

Clinic Desk Reference

15 one-screen cards for the eye OPD · RPC Rounds blog

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Cut-offs are taken from the published guidelines, standard texts and device normative data listed on each card. Device values are not interchangeable between machines. These cards support clinical judgement; they do not replace it. The online versions at sadbhaavclinic.com are kept up to date.

Topography and Keratoconus Screening Card: Cut-offs and Staging

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What to check, in order, when a topography or tomography report lands on your desk: is this keratoconus (or a suspect), how severe is it, is it progressing, and is the cornea safe for refractive surgery?

Step 1: quality and pattern

- Check the quality score, blinks, tear film and centration first. Dry eye and contact lens warpage (stop soft lenses about 1–2 weeks and rigid lenses about 3–4 weeks before) mimic ectasia.
- Look at both eyes side by side. Asymmetry between eyes is often the earliest sign.
- Red-flag axial patterns: inferior steepening, asymmetric bowtie with skewed radial axes (SRAX), and "crab-claw" (PMD-like) patterns.

Step 2: front-surface (Placido) indices

Index	Suspect	Keratoconus
Central K	Over 47.2 D	Over 48.7 D
I–S value (inferior minus superior power, 3 mm)	Over 1.4 D	Over 1.9 D
Inter-eye central K difference	Over 1.0 D	
SRAX (skew of the radial axes)	Over 21°	
KISA% (combines K, I–S, astigmatism and SRAX)	60–100%	Over 100%

Rabinowitz-McDonnell criteria. Placido indices miss early posterior-surface disease, so always look at tomography when available.

Step 3: tomography (Pentacam-type) checks

Parameter	Normal	Suspicious	Abnormal
BAD-D (Belin-Ambrósio final D)	Under 1.6	1.6–2.6	2.6 or more
Anterior elevation at the thinnest point (8 mm best-fit sphere)	Under +12 µm	+12 to +15 µm	Over +15 µm
Posterior elevation at the thinnest point (8 mm best-fit sphere)	Under +17 µm	+17 to +20 µm	Over +20 µm
Thinnest pachymetry	Over 500 µm	470–500 µm	Under 470 µm (interpret with the pattern)
Inter-eye thinnest-point difference	Under 30 µm	30 µm or more	
Thinnest point location	Displaced inferotemporally away from the apex, with a rapid "fall-off" of the pachymetry progression curve, is suspicious		

Device note: these cut-offs are for Pentacam-style Scheimpflug systems. Galilei, Sirius, MS-39 and swept-source OCT tomographers use their own indices and normative databases, so do not transfer numbers between machines. The BAD-D grey zone also depends on age: a borderline value is more worrying at 20 than at 55.

Step 4: stage it (Belin ABCD)

Stage	A: anterior radius (3 mm zone)	B: posterior radius (3 mm zone)	C: thinnest pachymetry	D: best distance VA
0	Over 7.25 mm (under 46.5 D)	Over 5.90 mm	Over 490 µm	20/20 or better
I	Over 7.05 mm (under 48.0 D)	Over 5.70 mm	Over 450 µm	Worse than 20/20
II	Over 6.35 mm (under 53.0 D)	Over 5.15 mm	Over 400 µm	Worse than 20/40
III	Over 6.15 mm (under 55.0 D)	Over 4.95 mm	Over 300 µm	Worse than 20/100
IV	Under 6.15 mm (over 55.0 D)	Under 4.95 mm	300 µm or less	Worse than 20/400

Each parameter is staged separately (for example A2 B3 C1 D1), with a suffix for scarring.

Step 5: is it progressing? (cross-linking decision)

- The global consensus (2015) defines progression as a consistent change in at least two of: steepening of the anterior surface, steepening of the posterior surface, and thinning (or faster change in thickness from periphery to the thinnest point).
- A commonly used practical trigger is an increase in Kmax of 1 D or more over 12 months on repeated, good-quality scans from the same device.
- Children and teenagers progress faster: many surgeons cross-link at diagnosis in paediatric keratoconus.
- Standard epithelium-off (Dresden) cross-linking needs at least about 400 µm of stroma after epithelial removal. Thinner corneas need modified (hypo-osmolar or customised) protocols.

Step 6: refractive surgery safety screen

Check	Safer	Caution or avoid
Residual stromal bed (LASIK)	300 µm or more	Under 250–300 µm
Percent tissue altered: (flap + ablation) ÷ preoperative CCT	Under 40%	40% or more (high ectasia risk)
Tomography	Normal in both eyes	Any suspicious BAD-D, elevation or pachymetry pattern: avoid LASIK; consider surface ablation only with great care, or phakic IOL
Epithelial thickness map (if available)	Even epithelium	Epithelial thinning over a steep area with a surrounding "doughnut" of thicker epithelium suggests early ectasia

Red flags on any report: inferior steepening with a skewed bowtie, posterior elevation over +20 µm, a thinnest point under 470 µm or far from the apex, inter-eye asymmetry, or a young patient with a rising cylinder. Repeat the scan, then decide.

Related: how to read topography and tomography (detailed tips), keratoconus notes and refractive surgery for residents.

Key sources

- Rabinowitz YS, McDonnell PJ. Computer-assisted corneal topography in keratoconus. *Refract Corneal Surg* 1989;5:400–8; and the KISA% index (Rabinowitz & Rasheed, *J Cataract Refract Surg* 1999)
- Belin ABCD keratoconus staging (*Oculus supplement, EyeWorld Asia-Pacific* 2018)
- Gomes JA et al. Global consensus on keratoconus and ectatic diseases. *Cornea* 2015;34:359–69
- Santiago MR et al. Association between the percent tissue altered and post-LASIK ectasia. *Am J Ophthalmol* 2014;158:87–95

OCT Macula Reference Card: Normal Thickness, DME and Hole Staging

Last updated: October 2026

A one-screen checklist for macular OCT reports: is the scan trustworthy, which layer is involved, how thick is it compared with normal, and which disease-specific cut-offs apply?

Step 1: is the scan reliable?

- Signal strength or quality index above the manufacturer's threshold (for example Cirrus signal strength 6/10 or more; Spectralis Q score about 20 dB or more).
- Centred on the fovea, with no segmentation errors. Always look at the B-scans, not just the thickness map: misplaced lines produce false "thinning" or "thickening".
- Compare with the previous scan using the same device and the follow-up (registration) mode.

