

ZEISS AT LISA tri family

A trifocal lens for repeatedly excellent outcomes

A meta analysis of peer-reviewed ZEISS AT LISA tri publications

AT LISA tri® 839MP from ZEISS has set the bar for multifocal IOLs

Since its launch, the ZEISS AT LISA tri 839MP IOL has accumulated a wealth of clinical evidence in scientific literature attesting to its robust visual and refractive performance and predictability.

With over 75 peer-reviewed publications by 60 different first authors detailing the results of over 9,000 eyes of 4,500 implanted patients, ZEISS AT LISA tri 839MP offers surgeons an IOL that has proven consistently to deliver excellent outcomes in terms of visual quality and patient satisfaction.

Ensuring patient satisfaction

Of peer-reviewed ZEISS AT LISA tri 839MP publications, 23 have so far explicitly investigated patient-reported outcomes. In this cohort of studies, 8 have reported patient satisfaction to have reached 100 %^{3, 12, 19, 22, 28, 35, 45, 47} and a further 9 studies rated patient satisfaction as greater than 90 %^{2, 4, 6, 18, 24, 29, 30, 34, 36}. The three remaining studies did not explicitly rate patient satisfaction as a percentage, but included qualitative assessments of patients, which equally attested the lens to ensure satisfied patients: Boehm et al⁷ for example asked patients to rate their quality of vision on a scale from 1 – 6, with ZEISS AT LISA tri scoring for quality of uncorrected vision for daily-life tasks of 2.1.



In more detail, a prospective study by Kretz et al¹⁹ found that all patients (100 %) were satisfied with the outcomes of surgery. Specifically, *"all patients were satisfied in terms of their ability to read, their intermediate and distance vision, quality of vision at all distances, and independence from spectacles for performing daily activities and computer use"*.

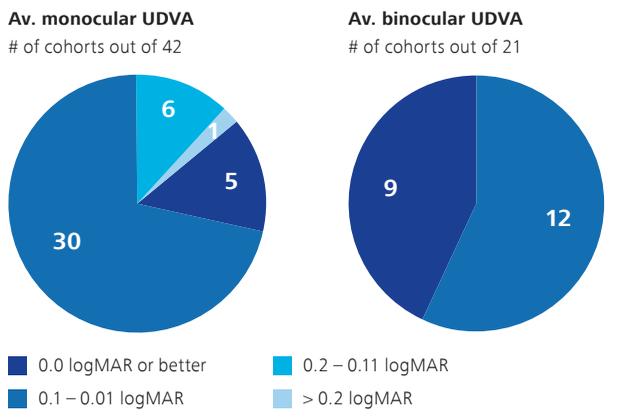
"The good visual and refractive outcomes, high level of spectacle independence, and low level of visual disturbances obtained in our series led to high levels of patient satisfaction."

Florian Kretz MD et al.

Consistency in visual performance

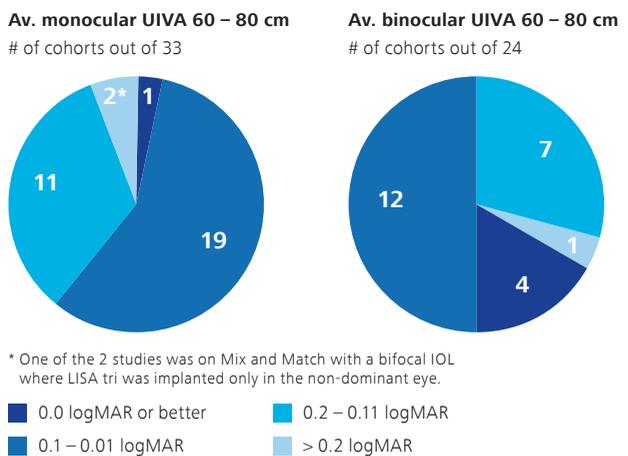
A meta-analysis of the studies investigating visual acuity for ZEISS AT LISA tri family IOLs showed that the lens reliably ensures excellent outcomes regarding visual acuity at far, intermediate, and near distances.

Among all studies that evaluated binocular uncorrected distance visual acuity (UDVA), all confirmed excellent binocular UDVA with AT LISA tri^{1-8, 10-23, 25-29, 31-35, 37-39, 41-47}:



To note should be the monocular UDVA > 0.2 logMAR, in which cases the patients had previously had LASIK surgery undergone.

