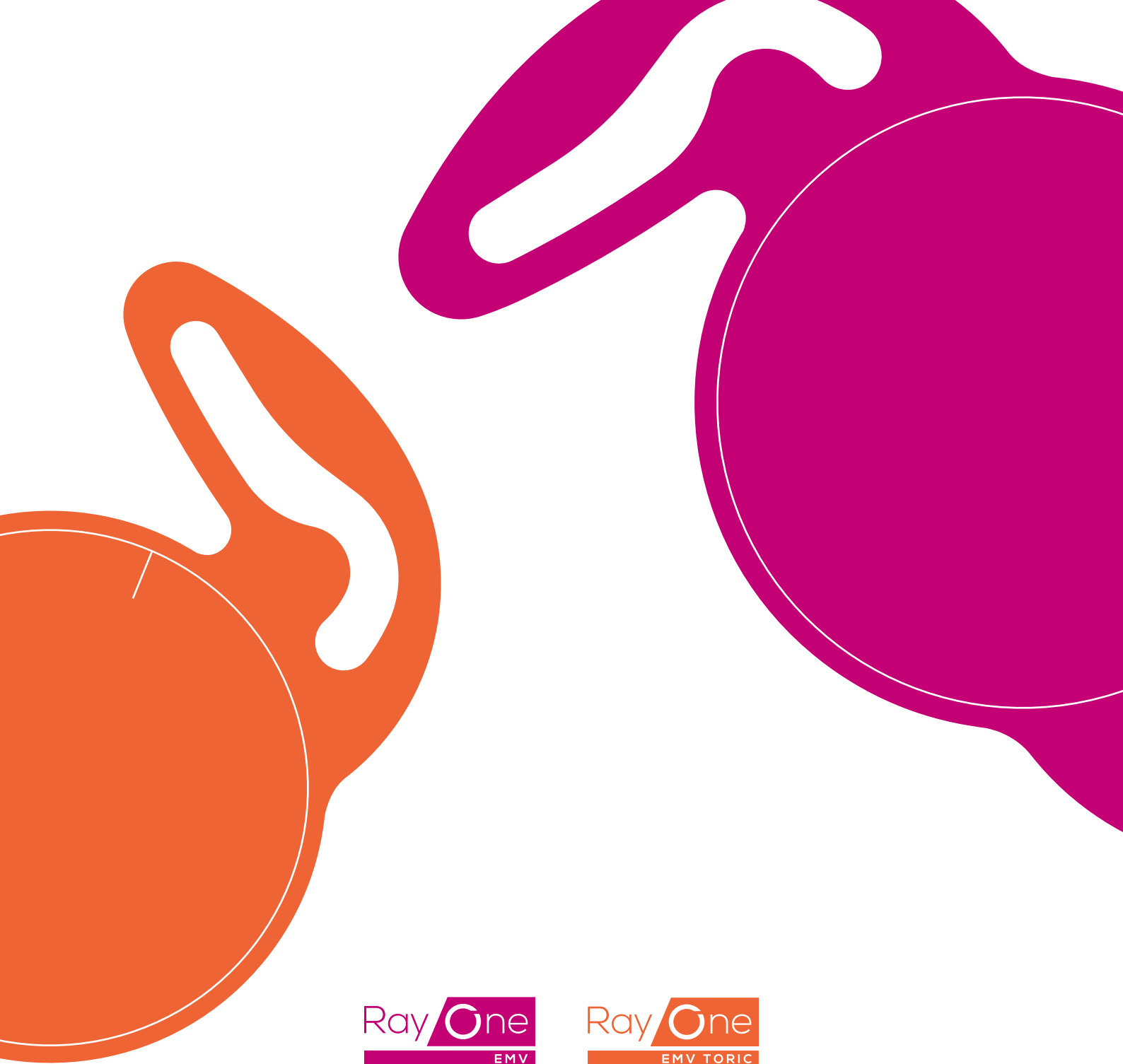




Extending range
without compromise

An increased range of focus IOL delivering up to 1.5 D of high quality vision

Developed in collaboration with Professor Graham Barrett, RayOne EMV's truly non-diffractive optic utilises positive spherical aberration to uniquely extend vision whilst avoiding the problems that can arise with diffractive lenses.

RayOne EMV's range of focus can be extended further with a customisable offset for Enhanced Monovision outcomes.

RayOne EMV & RayOne EMV Toric offer:



Increased range of focus: Up to 1.5 D^{1,2,3} with an emmetropic target.



High-quality vision: Truly non-diffractive IOL with monofocal levels of contrast sensitivity¹, dysphotopsia^{4,5} and high levels of patient satisfaction.⁶



Enhanced Monovision: Unique positive spherical aberration design provides a smoother transition between distance and near eyes.^{2,4}



Proven rotational stability and centration: predictable, sustainable and accurate visual results.^{10,11}



“For many years I have worked on optimising a lens for monovision, given that it accounts for nearly 30% of all surgeries. I collaborated with Rayner on bringing this lens to market as RayOne EMV, an exciting product for all surgeons looking for a presbyopia solution.”

