Extending the range of vision with intraocular lenses: Implementing best practices for cataract surgery

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Filling the gaps: Advances in intraocular lens design

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What are the key visual needs and expectations of patients after cataract surgery?

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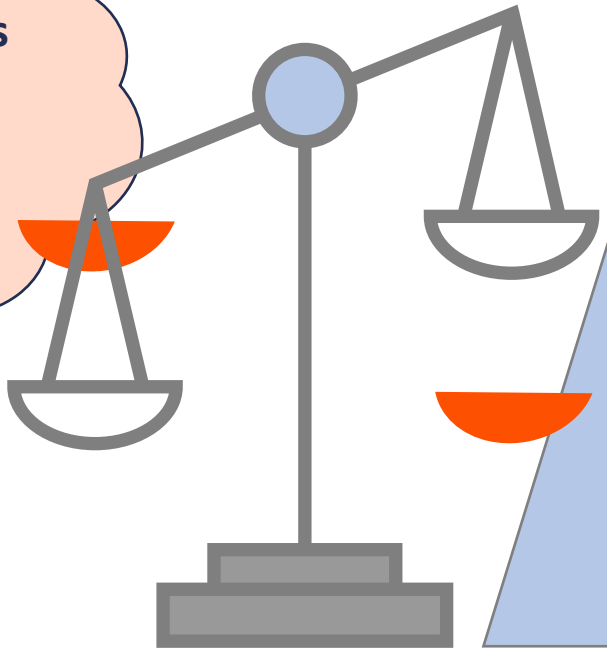
Setting expectations for IOLs

Patient expectations

- Good visual acuity[1,2]
- Spectacle independence[1,2]
- No complications or unsatisfactory results[1]



Important considerations

- Type and extent of positive dysphotopsias[2]
- Willingness to handle optical compromise or change[2]
- Requirement for post-surgery adjustment[3]

IOL, intraocular lens.

1. Salerno LC, et al. *Taiwan J Ophthalmol.* 2017;7(4):179–84; 2. Yeu E, Cuozzo S. *Ophthalmology.* 2021;128:e132–141;
3. Dick HB, Gerste RD. *Ophthalmology.* 2021;128:e206–13.

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How can the currently available intraocular lenses be used to address the visual needs of patients?

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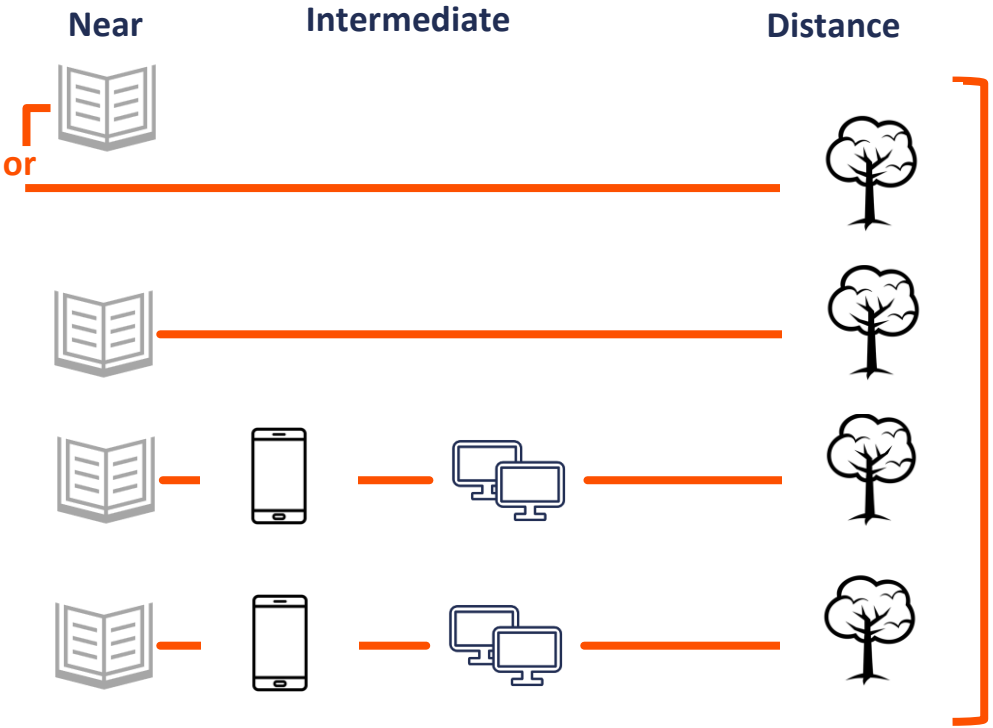
Visual outcomes vary with different IOLs