Step 2: normal central subfield thickness (CST)

Device	Typical normal CST	Centre-involved DME threshold (DRCR Retina Network)
Zeiss Cirrus	About 250–270 µm	Women 290 µm or more; men 305 µm or more
Heidelberg Spectralis	About 270–300 µm	Women 305 µm or more; men 320 µm or more
Other devices (Topcon, Optovue and others)	Use the device's own normative database. Thickness values are not interchangeable between machines, because they place the outer boundary at different layers.	

Step 3: name the layer, then the disease

Finding and location	Think of
Intraretinal cysts (inner or outer nuclear layer)	DME, RVO, uveitic and post-cataract CME (Irvine-Gass), wet AMD, retinitis pigmentosa, epiretinal membrane traction
Subretinal fluid, smooth dome	CSCR (look for a thick choroid and RPE bumps), wet AMD, VKH (multiple loculated pockets with septae)
Sub-RPE elevation	Drusen (dome, medium reflectivity), PED: serous (hollow), fibrovascular (filled), drusenoid; polypoidal lesions (sharp-peaked PED, "double-layer sign")
Hyper-reflective material above the RPE	Type 2 MNV, subretinal haemorrhage, vitelliform material, fibrosis
Outer retinal loss with choroidal hypertransmission	Atrophy: cRORA when 250 µm or more. See geographic atrophy.
Inner retinal hyper-reflectivity, then thinning	Acute and old artery occlusion; PAMM (middle-layer band)
Ellipsoid zone disruption only	Solar or laser injury, MEWDS, AZOOR, early hydroxychloroquine toxicity (parafoveal "flying saucer" sign), MacTel

Step 4: vitreomacular interface

Condition	Key cut-offs (International Vitreomacular Traction Study, 2013)
Vitreomacular adhesion (VMA)	Perifoveal vitreous separation with attachment within 3 mm of the fovea, normal foveal contour
Vitreomacular traction (VMT)	As VMA, but with distortion of the fovea. Focal: 1500 µm or less; broad: over 1500 µm.
Full-thickness macular hole: size (minimum linear diameter)	Small 250 µm or less; medium over 250 to 400 µm; large over 400 µm. Note whether VMT is present.
Lamellar hole vs macular pseudohole (2020 consensus)	Lamellar hole: irregular foveal contour, foveal cavity with undermined edges and loss of foveal tissue (often epiretinal proliferation). Pseudohole: steep foveal walls from an ERM without tissue loss.
Epiretinal membrane (Govetto staging)	Stage 1: foveal pit present. Stage 2: pit lost, layers identifiable. Stage 3: continuous ectopic inner foveal layers (EIFL). Stage 4: EIFL with disorganised layers. Higher stage means worse vision and outcome.

Step 5: disease-specific markers

- DME biomarkers: DRIL (disorganised retinal inner layers), hyper-reflective foci, subretinal fluid, ellipsoid zone integrity and vitreomacular interface. See OCT biomarkers in DMO.
- Wet AMD activity: new or increased intraretinal or subretinal fluid, a growing PED, or new haemorrhage. Persistent stable subretinal fluid can be tolerated in treat-and-extend regimens; intraretinal fluid is worse for vision.
- CSCR: subretinal fluid with a thick choroid (pachychoroid) and dilated Haller vessels; check for a small PED at the leak point.
- Hydroxychloroquine screening: look for parafoveal (or, in Asian patients, pericentral) loss of the ellipsoid zone. See the screening schedules card.

Common artefacts: segmentation errors in high myopia, ERM and large PEDs; mirror artefacts; decentration; and media opacity giving false thinning. If the number does not fit the picture, trust the B-scan.

Related: how to read an OCT (detailed tips), macular hole staging and retinal layers.

Key sources

- Duker JS et al. The International Vitreomacular Traction Study Group classification. Ophthalmology 2013;120:2611–9
- Hubschman JP et al. Optical coherence tomography-based consensus definition for lamellar macular hole. Br J Ophthalmol 2020;104:1741–7
- Govetto A et al. Insights into epiretinal membranes: a new OCT staging scheme. Am J Ophthalmol 2017;175:99–113
- DRCR Retina Network protocol definitions of centre-involved DME (Protocol V and later)

OCT Disc and Glaucoma Reference Card: RNFL, GCIPL and Pitfalls

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Clinic Desk Reference Glaucoma

A checklist for optic disc and ganglion cell OCT reports. The colour codes compare the patient with a normative database, so they help, but they can mislead in both directions.

Step 1: is the scan reliable?

- Signal strength above threshold, the circle centred on the disc, and no segmentation errors on the circular B-scan.
- Check disc area: very small or very large discs, tilted myopic discs and peripapillary atrophy fall outside most normative databases.
- Note the patient's age, ethnicity and refraction. Most databases do not include high myopes.

Step 2: the numbers

Parameter	Typical normal	Notes
Average RNFL thickness	About 90–105 µm (falls by roughly 0.2–0.5 µm a year with age)	Values in the 70s or lower are suspicious; under about 50–55 µm the "floor effect" makes RNFL useless for tracking progression
Quadrant pattern (ISNT)	Inferior thickest, then superior, then nasal, then temporal	Loss of the inferior or superior "humps" on the TSNIT curve is an early glaucoma sign
Inter-eye asymmetry (average RNFL)	Under about 9 µm	Larger asymmetry is suspicious even when both eyes are "green"
Ganglion cell-inner plexiform layer (GCIPL, Cirrus)	Average about 80–85 µm	Inferotemporal arcuate thinning is typical of glaucoma. Useful in high myopes and for early central damage.
Rim parameters (BMO-MRW, Spectralis)	Compare with the device's age-matched database	BMO-based rim width is more anatomically accurate than the disc margin seen clinically

Device note: RNFL values differ between Cirrus, Spectralis, Topcon and Optovue (typically by several microns). Use one device for follow-up, and never compare raw numbers across machines.