Professor Graham Barrett, developer of RayOne EMV

How does RayOne EMV work?

Unique positive spherical aberration design

RayOne EMV is a truly non-diffractive IOL that does not use light-splitting technology like many other IOLs which increase depth of focus, resulting in low levels of dysphotopsia, similar to standard monofocal lenses.¹

Compared to a lens with zero spherical aberration, the carefully controlled positive spherical aberration induced by RayOne EMV spreads light along the visual axis.

Consequently, the focal range is elongated from far into intermediate with up to 1.5 D of depth of focus (per lens on the spectacle plane).

The illustration shows a monofocal lens with zero spherical aberration and a small focal range (Fig 1), alongside RayOne EMV with positive spherical aberration and a larger focal range (Fig 2).

Figure 1: Monofocal IOL

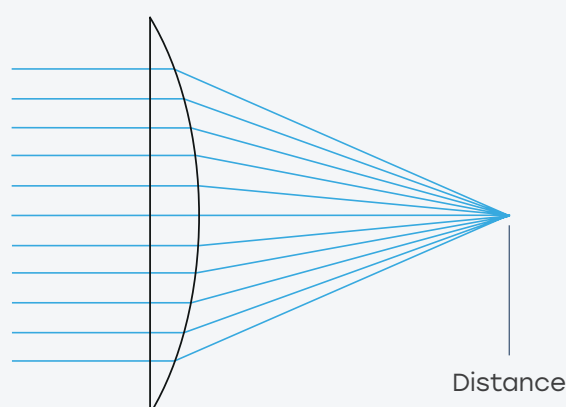
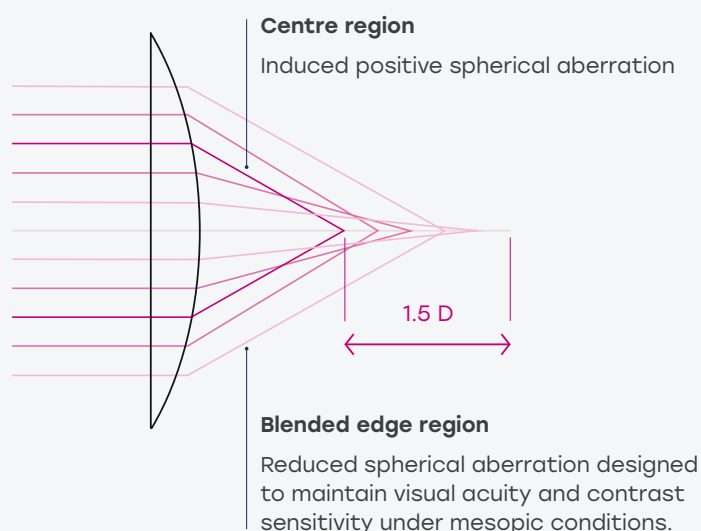


Figure 2: RayOne EMV



Extending vision with RayOne EMV

RayOne EMV's unique positive spherical aberration enables an optical extension that enables patients to achieve excellent binocular vision, with or without monovision.

When offsetting the second eye for monovision, the depth of field reaches past intermediate to also provide functional near vision for a range of lifestyle.

EMV targeting	Distance eye	Intermediate / Near eye	Approx. range of vision
Emmetropia	0 D	0 D	1.50 D (~66cm - ∞)
Micro Monovision	0 D	-0.5 D	2.00 D (~50cm - ∞)
Mini Monovision	0 D	-1.0 D	2.50 D (~40cm - ∞)
Modest Monovision	0 D	-1.5 D	3.00 D (~33cm - ∞)