Monofocal IOLs[1,2]
Spectacles for reading or distance still needed

Multifocal IOLs[2,3]*
High-quality vision from near to distance (bifocal or trifocal)

EDOF IOLs[3]
Continuous range of good-quality intermediate vision



Hybrid IOLs[4,5]
Combine optical designs to extend range of vision

*Depending on the IOL model, visual acuity between focal points and optimal vision distances may vary.[3]
EDOF, extended depth of focus; IOL, intraocular lens.

1. Auffarth GU, et al. *J Cataract Refract Surg.* 2021;47:184–91; 2. de Silva SR, et al. *Cochrane Database Syst Rev.* 2016;12:CD003169;
3. Kondylis G, et al. *Ann Eye Sci*. 2019;4:5; 4. Kanclerz P, et al. *Asia Pac J Ophthalmol (Phila).* 2020;9:194-202; 5. Zhong Y, et al. *Sci Rep.* 2021;11:6699.

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What is the evidence for the effectiveness of trifocal and extended depth of focus lens technologies?

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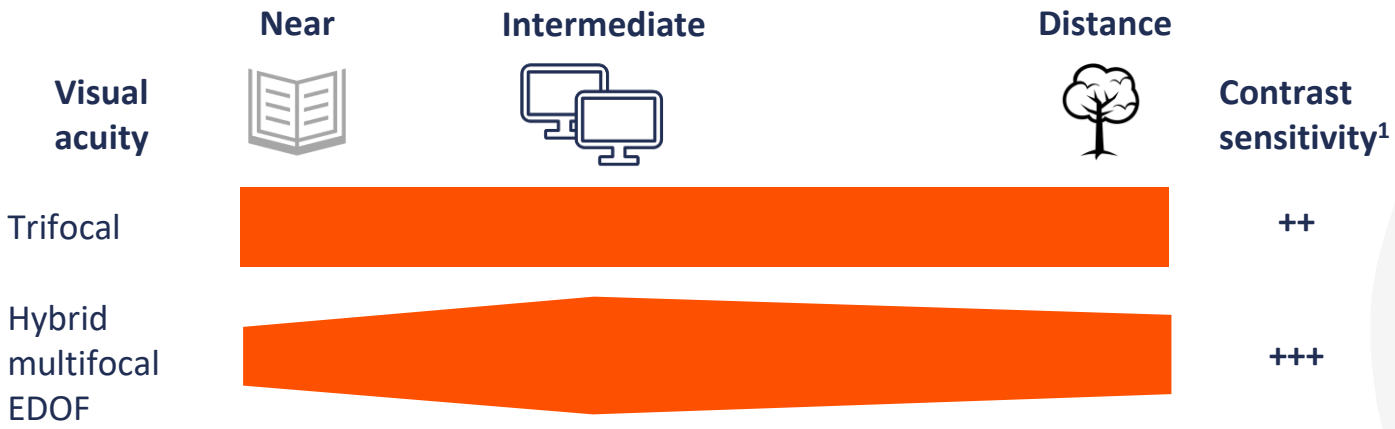
Trifocal IOLs and hybrid multifocal EDOF IOLs



Trifocal IOLs and hybrid multifocal EDOF IOLs split light at more points than monofocal or EDOF IOLs to provide an increased range of focus[1,2]

Multifocal IOLS have an increased likelihood of glare and halo photic effects compared with monofocal IOLs; glare and starbursts are also reported with EDOF IOLs[2,3]

(+) indicates performance in terms of contrast sensitivity, with more (+) indicating better performance.
EDOF, extended depth of focus; IOL, intraocular lens.