A critical distance often discussed for trifocal technologies is the ability to restore vision at intermediate distances. Data on the below summarizes intermediate VA data from peer-reviewed studies.^{1-4, 6+7, 9, 11, 13-25, 27-29, 31-33, 35, 39-47}



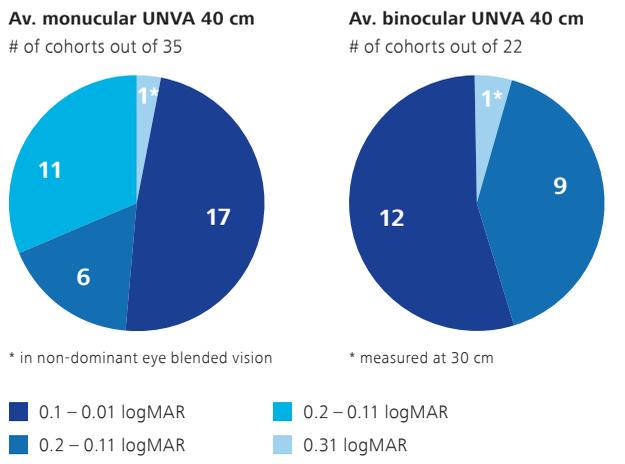
* One of the 2 studies was on Mix and Match with a bifocal IOL where LISA tri was implanted only in the non-dominant eye.

Excellent vision at intermediate distance is key to meeting patient’s digital reading requirements

For ZEISS AT LISA tri 839MP, a vast number of studies reports that patients achieved an average binocular UIVA of 0.1 logMAR or better^{14, 16-19, 22, 28, 34, 39}. Data for intermediate distances thereby covers a range from 60cm to 80cm, including critically important for day-to-day tasks such as shopping, computer and smartphone use, and reading the instruments on a car dashboard.

In individual studies, Kretz et al¹⁷ reported that the intermediate visual outcomes in a series of 50 patients were very good, with 79 % of eyes achieving UIVA of 0.1 logMAR or better, 94 % of eyes achieving 0.2 logMAR or better, and all eyes achieving 0.3 logMAR or better. The mean postoperative logMAR UIVA was 0.09 when measured at 66 cm.

One of the main goals of presbyopia-correcting IOLs is to be able to also have good vision at near distance to be spectacle independent. ZEISS AT LISA tri 839MP repeatedly achieves the goal of excellent vision at near distance^{2-4, 6, 7, 9-25, 27-29, 31-35, 37, 39-47}:



* in non-dominant eye blended vision

* measured at 30 cm

“The importance of intermediate vision cannot be overemphasized [...]. This diffractive trifocal AT LISA platform provides excellent intermediate vision without compromising distance and near vision.”

Abdulmohsen K. Almulhim MD

Looking at an individual study, Kretz et al⁵ reported that 91 % of patients reached binocular UDVA of 0.0 logMAR, 79 % attained binocular uncorrected intermediate visual acuity (UIVA) of 0.0 logMAR and 87 % binocular UNVA of 0.0 logMAR. Furthermore, 100 % of patients reached at least binocular UDVA, UIVA and UNVA of 0.3 logMAR or better.

Predictable and reliable outcomes

Results of ZEISS AT LISA tri family IOLs have shown that the lens delivers predictable and stable results over time. Kretz et al² reported that 90 % of 100 eyes treated had a spherical equivalent (SE) within ± 0.50 D three months after surgery. Mendicute et al¹ reported that postoperative SE was within ± 0.50 D in 177 cases (85.9 %) and 171 cases (83.0 %) 1 month and 3 months after surgery, respectively. At 1 month and 3 months, 196 eyes (95.1 %) and 201 eyes (97.6 %), respectively, were within ± 1.00 D of intended refraction.

In terms of stability of the visual outcome, there were no statistically significant differences in the intermediate, distance, and near visual acuity results between the 1-month postoperative visit and the 3-month visit except for monocular corrected distance visual acuity (CDVA).

In a prospective study of 50 eyes of 25 patients, Ganesh et al⁸ found good long-term stability of the refractive outcome, with no statistically significant difference in SE between 1 month, 6 months and 12 months postoperatively.

“Overall, postoperative visual function improved and remained stable following AT LISA tri 839MP IOL implantation under photopic and mesopic conditions.”

Yang Yang MD

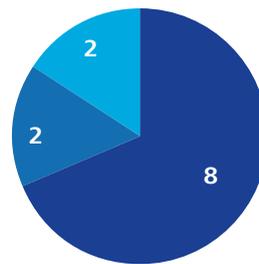
High levels of spectacle independence

Today’s patients expect to achieve spectacle independence, not just for near vision but at all distances.