Clinical results with RayOne EMV

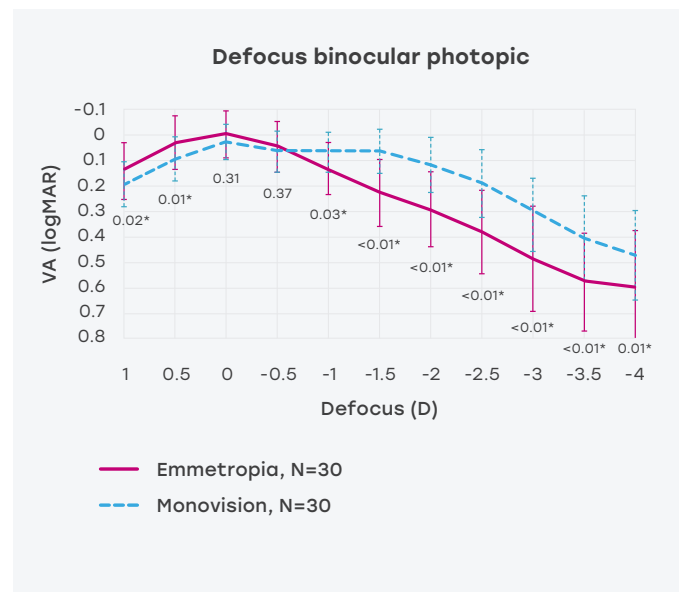
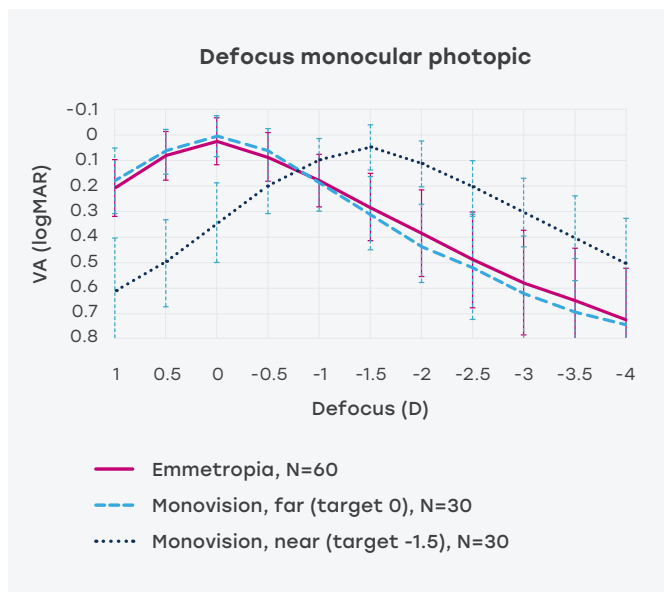
Since the launch of the RayOne EMV platform in 2020, extensive real-world clinical data has demonstrated:^{1,3,4,6,7}

- RayOne EMV can provide spectacle independence from distance to intermediate vision.
- RayOne EMV provides improvement in intermediate vision without compromising binocular distance vision.
- RayOne EMV can help to improve near vision, particularly when used with monovision.



Monovision targeting with RayOne EMV⁸

Yeo et al. prospectively evaluated 60 patients implanted bilaterally with RayOne EMV, comparing a bilateral emmetropia target against a modest monovision approach (-1.5 D in the near eye) at one-month post-surgery.



The monovision group achieved a binocular defocus range of 2.6 D under photopic conditions, compared to 1.3 D achieved in the bilateral emmetropia group (at 0.2 logMAR).



96% of the monovision patients were very or fairly satisfied with their vision, with the monovision group also reporting better performance for intermediate and near tasks.



The monovision results indicate that the far eye provides excellent distance and intermediate vision, whilst the near eye provides strong intermediate and near vision.



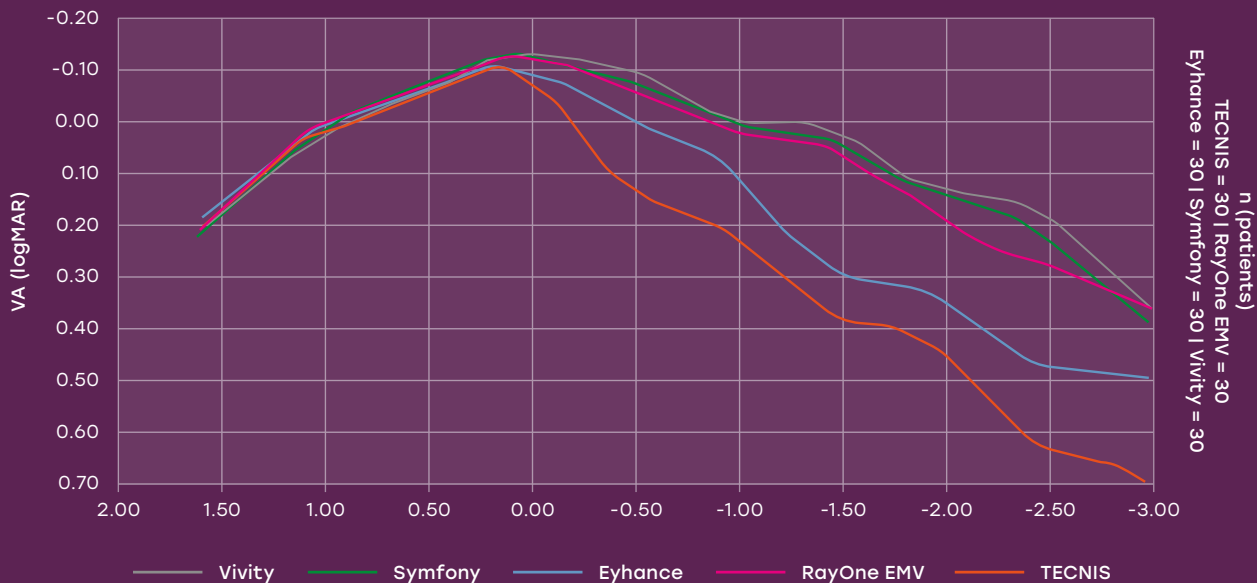
Modest monovision targeting with RayOne EMV improves intermediate and near vision without compromising distance visual acuity.