1. Kondylis G, et al. *Ann Eye Sci.* 2019;4:5; 2. Zhong Y, et al. *Sci Rep.* 2021;11:6699; 3. Ang RE, et al. *Clin Ophthalmol.* 2020;14:2339–51.

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How could new and emerging intraocular lens technologies further address the visual needs of patients?

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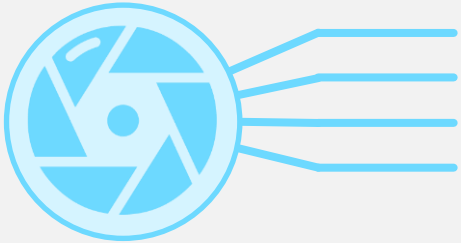
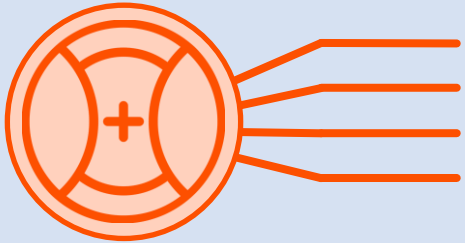
New and emerging IOL technologies

Small aperture IOL[1,2]



- Wide range of vision
- Good near vision in non-dominant eye
- May neutralize/help astigmatism
- Potential benefit with other corneal irregularities

Enhanced monofocal IOL with EDOF[3]



- Enhanced depth of focus*
- No increase in photic phenomena*

*Compared with standard monofocal IOL
EDOF, extended depth of focus; IOL, intraocular lens.

1. The Ophthalmologist. 2019. Available at: https://theophthalmologist.com/subspecialties/the-ic-8-iol-big-advantages-through-small-apertures (accessed 22 March 2022); 2. Ang RE, et al. *Clin Ophthalmol.* 2020;14:2339–51; 3. Auffarth GU, et al. *J Cataract Refract Surg.* 2021;47:184–91.

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How can we select the right intraocular lens for patients to meet their postoperative goals?

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IOL selection for individual patients

Discussion and patient education

Clinical factors

- Quality of imaging/topography[1]
- Quality/quantity/consistency of astigmatism[1,2]
- Ocular pathology (e.g. AMD, epiretinal membrane)[1]
- Dry eye and other corneal diseases[1]

Patient factors

- Financial situation[3]
- Desire for spectacle independence[1]
- Profession/hobby requirements[1]
- Acceptance of ocular phenomena or potential for lens exchange[1]
- Management of post-operative conditions (e.g. dry eye disease)[1]

Best IOL choice for visual outcomes and patient needs

AMD, age-related macular degeneration; IOL, intraocular lens.

Yeu E, Cuozzo S. *Ophthalmology.* 2021;128:e132–141; 2. Xia T, et al. *Asia Pac J Ophthalmol.* 2020;9:186–93;
3. Shah P. *Ophthalmol Times.* 2019. Available at: 9 best practices in refractive-cataract surgery planning (ophthalmologytimes.com) (accessed 22 March 2022).

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Intraocular lens selection: Key preoperative factors to consider

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What patient-specific ocular characteristics need to be assessed for intraocular lens selection?

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Pre-surgical assessment for IOL selection

Identify patient goals for IOL performance[1]

Assess ocular surface and condition/ comorbidities[1,2]

Perform accurate pre-surgical biometry for IOL power calculation[4]

Counsel patient to discuss IOL selection[1]

Dry eye disease[2,3]

- May be asymptomatic
- Signs and symptoms often under-reported

Other ocular comorbidities[1]

- AMD?
- Glaucoma?
- Epiretinal membrane?

AMD, age-related macular degeneration; IOL, intraocular lens.

1. Yeu E, Cuozzo S. *Ophthalmology.* 2021;128:e132–41; 2. Trattler WB, et al. *Clin Ophthalmol.* 2017;11:1423–30; 3. Gupta PK, et al. *J Cataract Refract Surg.* 2018;44:1090-6; 4. Xia T, et al. *Asia Pac J Ophthalmol* 2020;9:186–193.