Step 3: "red disease" and "green disease"

Trap	What happens	Examples
Red disease (false positive)	Red or yellow flags in an eye without glaucoma	High myopia and tilted discs (temporal shift of the RNFL bundles), small discs, segmentation errors, peripapillary atrophy, poor signal, ethnic variation
Green disease (false negative)	Normal colours despite real glaucoma	Large discs and high baseline RNFL, early focal notches averaged out, swelling (papilloedema, NAION) or ERM masking loss, vitreopapillary traction

Step 4: patterns that point away from glaucoma

- Temporal (papillomacular) RNFL loss and central GCIPL loss: think of toxic or nutritional optic neuropathy, optic neuritis, Leber hereditary optic neuropathy and compressive lesions.
- Band or "bow-tie" loss (nasal and temporal): chiasmal or optic tract lesions; check the GCIPL for a hemianopic (vertical-midline) pattern.
- Thick RNFL: disc swelling (papilloedema, NAION, papillitis) or disc drusen. See drusen vs papilloedema.
- Pallor out of proportion to cupping, young age, or vision loss out of keeping with the field: image the brain.

Step 5: progression

- Use the device's guided progression analysis with at least 3–4 good-quality scans. A sustained loss larger than the test-retest variability (typically about 4–5 µm for average RNFL on spectral-domain OCT) suggests change.
- Rate of loss matters more than a single value: compare the slope with the patient's age and life expectancy (see target IOP).
- In advanced disease, follow GCIPL, macular OCT and visual fields rather than RNFL.

Never diagnose glaucoma from OCT colours alone. Combine the disc examination (rim, notches, disc haemorrhage), the field, the IOP and the OCT, and look for agreement between structure and function.

Related: how to read an OCT, disc damage likelihood scale, visual field card and disc haemorrhage.

Key sources

- Chong GT, Lee RK. Glaucoma versus red disease: imaging and glaucoma diagnosis. Curr Opin Ophthalmol 2012;23:79–88
- Mwanza JC et al. Ability of Cirrus HD-OCT optic nerve head parameters to discriminate normal from glaucomatous eyes. Ophthalmology 2011;118:241–8
- Chauhan BC et al. Bruch's membrane opening minimum rim width and RNFL for glaucoma detection. Ophthalmology 2015;122:1786–94

Visual Field Reference Card: Reliability, Glaucoma Criteria and Staging

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A checklist for Humphrey-type automated perimetry printouts: reliability, is it glaucoma, how severe, and does the pattern point elsewhere?

Step 1: identify the test and the patient

- Name, age, the eye tested, pupil size, refraction used and visual acuity. A small pupil or the wrong near add depresses the whole field.
- Test pattern: 24-2 for glaucoma screening and follow-up; 10-2 for advanced glaucoma, central defects and hydroxychloroquine screening; 30-2 for neurological work-ups. The algorithm (SITA Standard, Fast or Faster) affects test time and variability.
- Is this the patient's first or second field? The first field often shows a learning effect, so confirm any defect on a repeat test.

Step 2: reliability indices

Index	Commonly accepted limit	Comment
Fixation losses	20% or less	Often over-flagged (blind-spot mapping error). Check the gaze tracker trace.
False positives	15% or less (some use 10%)	The most important index. A "trigger-happy" patient produces an impossibly good field with white patches on the greyscale.
False negatives	33% or less	Fatigue or inattention, but high false negatives are expected in advanced glaucoma

Step 3: is it glaucomatous? (Anderson-Patella minimum criteria)

Any one of the following, confirmed on two consecutive reliable fields:

1. Glaucoma Hemifield Test "outside normal limits".
2. A cluster of 3 or more contiguous non-edge points on the pattern deviation plot depressed at $p < 5\%$, with at least one at $p < 1\%$.
3. Pattern standard deviation (PSD) significant at $p < 5\%$.

The defect should respect the horizontal meridian, match the disc and OCT findings, and follow the nerve fibre pattern (nasal step, arcuate, paracentral).

Step 4: how severe? (Hodapp-Parrish-Anderson staging, 24-2 or 30-2)

Stage	Mean deviation	Pattern deviation points	Central 5°
Early	Better than −6 dB	Fewer than 18 points at $p < 5\%$ and fewer than 10 at $p < 1\%$	No point under 15 dB
Moderate	−6 to −12 dB	Fewer than 37 points at $p < 5\%$ and fewer than 20 at $p < 1\%$	No absolute (0 dB) point; under 15 dB in only one hemifield
Severe	Worse than −12 dB	37 or more points at $p < 5\%$, or 20 or more at $p < 1\%$	Any 0 dB point, or points under 15 dB in both hemifields

A field is staged by the worst criterion met. VFI (visual field index) expresses remaining function as a percentage and is useful for plotting rate of progression.

Step 5: progression

- Guided Progression Analysis (GPA) needs two baselines plus follow-up tests. "Possible progression" means 3 or more points worse than baseline ($p < 5\%$) on two consecutive tests; "likely progression" means the same on three consecutive tests.
- Look at the VFI or MD slope: a loss of about 1 dB a year or more is fast for most patients.
- Six fields in the first two years is the ideal to estimate the rate reliably in newly diagnosed glaucoma.

Step 6: patterns that are not glaucoma

Pattern	Think of
Respects the vertical meridian (hemianopia, quadrantanopia)	Chiasmal or retrochiasmal lesion: image the brain. Bitemporal: chiasm; homonymous: optic tract to occipital cortex.
Central or centrocaecal scotoma	Optic neuritis, toxic or nutritional neuropathy, LHON, macular disease
Altitudinal defect	NAION, branch retinal artery occlusion, advanced glaucoma
Enlarged blind spot	Papilloedema, disc drusen, MEWDS, peripapillary atrophy
Generalised depression (total deviation low, pattern deviation normal)	Cataract or media opacity, small pupil, wrong refraction
"Cloverleaf" or progressively constricting field	Fatigue or non-organic loss
Ring scotoma	Retinitis pigmentosa, high plus lens (aphakic correction) artefact

Before you act: rule out a lens rim artefact (edge points depressed), a ptotic lid (superior defect that lifts with taping), and a learning effect. Repeat any new defect before changing treatment.

Related: how to read a visual field (detailed tips), visual field defect localisation, perimetry algorithms and the OCT disc card.

Key sources

- Anderson DR, Patella VM. Automated Static Perimetry. 2nd ed. Mosby; 1999
- Hodapp E, Parrish RK II, Anderson DR. Clinical Decisions in Glaucoma. Mosby; 1993
- Chauhan BC et al. Practical recommendations for measuring rates of visual field change in glaucoma. Br J Ophthalmol 2008;92:569–73
- Reliability index limits (Eyes On Eyecare)

Specular Microscopy Reference Card: Cell Density, CV and Hexagonality

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- Clinic Desk Reference
- Cornea & Lens

Specular microscopy tells you how much endothelial reserve a cornea has. Check it before cataract surgery in Fuchs dystrophy, after trauma or previous surgery, before phakic IOLs, and when grading donor corneas.