High-quality vision with emmetropic targeting¹

Ferreira et al. led a prospective, comparative case series in which RayOne EMV demonstrated excellent visual outcomes for distance and intermediate vision, and good visual acuity for near vision when targeting emmetropia.

RayOne EMV provides continuous high-quality vision when targeting for emmetropia, performing similarly to leading EDOF lenses across the 0 D to -2.0 D defocus range.



Comparing RayOne EMV with leading EDOF lenses^{9,23}

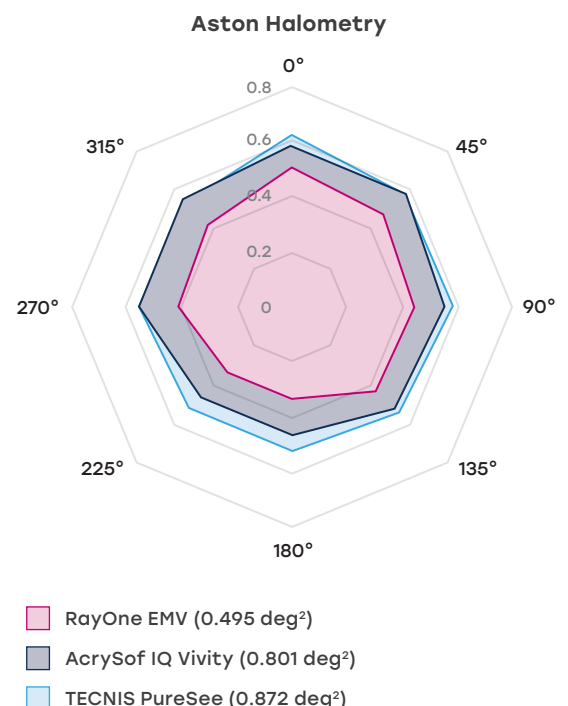
In a prospective, randomised, double-masked study, RayOne EMV was directly compared with AcrySof IQ Vivity in patients targeted for mini-monovision following bilateral cataract surgery.

Binocular uncorrected visual acuity at distance, intermediate and near showed no significant difference between the two lenses.

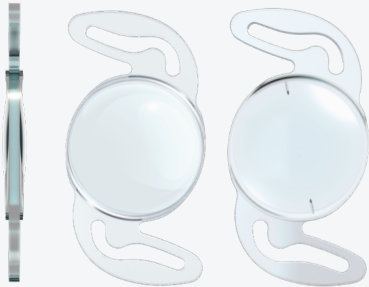
The RayOne EMV group showed a significantly smaller binocular halo size, compared with AcrySof IQ Vivity ($P < 0.01$).

When compared head-to-head to AcrySof IQ Vivity, RayOne EMV delivers equivalent visual outcomes with a significantly superior dysphotopsia profile⁹.

In a separate study conducted utilising the same methodology, conditions and researcher, TECNIS PureSee exhibited a larger halo size than RayOne EMV.²³



RayOne EMV & EMV Toric



Key information

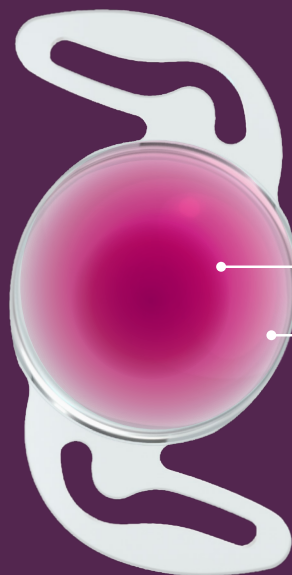
- Up to 1.5 D increased range of focus with an emmetropic target.^{1,2,3}
- High levels of contrast sensitivity¹ and low levels of dysphotopsia^{4,5}, similar to standard monofocal lenses.
- Controlled positive spherical aberration design provides a natural range of vision.^{2,4}

Designed to provide:

- Smoother, blended transition between the eyes when compared to monovision with standard monofocals, maintaining binocular stereoacuity and reducing asthenopia.
- High-quality spectacle-free distance vision.
- Reduced pupil dependency, for optimised performance under low light conditions.
- Reduced sensitivity to decentration and tilt compared to other IOL designs.
- Complements the eye's natural level of spherical aberration.
- Fully preloaded across the entire power range.



Centre region: Induced positive spherical aberration



Blended edge region: Reduced longitudinal spherical aberration designed to maintain visual acuity and contrast sensitivity under mesopic conditions

Correct more of your patients, even those with significant corneal astigmatism

- Proven rotational stability and centration^{10,11} with predictable, sustainable and accurate visual results
- Average offset of only 0.08 mm 3 to 6 months after surgery¹⁰
- 1.49° mean absolute change in lens orientation after 6 months¹¹
- Available in a wide range of IOL plane cylinders: +0.75 D to +4.5 D, in +0.75 D increments

For best results in treating astigmatism with any lens, aim for less than 0.5 D of residual cylinder¹²