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Does intraocular lens selection need special consideration in patients who have undergone previous refractive surgery?

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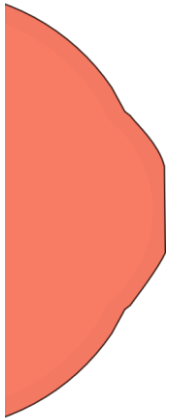
Effect of prior refractive surgery on IOL surgery



Any refractive surgery changes the shape of the cornea[1]

Prior refractive surgery affects IOL power calculations[1,2]

It is important to ask patients if they have had refractive surgery

- Some patients may not count it as surgery[3]

Advanced formulas and improved techniques to measure axial length and keratometry may reduce IOL power prediction error[1]

Prior radial keratotomy leads to an unpredictable IOL surgery outcome[1]

Patients should receive additional counselling on possible outcomes[4]

Further surgery or IOL exchange may be required[4]

IOL, intraocular lens.

1. Savini G, Hoffer KJ. *Eye and Vision.* 2018;5:18; 2. Turnbull AMJ, et al. *Ophthalmol.* 2020;127:45–51; 3. Loh J, personal communication. March 2022; 4. Abdalla Elsayed MEA, et al. *Sci Rep.* 2019;9:12877.

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What ocular pathological characteristics should be considered prior to intraocular lens selection?

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Addressing ocular pathology for IOL surgery

Glaucoma[1]

- Reduced contrast sensitivity
- Difficulty in evaluating visual field results

AMD[2,3]

- No single ideal lens
- Contraindications for certain IOLs

Epiretinal membrane[3,4]

- Consult a retinal specialist
- Poor candidate for multifocal IOLs

- Identify problems[3]
- Educate the patient[5]
- Make appropriate IOL selection[3]

IOL, intraocular lens.

1. Zhao C, et al. *Int J Ophthalmol.* 2020;13:580-6; 2. Grzybowski A, et al. *Graefes Arch Clin Exp Ophthalmol.* 2017;255:1687–96;
3. Yeu E, Cuozzo S. *Ophthalmology* 2021;128:e132–41; 4. Hardin JS, et al. *JAMA Ophthalmol.* 2018;136:148–54; 5. Wisely CE, et al. *Clin Ophthalmol.* 2020;14:1365–71.

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How can we determine what the patient expects from surgery?

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Assessing patient preferences

Patient-reported questionnaires[1,2]

- Vision-related QoL
- Quality of vision
- Spectacle independence
- Dysphotopsia

Ask the patient directly[3,4]

- When do you currently use your spectacles?
- What are your preferences regarding spectacle use after surgery?
- How do you feel about the possibility of experiencing issues such as glare or halos after surgery?
- What are your usual activities, hobbies or pastimes?

QoL, quality of life.

1. Gryzbowski A, et al. *Graefe's Arch Clin Exp Ophthalmol*. 2019;257:1091–9. 2. Lasch K, et al. *Am J Ophthalmol* 2022;237:91–103. 3. Yeu E, Cuozzo S. *Ophthalmology* 2021;128:e132–41; 4. Loh J. 2022. Personal communication.

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Prior to cataract surgery, how can we effectively communicate with patients regarding their choice of intraocular lens and refractive targets?

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Consistent patient communication[1,2]

Pre-consultation

Waiting room literature:

Leaflets and posters can help guide the discussion

Consultation

- Educate the patient
- Discuss strengths and weaknesses of IOL options
- Give your opinion and recommendations
- Tailor session to the patient's needs and ocular health
- Answer questions

Post-consultation

Additional resources

- Literature
- Videos

Telehealth visits for further questions

IOL, intraocular lens.

1. Loh J. 2022. Personal communication; 2. Shah P. *Ophthalmol Times.* 2019. Available at: https://www.ophthalmologytimes.com/view/9-best-practices-refractive-cataract-surgery-planning (accessed 22 March 2022).

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