The three numbers

Parameter	Normal	Abnormal or worrying	Meaning
Cell density (ECD)	About 2,000–3,000 cells/mm² in adults (higher in children)	Under 1,500: limited reserve. Under 1,000: high risk of decompensation after intraocular surgery. Under about 500: corneal oedema.	How many pump cells are left
Coefficient of variation (CV, polymegethism)	Under 0.30 (30%)	Over 0.40	Variation in cell size: a stressed endothelium
Hexagonality (pleomorphism)	Over 60% hexagonal cells	Under 50%	Loss of regular shape: an unstable endothelium

Cell density falls with age, by roughly 0.5–0.6% a year in adults. Cataract surgery typically costs about 5–10% of cells, more with hard nuclei, long phaco time or shallow chambers.

Typical density by age (approximate)

Age	Approximate ECD (cells/mm²)
Infancy	4,000–5,000 or more
20–30 years	About 3,000–3,500
40–60 years	About 2,600–3,000
Over 70 years	About 2,300–2,600

Population values vary; Indian and East Asian series report similar or slightly higher densities. Use the fellow eye and previous counts for comparison.

What to do with the result

Situation	Action
Cataract with ECD over about 1,500 and normal CV and hexagonality	Routine surgery with good endothelial protection (dispersive viscoelastic, low phaco energy)
Cataract with ECD 1,000–1,500, or guttae	Counsel about slower recovery and possible oedema. Use soft-shell technique and chop to reduce energy; consider DMEK later if needed.
Fuchs dystrophy with morning blur, CCT over about 620–640 µm, or epithelial bullae	Consider combined or staged cataract surgery and endothelial keratoplasty (DMEK or DSAEK)
Phakic IOL (anterior chamber or iris-fixed)	Check ECD before and yearly after. Explant if it falls below the safe limit for age or drops fast.
Donor cornea for keratoplasty	Most eye banks require about 2,000 cells/mm² or more for penetrating keratoplasty, and often more (about 2,300–2,500) for DMEK

Reading the image: the automatic count is only as good as the image. Check that at least about 50–100 cells were counted, that the analysed area is in focus, and that guttae (dark spots) have not been counted as cells. In advanced guttae the device may give a falsely high or "unmeasurable" count; confocal microscopy or clinical judgement then takes over.

Red flags: ECD under 1,000 cells/mm², a fall of more than about 10% in a year, CV over 0.40 with hexagonality under 50%, or guttae with central corneal thickening. Plan endothelial protection or keratoplasty rather than routine surgery.

Related: Fuchs endothelial dystrophy, keratoplasty types, the cataract pre-op risk checklist and normal values.

Key sources

- Bourne WM, Nelson LR, Hodge DO. Central corneal endothelial cell changes over a ten-year period. Invest Ophthalmol Vis Sci 1997;38:779–82
- McCarey BE, Edelhauser HF, Lynn MJ. Review of corneal endothelial specular microscopy for FDA clinical trials of refractive procedures, surgical devices and new intraocular drugs and solutions. Cornea 2008;27:1–16
- Eye Bank Association of India and Eye Bank Association of America medical standards (current editions)

Biometry Check Before Cataract Surgery: When to Recheck and Which Formula

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A one-page check before you sign an IOL power. Most refractive surprises come from a measurement that should have been repeated, not from the formula.

Recheck the biometry if any of these apply

Check	Recheck when
Axial length (AL)	Under about 22 mm or over about 25 mm, or more than 0.3 mm different from the fellow eye without anisometropia to explain it
Mean keratometry (K)	Under about 40 D or over about 47 D, or more than 1 D different between eyes
Corneal cylinder	Different axis or magnitude between the biometer and topography (repeat; treat dry eye first)
Calculated IOL power	More than about 3 D different between the two eyes, or not in keeping with the old spectacle prescription
Quality	Low signal-to-noise or standard deviation flags, a dense cataract, poor fixation
History	Previous LASIK, PRK or RK; previous vitrectomy or silicone oil; contact lens wear; keratoconus

Error rules of thumb

- 1 mm of axial length error gives about 2.5–3 D of refractive error (more in short eyes); 0.1 mm gives about 0.25–0.3 D.
- 1 D of keratometry error gives about 1 D of refractive error.
- Contact (applanation) A-scan compresses the cornea, gives a falsely short AL and leaves the patient myopic. Prefer optical or immersion biometry.

Choosing the formula by axial length

Axial length	Good choices	Notes
Short (under 22 mm)	Barrett Universal II, Kane, Hill-RBF, Haigis; Hoffer Q among the older formulas	Check ACD and lens thickness; consider a nanophthalmos work-up if AL is under about 20.5 mm
Average (22–26 mm)	Barrett Universal II, Kane, EVO, Hill-RBF; SRK/T and Holladay 1 are acceptable	Use optimised constants
Long (over 26 mm)	Barrett Universal II, Kane, EVO; SRK/T or Holladay 1 with the Wang-Koch AL adjustment	Older formulas tend to leave long eyes hyperopic; aim slightly myopic
Post-refractive surgery	Barrett True-K, total-keratometry-based formulas, and the ASCRS calculator	See post-refractive IOL calculation

Special situations

Situation	What to do
Silicone oil in the eye	Use the optical biometer's silicone oil mode. For ultrasound, sound velocity in oil is about 980 m/s (versus 1532 m/s in vitreous). Adjust the IOL power for the oil, typically adding about +3 to +3.5 D for a posterior-chamber IOL if the oil will stay.
Staphyloma or high myopia	Measure along the visual axis with optical biometry, or use B-scan-guided A-scan
Sulcus IOL (posterior capsule rupture)	Reduce the power, typically by about 0.5–1.0 D depending on the IOL power (see sulcus power adjustment). Use optic capture when possible.
Corneal astigmatism of about 1.0–1.25 D or more	Consider a toric IOL or limbal relaxing incisions, and account for posterior corneal astigmatism (use a toric calculator that includes it, such as Barrett). See toric IOL pearls and the LRI calculator.
Children	Aim for undercorrection (hyperopia) depending on age, because the eye will grow. See congenital cataract.