Proven hydrophilic material performance

- Single-piece IOL created from a homogeneous material free of microvacuoles¹³
- Compressible material for delivery through a 2.2 mm micro incision¹⁴
- Excellent handling characteristics with controlled unfolding within the capsular bag¹⁵
- Low silicone oil adherence¹⁶
- Excellent uveal biocompatibility¹⁷
- Hydrophilic acrylic material with low inflammatory response¹⁸

360° Optimised barrier to reduce PCO

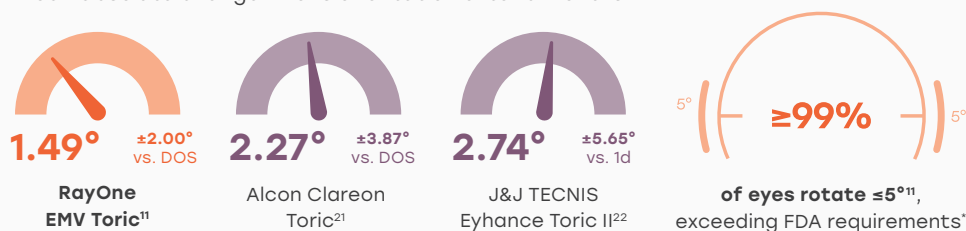
Rayner's 360° Amon-Apple Enhanced Square Edge creates an optimum barrier to reduce epithelial cell migration including at the haptic-optic junction.^{19,20}

Extremely low Nd:YAG capsulotomy rates, comparable with hydrophobic acrylic lenses with square-edge optics.¹⁵

Nd:YAG Capsulotomy rates ¹⁹		Mean time to Nd:YAG capsulotomy ¹⁹
At 12 months	0.6%	9.3 ± 5.5 months (range 2.6 - 22.7 months) Follow-up period: 5.3 - 29 months
At 24 months	1.7%	

In an FDA IDE study, RayOne EMV delivered exceptional rotational stability¹¹:

Mean absolute change in lens orientation after 6 months



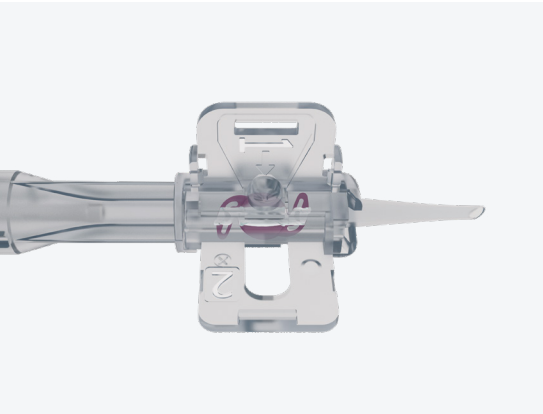
*Measured between consecutive visits from Day 1 to 6M

Comparison of preloaded IOLs

Company	Rayner	Alcon	Alcon	J&J
Lens platform	EMV	AcrySof IQ	Clareon	Tecnis
Injector	RayOne	UltraSert	AutonoMe	iTec
Miyata grade (glistenings)	0 ² (None)	1 ³ (Glistenings)	0 ¹⁵ (None)	0 ¹² (None)
Abbe value	56 ²	37 ⁹	Unknown	55 ⁹
Refractive index	1.46 ³	1.55 ¹⁰	1.55 ¹²	1.47 ¹²
Mean decentration	0.08 mm ⁴	0.78 mm ¹¹	0.06 mm ¹³	0.27 mm ¹³
Nozzle diameter	1.65 mm ⁵	2.08 mm ⁵	2.0 mm ¹⁵	1.86 mm ⁵
Injector preparation steps	2 ⁶	3 ¹⁰	3 ¹⁵	4 ¹²

Table references: 1. Mathew RG and Coombes AGA. Ophthalmic Surg Lasers Imaging. 2010 Nov-Dec; 41(6):651-5. 2. Rayner. Data on File. White paper. 3. Ferreira T et al. J of Refract Surg. 2019; 35(7): 418-25. 4. Bhogal-Bhamra GK et al. Journal of Refractive Surgery. 2019;35(1):48-53. 5. Nanavaty MA and Kubrak-Kisza M. J Cataract Refract Surg 2017; 43:558-563. 6. www.rayner.com. 7. Cullin F et al. Acta Ophthalmol. 2014; 92(2): 179-83. 8. Yildirim TM et al. PLoS ONE. 2021; 16(4): e0250860. 9. Zhao H et al. Br J Ophthalmol. 2007; 91(9): 1225-29. 10. www.myalcon.com. 11. Humbert G et al. FR J Ophthalmol. 2013; 36(4): 352-61. 12. jnvisionpro.com. 13. Baumeister M et al. J of Refract Surg. 2009; 35(6): 1006-12. 14. FDA Summary of Safety and Effectiveness Data PMA P190018 (2020). 15. Clareon IOL: A New Monofocal Platform. The Ophthalmologist. 2017.