Of all peer-reviewed publications several studies specifically tested the levels of spectacle independence with ZEISS AT LISA tri 839MP, repeatedly achieving high scores at all distances^{4, 6, 7, 10, 12, 17, 18, 20, 23, 25, 27, 29-30, 36, 45, 47}:

Overall level of spectacle Independence at far distance

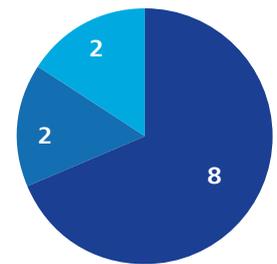
of cohorts out of 12



■ 100 % ■ >98 % ■ >90 %

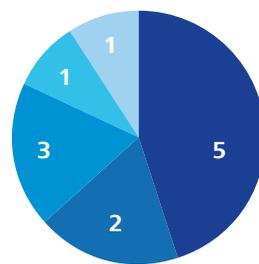
Overall level of spectacle Independence at intermediate distance

of cohorts out of 12



Overall level of spectacle Independence at near distance

of cohorts out of 12



■ 100 %
■ ≥90 %
■ ≥85 %
■ ≥75 %
■ ≥65 %

To cite a multicentre prospective study, Mendicute et al²⁸ reported that spectacle independence at all distances was higher than 90 % after 3 months. The breakdown for each category was 99 % for distance, 95.1 % for intermediate and 89.2 % for near vision at 3 months.

“The combination of good visual outcomes at all distances, high spectacle independence (over 90 %), and a low incidence of disabling photic phenomena is the main reason for the high level of satisfaction (over 90 %) reported by patients in our sample.”

Javier Mendicute MD

Conclusion

Seven years after its launch on the European market, the ZEISS AT LISA tri 839MP has proven its credentials in numerous peer-reviewed studies. The lens delivers on its promise to repeatedly ensure optimal outcomes. Its tried-and-trusted technology offers excellent distant, intermediate, and near visual outcomes. It is also associated with a high level of refractive correction predictability, with a positive impact on the performance of vision-related daily activities. It frees the vast majority of patients from their dependence on glasses and delivers consistently high levels of postoperative patient satisfaction.

Bibliography

- ¹ Alfonso JF, Fernández-Vega Cueto L, Belda-Salmerón L, et al. Visual function after implantation of a diffractive aspheric trifocal intraocular lens. *Eur J Ophthalmol* 2016;26(5):405–11.
- ² Alió JL, Kaymak H, Breyer D, et al. Quality of life related variables measured for three multifocal diffractive intraocular lenses: A prospective randomised clinical trial. *Clinical & Experimental Ophthalmology* 2017.
- ³ Al-Khateeb G, Shajari M, Kohnen T. Intraindividual comparative analysis of the visual performance after cataract surgery with implantation of a trifocal and a bifocal intraocular lens. *J Cataract Refract Surg* 2017;43(5):695–98.
- ⁴ Almulhim AK, Alarfaj KM, Altaisan AA, Alromaih AZ, Aldawod RA. Visual outcomes and patient satisfaction after bilateral implantation of a new trifocal diffractive intraocular lens. *Saudi J Ophthalmol*. 2018 Oct–Dec;32(4):310–317.
- ⁵ Ang RE. Comparison of tolerance to induced astigmatism in pseudophakic eyes implanted with small aperture, trifocal, or monofocal intraocular lenses. *Clin Ophthalmol*. 2019 May 30;13:905-911. doi: 10.2147/OPHTH.S208651. eCollection 2019.
- ⁶ Bilbao-Calabuig R, Llovet-Rausell A, Ortega-Usobiaga J, et al. Visual Outcomes Following Bilateral Implantation of Two Diffractive Trifocal IOLs in 10 084 eyes. *American Journal of Ophthalmology* 2017.
- ⁷ Böhm M, Hemkepler E, Herzog M, Schönbrunn S, de' Lorenzo N, Petermann K, Kohnen T. Comparison of a panfocal and trifocal diffractive intraocular lens after femtosecond laser-assisted lens surgery. *J Cataract Refract Surg*. 2018 Dec;44(12):1454-1462.
- ⁸ Brito P, Salgado-Borges J, Neves H, et al. Light-distortion analysis as a possible indicator of visual quality after refractive lens exchange with diffractive multifocal intraocular lenses. *J Cataract Refract Surg* 2015;41(3): 613–22.