Theatre safety check (every case)

1. Right patient, right eye marked, and biometry printout for that eye.
2. IOL model, power and constant match the plan; a backup IOL (for the sulcus and for a different model) is available.
3. Target refraction agreed with the patient (distance, monovision, near) and written on the sheet.
4. Toric axis marked with the patient sitting upright.

Biggest preventable errors: the wrong eye's biometry, the wrong IOL taken from the shelf, and not repeating a measurement that "looked odd". A two-person check of eye, model and power prevents most of them.

Related: biometry rules of thumb (detailed), IOL formulas compared, IOL calculators, A-constant reference and refractive surprise.

Key sources

- Hoffer KJ, Savini G. Update on intraocular lens power calculation study protocols. Ophthalmology 2021;128:e115–20
- Wang L, Koch DD et al. Optimizing intraocular lens power calculations in eyes with axial lengths above 25.0 mm. J Cataract Refract Surg 2011;37:2018–27
- Royal College of Ophthalmologists. Cataract Surgery Guidelines (biometry standards)

Electrophysiology Reference Card: ERG, EOG and VEP Patterns

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- Clinic Desk Reference
- Retina & Neuro

Which test answers which question, what the waveforms mean, and the classic patterns to recognise. Normal values are laboratory-specific: always compare with the lab's own age-matched range.

Which test for which question?

Test	What it tests	Use it for
Full-field ERG (ffERG)	Mass response of rods and cones across the whole retina	Retinitis pigmentosa and other dystrophies, CSNB, cone dystrophy, drug toxicity (e.g. vigabatrin), unexplained night blindness
Pattern ERG (PERG)	Macular function (P50) and ganglion cells (N95)	Separating macular from optic nerve causes of poor vision
Multifocal ERG (mfERG)	Cone function mapped across the central 30–50°	Hydroxychloroquine toxicity, occult macular dystrophy, AZOOR
EOG	RPE function (light rise / dark trough)	Best vitelliform dystrophy
VEP	The whole visual pathway to the occipital cortex	Optic neuritis and demyelination, compressive lesions, non-organic loss, infants

ISCEV full-field ERG: the standard responses

Step	Adaptation and flash	Mainly reflects
DA 0.01	Dark-adapted, dim flash	Rod bipolar cells (b-wave only)
DA 3.0 (and DA 10)	Dark-adapted, bright flash	Combined rod-cone: a-wave = photoreceptors, b-wave = bipolar (inner retina)
DA oscillatory potentials	Dark-adapted	Amacrine cells; reduced in ischaemia (e.g. diabetic retinopathy)
LA 3.0	Light-adapted single flash	Cone system
LA 30 Hz flicker	Light-adapted flicker	Cone system (rods cannot follow 30 Hz)

Dark adaptation for at least 20 minutes before scotopic steps, and light adaptation for 10 minutes before photopic steps (ISCEV standard).

Classic patterns

Pattern	Conditions
Negative ERG (b-wave smaller than a-wave in the DA bright flash)	Complete and incomplete CSNB, X-linked retinoschisis, CRAO, melanoma-associated retinopathy (MAR), quinine toxicity, Batten disease (CLN3), birdshot chorioretinopathy (some)
Rods affected more than cones, delayed flicker	Retinitis pigmentosa (often reduced long before visible fundus change)
Cones affected, rods normal	Cone and cone-rod dystrophy, achromatopsia (flicker almost absent)
Extinguished ERG in an infant	Leber congenital amaurosis
Normal ffERG with abnormal PERG P50 or mfERG	Macular disease (e.g. Stargardt, occult macular dystrophy, HCQ toxicity)
Normal ffERG and P50, reduced PERG N95	Ganglion cell or optic nerve disease
Abnormal EOG with normal ERG	Best vitelliform dystrophy (the defining pattern). Arden ratio typically under about 1.5; normal is usually about 1.8 or more (lab-specific).
Reduced oscillatory potentials	Diabetic retinopathy, ischaemic retinopathies

VEP quick guide

- Pattern-reversal VEP P100 latency is about 100 ms in healthy adults; the lab's upper limit is usually around 110–118 ms.
- Delayed latency with preserved amplitude: demyelination (optic neuritis, multiple sclerosis); latency often stays delayed after vision recovers.
- Reduced amplitude: axonal loss, ischaemic or compressive neuropathy, or poor fixation, uncorrected refraction or media opacity.
- Flash VEP is used when pattern VEP is not possible (infants, very poor vision, uncooperative patients).
- A normal pattern VEP at small check sizes in a patient claiming very poor vision suggests non-organic loss.

Before ordering: write the clinical question on the request ("is the macula or the optic nerve the cause of 6/36 vision?"). The lab will choose the right protocol, and dilated pupils (for ERG) or undilated pupils with best refraction (for pattern VEP) must be arranged accordingly.

Related: electro-oculography, normal values and optic neuritis vs NAION.

Key sources

- Robson AG et al. ISCEV standard for full-field clinical electroretinography (2022 update). Doc Ophthalmol 2022;144:165–77
- Constable PA et al. ISCEV standard for clinical electro-oculography (2017 update). Doc Ophthalmol 2017;134:1–9
- Odom JV et al. ISCEV standard for clinical visual evoked potentials (2016 update). Doc Ophthalmol 2016;133:1–9

FFA and ICG Angiography Patterns: Quick Reference Card

Last updated: October 2026

- Clinic Desk Reference
- Retina & Uvea

Read an angiogram by phase, then classify every abnormality as too bright (hyperfluorescence) or too dark (hypofluorescence), and decide why.

FFA phases (approximate timings after injection)

Phase	Timing	What you see
Choroidal (pre-arterial)	About 8–12 s	Patchy choroidal flush; a cilioretinal artery fills now
Arterial	About 1 s after choroidal	Retinal arteries fill
Arteriovenous (capillary)	A few seconds later	Capillaries fill; laminar flow along the veins
Venous	About 20–30 s	Veins fill completely; maximum vessel fluorescence; foveal avascular zone well seen
Late (recirculation)	About 5–10 minutes	Dye leaves the vessels: leakage, staining and pooling show up now

A delayed arm-to-retina time or arterial filling suggests carotid disease or artery occlusion. Delayed venous filling suggests vein occlusion or ocular ischaemic syndrome.