RayOne injector

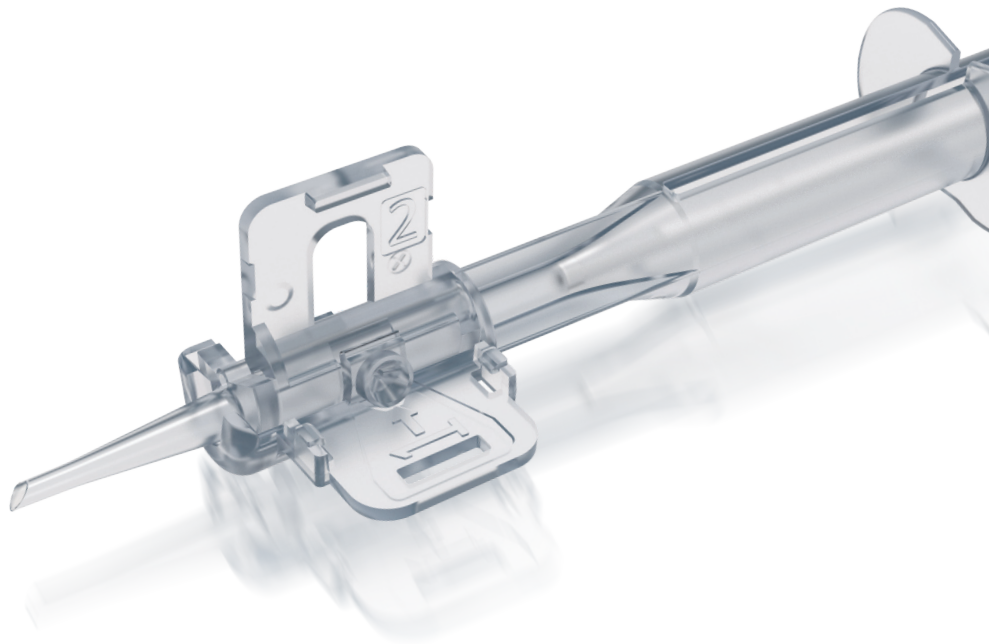


Two-step system

- Easy to use¹⁴
 - i. Minimal learning curve
 - ii. Minimises error
- Efficient IOL delivery time¹⁴
 - i. Designed for repeatability
 - ii. Reduces operating time
- **Step 1:** Insert OVD into cartridge via port
- **Step 2:** Lock cartridge ready for implantation

Features & benefits

- 1.65 mm nozzle for 2.2 mm incision
- Small fully preloaded injector nozzle
 - i. Ease of insertion
 - ii. Enables true micro incision
- Parallel-sided for minimal stretch
 - i. 2.2 mm delivery
 - ii. Maintains incision architecture
- Ergonomic design for ease of handling
- Single-handed plunger with minimal force required



Unique patented Lock & Roll technology for consistent delivery

- Rolls the lens to under half its size before injection
 - i. Consistent, smoother delivery
 - ii. Reduces insertion forces
- Fully enclosed cartridge with no lens handling
 - i. Reduces the risk of lens damage
 - ii. Minimises chance of contamination

Lock & Roll technology



Consistently locked and rolled to under half its size in one simple action

In a comparative study of six market-leading preloaded delivery systems¹⁴

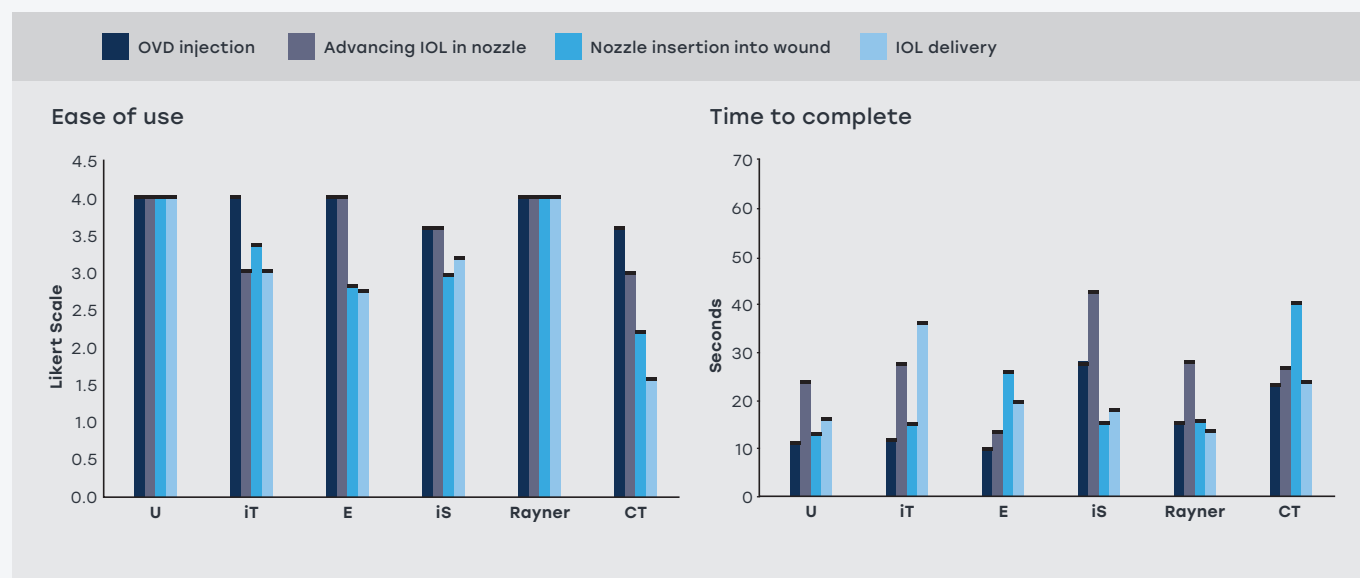
1. RayOne received the maximum score for 'ease of use' for all delivery steps:



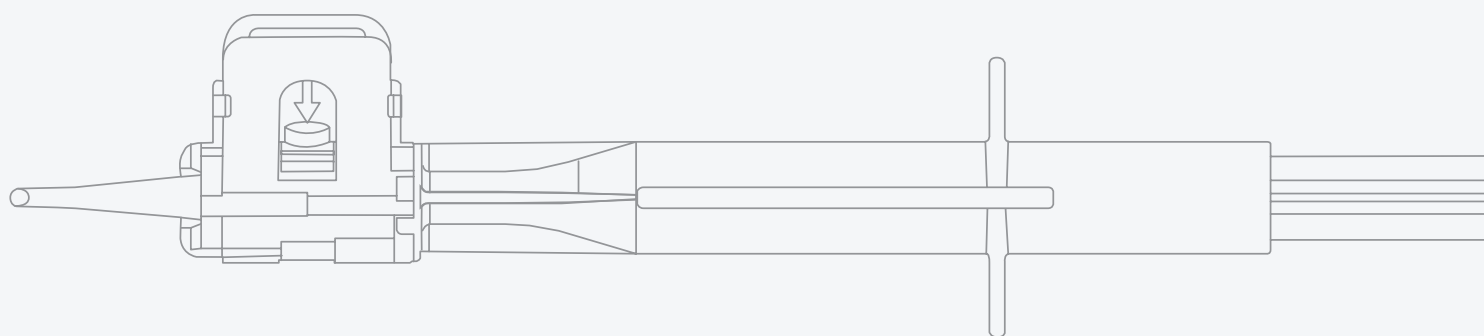
2. RayOne was the least time-consuming system for delivering the IOL

3. RayOne showed less injector tip damage post-insertion than 50% of the tested delivery systems

4. RayOne showed minimal wound stretch compared to other tested delivery systems when inserted through a 2.2 mm incision



Ultrasert (U) (Alcon Laboratories, Inc.), iTec (iT) (Abbott Medical Optics, Inc.), Eyecee (E) (Bausch & Lomb, Inc.), iSert (iS) (Hoya Surgical Optics, Inc.), and CT Lucia (CT) (Carl Zeiss Meditec AG). All trademarks are property of their respective owners.





Long-term, real-time, patient-led reported insights

RayPRO is a comprehensive Patient Reported Outcome Measurements (PROMs) platform that allows clinics to gain essential data on patient outcomes.

- A truly unique patient-reported outcomes (PROMs) platform with the ability to track patients over 3 years post-surgery.
- Gives actionable feedback and insight from patients on their experiences and perspectives post-surgery.
- Supports all IOL brands and models as well as validated clinical questionnaires.
- Utilises a unique multiple-patient upload feature to quickly and effectively add patients.

Cat-PROM5 integrated

Clinically validated questionnaire designed by Sparrow JM, Frost NA, Donovan JL et al.

Comparison view

This unique feature within RayPRO allows users to directly compare the performance of up to four different IOLs' patient data.

Multiple-patient upload

Supports fast and efficient upload of patients via an intuitive multiple patient upload system. In some cases, this can be automated with scripts.

Automated collection and reporting

RayPRO sends patient follow-up questionnaires automatically at predefined time points and displays the results in real time.

DPIA/GDPR/HIPAA compliant

RayPRO cooperates with all national data protection standards.

[Learn more about RayPRO at
www.rayner.com/raypro](https://www.rayner.com/raypro)

RayTrace

A proprietary online IOL calculator for all Rayner IOLs. RayTrace was one of the first online calculation tools and is trusted by surgeons all over the world for the accuracy of its spiral, trifocal, toric and supplementary IOL calculations.

Clear and accurate results

- IOL power recommendations with estimated post-operative outcomes for multiple power combinations.
- Theatre View print option for easy OR reference.
- Allowance for Posterior Corneal Astigmatism which can be turned off if using measured values.
- Saves users previous calculations which can be edited as required.

[Create a RayTrace account at
www.rayner.com/raytrace](https://www.rayner.com/raytrace)

Key features

Bilateral calculations: Surgeons are able to calculate both eyes at the same time.

PEARL-DGS formula: Additional formula option for comparison, also allowing calculation of SE for post-LASIK eyes

Easy-to-use design: Clear user interface, allowing for quick calculations.