- ⁹ Chen S-Y, Xie C, Wang Y, et al. Full-vision maintenance in extra-high myopia from implantable collamer lens to trifocal intraocular lens implantation. *Int J Ophthalmol* 2018;11(7):1239–42.
- ¹⁰ Chow SSW, Chan TCY, Ng ALK, Kwok AKH. Outcomes of presbyopia-correcting intraocular lenses after laser in situ keratomileusis. *Int Ophthalmol*. 2019 May;39(5): 1199-1204.
- ¹¹ Farideh D, Azad S, Feizollah N, et al. Clinical outcomes of new toric trifocal diffractive intraocular lens in patients with cataract and stable keratoconus: Six months follow-up. *Medicine (Baltimore)* 2017;96(12):e6340.
- ¹² Ganesh S, Brar S, Pawar A. Long-term visual outcomes and patient satisfaction following bilateral implantation of trifocal intraocular lenses. *Clin Ophthalmol* 2017;11: 1453–59. 28860693.
- ¹³ Gerl M, Breyer DRH, Hagen P, et al. Klinischer Vergleich einer trifokalen und einer trifokal-torischen Intraokularlinse auf gleicher diffraktiver Plattform: Clinical Comparison of a Trifocal and a Trifocal-Toric Intraocular Lens Based on the Same Diffractive Platform. *Klin Monbl Augenheilkd* 2017.
- ¹⁴ Höhn F, Tandogan T, Breyer DRH, et al. Funktionelle Ergebnisse 1 Jahr nach Implantation einer bitorischen, trifokalen Intraokularlinse. *Klin Monbl Augenheilkd*. 2015;232(8):957–61
- ¹⁵ Kim BH, Hyon JY, Kim MK. Effects of Bifocal versus Trifocal Diffractive Intraocular Lens Implantation on Visual Quality after Cataract Surgery. *Korean J Ophthalmol*. 2019 Aug;33(4):333-342.
- ¹⁶ Kim M, Kim JH, Lim TH, et al. Comparison of Reading Speed after Bilateral Bifocal and Trifocal Intraocular Lens Implantation. *Korean J Ophthalmol* 2018;32(2):77–82.
- ¹⁷ Kohnen T, Titke C, Böhm M. Trifocal Intraocular Lens Implantation to Treat Visual Demands in Various Distances Following Lens Removal. *American Journal of Ophthalmology* 2016;161:71-7.e1 (accessed 19 Apr 2016).

- ¹⁸ Kretz FTA, Choi CY, Müller M, et al. Visual Outcomes, Patient Satisfaction and Spectacle Independence with a Trifocal Diffractive Intraocular Lens. *Korean J Ophthalmol* 2016;30(3):180–91.
- ¹⁹ Kretz, Florian T A, Breyer D, Diakonis VF, et al. Clinical Outcomes after Binocular Implantation of a New Trifocal Diffractive Intraocular Lens. *Journal of Ophthalmology* 2015;2015:962891
- ²⁰ Kretz, Florian T A, Breyer D, Klabe K, et al. Clinical Outcomes After Implantation of a Trifocal Toric Intraocular Lens. *J Refract Surg* 2015;31(8):504–10
- ²¹ Kretz, Florian T A, Müller M, Gerl M, et al. Binocular function to increase visual outcome in patients implanted with a diffractive trifocal intraocular lens. *BMC Ophthalmol* 2015;15:110.
- ²² Law EM, Aggarwal RK, Kasaby H. Clinical outcomes with a new trifocal intraocular lens. *Eur J Ophthalmol* 2014;24(4):501–08
- ²³ Lenton L. Visual performance in a flight simulator: multifocal intraocular lenses in pilots. *BMJ Open Ophthalmol* 2018;3(1):e000139.
- ²⁴ Liu X, Xie L, Huang Y. Comparison of the Visual Performance After Implantation of Bifocal and Trifocal Intraocular Lenses Having an Identical Platform. *J Refract Surg* 2018;34(4):273–80.
- ²⁵ Marques EF, Ferreira TB. Comparison of visual outcomes of 2 diffractive trifocal intraocular lenses. *J Cataract Refract Surg* 2015;41(2):354–63. 25661129
- ²⁶ Martínez de Carneros-Llorente A, Martínez de Carneros A, Martínez de Carneros-Llorente P, Jiménez-Alfaro I. Comparison of visual quality and subjective outcomes among 3 trifocal intraocular lenses and 1 bifocal intraocular lens. *J Cataract Refract Surg*. 2019 May;45(5):587-594.
- ²⁷ Martinez-de-la-Casa JM, Carballo-Alvarez J, Garcia-Bella J, et al. Photopic and mesopic performance of 2 different trifocal diffractive intraocular lenses. *Eur J Ophthalmol* 2016:0