Hyperfluorescence: why is it too bright?

Mechanism	Behaviour over time	Examples
Window (transmission) defect	Appears early with the choroidal flush, fades late; size and shape stay the same	RPE atrophy (geographic atrophy, old scars), macular hole
Leakage	Increases in size and brightness with fuzzy margins	Classic CNV (lacy, early), occult CNV (stippled, late), CME (petaloid or honeycomb), disc swelling, neovascularisation elsewhere
Pooling	Fills a defined space; brightness increases, borders stay sharp	Serous PED, CSCR (ink-blot or smoke-stack leak)
Staining	Late fluorescence of tissue without leakage	Drusen, scars, sclera, disc tissue, vessel walls in vasculitis
Abnormal vessels	Early, well-defined	Tumour vessels, telangiectasia (Coats, MacTel), shunts
Autofluorescence and pseudofluorescence	Visible before dye injection	Disc drusen and astrocytic hamartoma (autofluorescence); mismatched filters (pseudofluorescence)

Hypofluorescence: why is it too dark?

Mechanism	Examples
Blocked fluorescence (something in front)	Haemorrhage (retinal blocks retinal vessels; subretinal blocks choroid), pigment, lipofuscin (Stargardt "dark choroid"), exudate, media opacity
Filling defect (no perfusion)	Capillary non-perfusion (diabetic retinopathy, RVO), artery occlusion, choroidal infarcts (Elschnig spots), choroideraemia, choroidal ischaemia

ICG angiography: when and what

Question	ICG finding
Polypoidal choroidal vasculopathy?	Early focal hyperfluorescent polyps with a branching vascular network (the diagnostic standard; EVEREST criteria)
Occult CNV or retinal angiomatous proliferation (RAP)?	Late plaque (occult CNV) or a focal "hot spot" (RAP)
CSCR or pachychoroid?	Mid-phase choroidal hyperpermeability and dilated choroidal vessels
Choroiditis (white dot syndromes, VKH, sympathetic ophthalmia, birdshot)?	Hypofluorescent dark dots in the intermediate and late phases, often more numerous than the visible lesions
Choroidal tumours?	Haemangioma: very early intense filling with late "washout". Melanoma: variable, with intrinsic circulation.

ICG is about 98% protein-bound and fluoresces in the near-infrared, so it passes through pigment, blood and exudate and stays inside the choriocapillaris, which is why it shows the choroid better than fluorescein.

Safety: fluorescein commonly causes nausea and yellow skin and urine; anaphylaxis is rare but real, so keep a resuscitation kit ready. ICG contains iodide: take care with iodine allergy, and avoid it in pregnancy unless essential.

Related: FFA indications, ICG angiography indications, CSCR and the OCT macula card.

Key sources

- AAO BCSC Section 12: Retina and Vitreous (current edition), chapter on diagnostic approach
- Koh A et al. EVEREST study: ICGA-guided photodynamic therapy for polypoidal choroidal vasculopathy. Retina 2012;32:1453–64
- Kwiterovich KA et al. Frequency of adverse systemic reactions after fluorescein angiography. Ophthalmology 1991;98:1139–42

B-scan Ultrasound Patterns: RD, PVD, Choroidal Detachment and Masses

Last updated: October 2026

Clinic Desk Reference Retina & Oncology

When the fundus is hidden by cataract, blood or corneal opacity, B-scan answers three questions: is the retina attached, is there a mass, and is there a foreign body? Always scan dynamically (ask the patient to move the eye) and compare with the fellow eye.

Membranes in the vitreous cavity

Feature	Posterior vitreous detachment	Retinal detachment	Choroidal detachment
Shape	Thin, smooth, often incomplete	Folded or funnel-shaped (open or closed funnel)	Smooth, thick, dome-shaped; "kissing" if large
Attachment	May attach at the disc or vitreous base, but often free	Attached at the optic disc and the ora serrata	Does <i>not</i> reach the disc; anchored by vortex veins
Reflectivity (A-scan)	Low (spike well under 100%)	High (100% spike at high gain and at low gain)	High, often a double-peaked spike
Movement after eye movement	Marked, undulating, with long after-movement	Moderate (less in chronic RD or PVR)	Little or none
Under the membrane	Clear or with blood	Clear or with cells or blood	Clear (serous) or echogenic (haemorrhagic)

Masses

Lesion	B-scan shape	A-scan internal reflectivity	Other clues
Choroidal melanoma	Dome or "collar-stud" (mushroom) shape	Low to medium, regular, with decreasing spikes ("angle kappa")	Acoustic hollowness, choroidal excavation, orbital shadowing; internal vascular pulsation
Choroidal haemangioma	Smooth dome, usually posterior pole	High	No excavation; orange lesion clinically
Metastasis	Flat or lumpy, often multifocal	Medium to high, irregular	History of cancer (breast, lung)
Disciform scar or haemorrhage	Irregular, flat to elevated	High, irregular	Fellow-eye AMD; changes over weeks
Retinoblastoma	Irregular mass	High	Calcification with dense shadowing (persists at low gain)
Optic disc drusen	Bright nodule at the disc	Very high	Persists at low gain, with posterior shadowing

Other common findings

- Vitreous haemorrhage: low-reflective dots that move freely. Fresh blood is faint; older blood organises into membranes. In diabetes, look for traction on the retina; in a non-diabetic, look for a tear or detachment.
- Endophthalmitis: diffuse vitreous opacities and choroidal thickening; check for retinal detachment before tap and injection.
- Intraocular foreign body: very bright echo with shadowing; metal and glass show reverberation artefacts. CT is the test of choice; avoid MRI if a metallic foreign body is possible.
- Posterior scleritis: thickened sclera with fluid in Tenon's space, giving the "T-sign" around the optic nerve.
- Dislocated lens or IOL: bright, often mobile structure lying on the retina.
- Staphyloma: posterior outpouching of the globe in high myopia; affects biometry.

Technique tips: start at high gain to find faint membranes, then lower the gain to judge reflectivity. Scan in transverse and longitudinal planes, centre the probe on the lesion for height measurement, and document axial length if a vitrectomy or IOL is planned. In open-globe injury, do not press on the eye; scan through the closed lid with plenty of gel, or defer.