Toric recommendation: RayTrace automatically gives recommendations for toric lenses when appropriate.

Technical information

Model name	RayOne EMV	RayOne EMV Toric
Model number	RAO200E	RAO210T
Power range	+10.0 to +30.0 D (0.5 D increments)	SE: +10.0 D to +30.0 D (0.5 D increments) Cylinder: +0.75 D, +1.5 D, +2.25 D, +3.0 D, +3.75 D, +4.5 D
Delivery system type	Fully preloaded IOL injection system	
Incision size	2.2 mm	

Delivery system	
Injector type	Single-use, fully preloaded IOL injection system
Nozzle size	1.65 mm
Bevel angle	45°
Lens delivery	Single-handed plunger

Aspheric monofocal IOL	
Material	Single-piece Rayacryl hydrophilic acrylic
Water content	26% in equilibrium
UV protection	Benzophenone UV-absorbing agent
UV light transmission	UV 10% cut-off is 380 nm
Refractive index	1.46
Abbe	56
Overall diameter	12.50 mm
Optic diameter	6.00 mm
Optic shape	Biconvex (positive powers)
Asphericity	Aspheric anterior surface
Optic edge design	Amon-Apple 360° enhanced square edge
Haptic angulation	0°, uniplanar
Haptic style	Closed-loop with anti-vaulting haptic (AVH) technology

Estimated constants for optical biometry									
	SRK/T	Haigis			HofferQ	Holladay	Holladay II	Barrett	
	A-constant	a0	a1	a2	pACD	SF	pACD	LF	DF
EMV and EMV Toric	118.6	1.044	0.40	0.10	5.32	1.56	5.32	1.51	0
IOLcon.org optimised constants for EMV and EMV Toric	118.416	0.1481	0.237	0.1612	5.178	1.437	N/A	1.51	0

For Contact Ultrasound, the estimated A-constant is 118.0

Please note that the constants indicated for all Rayner lenses are estimates and are for guidance purposes only. Surgeons must always expect to personalise their own constants based on initial patient outcomes, with further personalisation as the number of eyes increases.

References: **1.** Ferreira TB. Comparison of visual outcomes of a monofocal, two enhanced monofocals and two extended depth of focus intraocular lenses. Presented at ESCRS 2022. **2.** Rayner, data on file. **3.** Royo, M. RayOne EMV and TECNIS Eyhance: A Comparative Clinical Defocus Curve. Data on file. 2021. **4.** RayOne EMV: First Clinical Results, Rayner. Oct 2020. **5.** Rayner Peer2Peer webinar. May 2022. **6.** Rayner RayPRO, data on file. **7.** How to Choose the Right Solution for Your Patients, CRSTE April 2021. **8.** Yeo TK, Pek DCK, Wong JXH. Visual Performance and Subjective Outcomes with Enhanced Monofocal Intraocular Lens Implantation Targeted for Emmetropia or Modest Monovision. *Clinical Ophthalmology*. 2025;19:2847–2857. **9.** Findl, O., et al. Comparing an Advanced Monofocal With a Non-diffractive Extended Depth of Focus Intraocular Lens Using a Mini-Monovision Approach. *Am J Ophthalmol*. 2025;271:86–95. **10.** Bhogal-Bhamra GK, Sheppard AL, Kolli S, Wolffsohn JS. *J Refract Surg*. 2019;35(1):48–53. **11.** Rayner RayOne EMV Toric FDA IDE study (G230072). **12.** Zhong Y, et al. Femtosecond Laser Arcuate Keratotomy vs Toric Intraocular Lens Implantation in Cataract Surgery: A Randomized Clinical Trial. *JAMA Ophthalmology*. 2025;143(3):199–206. **13.** Rayner. Data on File (RDTR 1937). **14.** Nanavaty MA and Kubrak-Kisza M. *J Cataract Refract Surg* 2017; 43:558–563. **15.** Rayner, PMCF data on file. **16.** McLoone E, Mahon G, Archer D, Best R. *Br J Ophthalmol*. 2001; 85:543–545. **17.** Tomlins PJ, Sivaraj RR, Rauz S, Denniston AK, Murray PI. *J Cataract Refract Surg*. 2014; 40:618–625. **18.** Rayner, data on file. **19.** Mathew RG, Coombes AGA. *Ophthalmic Surg Lasers Imaging*. 2010 Nov-Dec; 41(6):651–5. **20.** Vyas AV, Narendran R, Bacon PJ, Apple DJ. *J Cataract Refract Surg* 2007; 33:81–87. **21.** Alcon Clareon Toric Instructions for Use (Rev. 900484016–0624, 2024). **22.** Johnson & Johnson Vision TECNIS Eyhance Toric II Instructions for Use (Rev. Z311770E-B, 2022). **23.** Findl, O., et al. Comparison of two intraocular lens designs. *Am J Ophthalmol*. 2026;288:51–61.



Not all Rayner products are approved for sale in every country.
Users must refer to the product 'instructions for use' in all cases: www.rayner.com/ifu

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