- ²⁸ Mencucci R, Favuzza E, Caporossi O, et al. Comparative analysis of visual outcomes, reading skills, contrast sensitivity, and patient satisfaction with two models of trifocal diffractive intraocular lenses and an extended range of vision intraocular lens. *Graefes Arch Clin Exp Ophthalmol* 2018.
- ²⁹ Mencucci R, Favuzza E, Caporossi O, et al. Visual performance, reading ability and patient satisfaction after implantation of a diffractive trifocal intraocular lens. *Clin Ophthalmol* 2017;11:1987–93.
- ³⁰ Mendicute J, Kapp A, Levy P, et al. Evaluation of visual outcomes and patient satisfaction after implantation of a diffractive trifocal intraocular lens. *J Cataract Refract Surg* 2016;42(2):203–10.
- ³¹ Mojzis P, Kukuckova L, Majerova K, et al. (2017). Post-operative visual performance with a bifocal and trifocal diffractive intraocular lens during a 1-year follow-up. *Int J Ophthalmol*, 17 October 2017:1528–33.
- ³² Mojzis P, Kukuckova L, Majerova K, et al. Comparative analysis of the visual performance after cataract surgery with implantation of a bifocal or trifocal diffractive IOL. *J Refract Surg* 2014;30(10):666–72.
- ³³ Mojzis P, Majerova K, Hrcckova L, et al. Implantation of a diffractive trifocal intraocular lens: one-year follow-up. *J Cataract Refract Surg* 2015;41(8):1623–30
- ³⁴ Mojzis P, Majerova K, Plaza-Puche AB, et al. Visual outcomes of a new toric trifocal diffractive intraocular lens. *J Cataract Refract Surg* 2015;41(12):2695–706.
- ³⁵ Mojzis P, Peña-García P, Liehneova I, et al. Outcomes of a new diffractive trifocal intraocular lens. *J Cataract Refract Surg* 2014;40(1):60–69
- ³⁶ Piovella M, Colonval S, Kapp A, et al. Patient outcomes following implantation with a trifocal toric IOL: twelve-month prospective multicentre study. *Eye (Lond)*
- ³⁷ Plaza-Puche AB, Alio JL, Sala E, et al. Impact of low mesopic contrast sensitivity outcomes in different types of modern multifocal intraocular lenses. *Eur J Ophthalmol* 2016:0.

- ³⁸ Plaza-Puche AB, Alio JL. Analysis of defocus curves of different modern multifocal intraocular lenses. *Eur J Ophthalmol* 2016;0.
- ³⁹ Postolache C, Postolache O. Comparison of refractive results with bifocal implants AT LISA 809 and trifocal AT LISA tri 839. *Rom J Ophthalmol* 2015;59(2):100–02
- ⁴⁰ Qi Y, Lin J, Leng L, et al. Role of angle κ in visual quality in patients with a trifocal diffractive intraocular lens. *J Cataract Refract Surg* 2018;44(8):949–54.
- ⁴¹ Sezgin Asena B. Visual and refractive outcomes, spectacle independence, and visual disturbances after cataract or refractive lens exchange surgery: Comparison of 2 trifocal intraocular lenses. *J Cataract Refract Surg*. 2019 Nov;45(11):1539-1546.
- ⁴² Steinwender G, Schwarz L, Böhm M, et al. Visual results after implantation of a trifocal intraocular lens in high myopes. *J Cataract Refract Surg* 2018;44(6):680–85.
- ⁴³ Tarib I, Diakonis VF, Breyer D, Höhn F, Hahn U, Kretz FTA. Outcomes of combining a trifocal and a low-addition bifocal intraocular lens in patients seeking spectacle independence at all distances. *J Cataract Refract Surg*. 2019 May;45(5):620-629.
- ⁴⁴ Velasco-Barona C, Corredor-Ortega C, Mendez-Leon A, Casillas-Chavarin N L, Valdepeña-Lopez Velarde D, Cervantes-Coste G, Malacara-Hernandez D and Gonzalez-Salinas R. Influence of angle κ and higher-order aberrations on visual quality employing two diffractive trifocal IOLs: (AT LISA tri 839MP vs Acrysof IQ PanOptix). *Journal of Ophthalmology* 2019, Article ID 7018937
- ⁴⁵ Wang W, Ni S, Li X, et al. Femtosecond laser-assisted cataract surgery with implantation of a diffractive trifocal intraocular lens after laser in situ keratomileusis: a case report. *BMC Ophthalmol* 2018;18(1):160.
- ⁴⁶ Xue S, Zhao G, Yin X, et al. Effect of incision on visual outcomes after implantation of a trifocal diffractive IOL. *BMC Ophthalmol* 2018;18(1):171.
- ⁴⁷ Yang Y, Lv H, Wang Y, et al. Clinical outcomes following trifocal diffractive intraocular lens implantation for age-related cataract in China. *Clin Ophthalmol* 2018;12:1317–24.