Related: retinal detachment, ocular tumours, COMS findings, open globe injury and drusen vs papilloedema.

Key sources

- Byrne SF, Green RL. Ultrasound of the Eye and Orbit. 2nd ed. Mosby; 2002
- AAO BCSC Section 12: Retina and Vitreous and Section 4: Ophthalmic Pathology and Intraocular Tumors (current editions)

Ophthalmic Normal Values: Quick Reference for the Eye Clinic

Last updated: October 2026

- Clinic Desk Reference
- All subspecialties

The numbers we check every day, on one page. Values are typical adult ranges; always interpret them against age, ethnicity, the device used and the fellow eye.

Globe, cornea and anterior segment

Parameter	Typical normal	Notes and red flags
IOP (Goldmann)	10–21 mmHg (mean about 15–16)	Inter-eye difference over 3–4 mmHg needs attention. Read with CCT. See CCT and IOP.
Central corneal thickness	About 520–560 µm (mean about 540)	Under 500 µm: IOP underestimated and caution for refractive surgery. Thick in Fuchs dystrophy and corneal oedema.
Keratometry (mean K)	About 42–45 D (range 40–48)	Over 47–48 D, or asymmetry over 1 D between eyes: think keratoconus. See the topography card.
Corneal astigmatism	Under 1 D in most eyes	With-the-rule in the young, drifting to against-the-rule with age
Horizontal corneal diameter (white-to-white)	Adult 11.5–12.5 mm; newborn about 10 mm	Over 12 mm in an infant: rule out congenital glaucoma. Under 10 mm in an adult: microcornea. Over 13 mm: megalocornea.
Anterior chamber depth (endothelium to lens)	About 2.8–3.5 mm	Under 2.5 mm: angle-closure risk; check gonioscopy
Axial length	About 22.0–24.5 mm (mean 23.5)	Under 22 mm short; over 26 mm long. Inter-eye difference over 0.3 mm: recheck biometry.
Lens thickness	About 3.5–5.0 mm, increasing with age	A thick lens with a shallow AC means lens-related angle closure
Endothelial cell density	About 2,000–3,000 cells/mm² in adults	See the specular microscopy card

Tear film and ocular surface

Test	Normal	Abnormal
Schirmer I (no anaesthesia, 5 min)	10 mm or more	Under 5 mm: aqueous deficiency
Schirmer with anaesthesia (basal)	Over 5–10 mm	Under 5 mm
Tear break-up time (fluorescein or non-invasive)	10 seconds or more	Under 10 s (DEWS III uses NIBUT under 10 s)
Tear osmolarity	Under 308 mOsm/L	308 or more, or inter-eye difference over 8. See TFOS DEWS III.
Tear meniscus height	About 0.2–0.3 mm or more	Under 0.2 mm suggests low tear volume

Lids and orbit

Parameter	Normal	Notes
Palpebral fissure height	About 8–11 mm	
MRD1	About 4–5 mm	2 mm or less: significant ptosis. See ptosis tests.
MRD2	About 5 mm	Increased in lower-lid retraction (thyroid eye disease)
Levator function	13–15 mm or more	Good 8 mm or more, fair 5–7 mm, poor 4 mm or less
Upper lid crease height	About 8–10 mm (lower in many Asian lids)	High crease: aponeurotic ptosis; absent: congenital ptosis
Exophthalmometry (Hertel)	About 12–20 mm (population-dependent)	Inter-eye asymmetry of 2 mm or more is significant

Binocular vision and accommodation

Parameter	Normal	Notes
Amplitude of accommodation	Hofstetter: minimum = 15 – 0.25 × age; average = 18.5 – 0.3 × age (D)	Below the minimum for age: accommodative insufficiency
Near point of convergence	Up to about 6–8 cm	Over 10 cm: convergence insufficiency
AC/A ratio	3–5 PD per dioptre	High in convergence excess and accommodative esotropia
Stereoacuity	40–60 seconds of arc or better (adults)	Reduced in amblyopia and strabismus
Fusional convergence at distance / near	About 14–20 PD / about 25–38 PD (base-out)	Lab and method-dependent

Optic disc, retina and imaging

Parameter	Normal	Notes
Vertical cup-to-disc ratio	Average about 0.3; up to 0.5–0.6 can be normal in large discs	Inter-eye asymmetry over 0.2 is a red flag. Always judge with disc size (DDLs).
Disc diameter (vertical)	About 1.5–2.0 mm	Small discs hide cupping; large discs show physiological cups
Retinal artery-to-vein calibre	About 2:3	Arteriolar narrowing in hypertension
Central subfield thickness (OCT)	Device-dependent: about 250–270 µm on Cirrus, 270–300 µm on Spectralis	See the OCT macula card
Average RNFL thickness (OCT)	About 90–105 µm (device and age dependent)	See the OCT disc card
EOG Arden ratio	About 1.8 or more (lab-specific)	Reduced in Best disease. See the electrophysiology card.
Pattern VEP P100 latency	About 100 ms (lab upper limit usually around 110–118 ms)	Delayed in demyelination

Volumes and physiology (viva favourites)

- Aqueous production: about 2–3 µL/min. Anterior chamber volume about 0.25 mL; posterior chamber about 0.06 mL.
- Vitreous volume: about 4 mL. Tear volume: about 7 µL; a drop is about 30–50 µL, so one drop is plenty.
- Episcleral venous pressure: about 8–10 mmHg.
- Normal pupil: 2–4 mm in light; physiological anisocoria up to about 1 mm in up to 20% of people.

How to use this card: normal ranges overlap with disease. A value inside the range can still be abnormal for that patient (for example a CCT of 520 µm that was 560 µm before LASIK), and a value outside it can be normal. Compare with the fellow eye and with previous readings.

Key sources

- AAO Basic and Clinical Science Course (BCSC), current edition: sections on fundamentals, cornea, glaucoma and oculoplastics
- Hofstetter HW. Useful age-amplitude formula. Optom World 1950;38:42–5
- TFOS DEWS III diagnostic cut-offs (Review of Optometry)

When to Prescribe Glasses in Children: AAO Thresholds by Age

Last updated: October 2026

When does a young child's cycloplegic refraction need glasses? The AAO thresholds below are a consensus starting point. Lower them when there is strabismus, amblyopia, symptoms or poor visual behaviour.

AAO guidelines for refractive correction in infants and young children

Condition (cycloplegic refraction)	Under 1 year	1 to under 2 years	2 to under 3 years	3 to under 4 years
Isoametropia (similar in both eyes)				
Myopia	5.00 D or more	4.00 D or more	3.00 D or more	2.50 D or more
Hyperopia, no manifest deviation	6.00 D or more	5.00 D or more	4.50 D or more	3.50 D or more
Hyperopia with esotropia	2.00 D or more	2.00 D or more	1.50 D or more	1.50 D or more
Astigmatism	3.00 D or more	2.50 D or more	2.00 D or more	1.50 D or more
Anisometropia (difference between eyes, without strabismus)				
Myopia	4.00 D or more	3.00 D or more	3.00 D or more	2.50 D or more
Hyperopia	2.50 D or more	2.00 D or more	1.50 D or more	1.50 D or more
Astigmatism	2.50 D or more	2.00 D or more	2.00 D or more	1.50 D or more

From the AAO Pediatric Eye Evaluations Preferred Practice Pattern. Values are based on expert consensus, not trial data. With strabismus, use lower anisometropia thresholds. Over 4 years of age, prescribe according to acuity, symptoms and amblyopia risk.

How much to prescribe

- Accommodative esotropia: give the full cycloplegic hyperopic correction. Add bifocals (+2.50 to +3.00 D executive or flat-top) if there is a residual near deviation (high AC/A).
- Hyperopia without esotropia: many clinicians cut the plus symmetrically by about 1–1.5 D (or about a third) to help acceptance, but never cut the anisometropic difference.
- Myopia: give the full correction; avoid undercorrection, which does not slow progression. See myopia control.
- Astigmatism: prescribe the full cylinder at the measured axis.
- Anisometropia: correct the full difference; children adapt well to aniseikonia.
- Review about 6–8 weeks after the first glasses for acuity, alignment and amblyopia; then start occlusion if acuity plateaus. See amblyopia treatment.

Cycloplegic drops by age

Age	Usual regimen	Notes
Under about 6–12 months (and preterm infants)	Cyclopentolate 0.5% (with phenylephrine 1–2.5% if needed for dilation)	Avoid phenylephrine 10% in infants. Press on the lacrimal sac to reduce systemic absorption. Watch for feeding intolerance in neonates.
Children over 1 year	Cyclopentolate 1%: 1 drop, repeated after 5–10 minutes; refract after 30–45 minutes	Add tropicamide 1% or an extra cyclopentolate drop in darkly pigmented irides
Suspected accommodative esotropia with residual accommodation, or very dark irides	Atropine 1% (0.5% in young children), twice daily for about 3 days before the visit (not on the day)	Warn about fever, flushing and dry mouth. Stop if signs of toxicity.

Cyclopentolate toxicity (more likely with 2% drops, low body weight, or Down syndrome): restlessness, hallucinations, ataxia and tachycardia, usually within an hour. Most cases settle with observation; refer to paediatrics if severe.

Related: amblyopia classification, children's eye check-ups and the strabismus measurement card.

Key sources

- AAO: Guidelines for refractive correction in infants and young children (Pediatric Eye Evaluations PPP table)
- AAO Preferred Practice Pattern: Amblyopia and Esotropia and Exotropia (current editions)

Screening Schedules: DR Follow-up, ROP in India and Hydroxychloroquine

Last updated: October 2026

Three screening schedules we use every week: diabetic retinopathy follow-up, ROP screening in Indian neonatal units, and hydroxychloroquine toxicity.

1. Diabetic retinopathy: when to see the patient again (ICO 2017)

Grade	High-resource setting	Low or intermediate-resource setting	Refer to ophthalmologist?
No apparent retinopathy	1–2 years	1–2 years	No
Mild NPDR (microaneurysms only)	6–12 months	1–2 years	No
Moderate NPDR	3–6 months	6–12 months	Yes
Severe NPDR	Under 3 months	Under 3 months	Yes
Proliferative DR	Under 1 month	Under 1 month	Yes
Non-centre-involved DME	3 months	3 months	Yes (in low-resource settings, if laser is available)
Centre-involved DME	1 month	1 month	Yes

These intervals assume reasonable diabetes control. Shorten them in pregnancy (examine each trimester), after rapid HbA1c improvement, and around cataract surgery. Remember the 4-2-1 rule for severe NPDR (see DR guide).

2. Retinopathy of prematurity: who and when (India)

Question	Indian operational guidelines (MoHFW, RBSK)
Whom to screen	All babies with birth weight of 2000 g or less, or gestational age of 34 weeks or less. Also babies over 34 weeks with risk factors: cardiorespiratory support, prolonged oxygen, sepsis, blood transfusion, intraventricular haemorrhage, apnoea or poor weight gain.
When to do the first screen	By 25–30 days of life. Screen before discharge even if the baby goes home early. Very small or sick babies (for example under 28 weeks or under 1200 g) are often screened earlier, at 2–3 weeks.
Follow-up	Depends on zone and stage: weekly or more often for zone I disease, stage 3, or any pre-plus; every 2 weeks for mature-appearing zone II disease; continue until vascularisation is complete or ROP regresses.
When to treat	ETROP type 1 ROP: zone I any stage with plus; zone I stage 3 without plus; zone II stage 2 or 3 with plus. A-ROP needs urgent treatment. Treat within 48–72 hours.

Indian criteria are wider than Western ones (which use about 1500 g or 30–32 weeks) because larger, more mature babies develop severe ROP in Indian units. See ICROP3 update.

3. Hydroxychloroquine retinopathy (AAO 2016 recommendations)

Item	Recommendation
Safe dose	5 mg/kg real body weight per day or less
Baseline	Fundus exam within the first year to exclude maculopathy; add OCT and fields if abnormal
Annual screening	From 5 years of use if there are no major risk factors; from the start if there are
Major risk factors	Dose over 5 mg/kg/day, kidney disease, tamoxifen use, pre-existing retinal or macular disease
Tests	Automated fields (10-2 white, or 24-2 or 30-2 in Asian patients, whose damage is often pericentral) and SD-OCT. Multifocal ERG and fundus autofluorescence are useful adjuncts.
If toxicity is found	Stop the drug in discussion with the rheumatologist. Damage can progress for a while after stopping.

Other drugs worth a baseline check: ethambutol (acuity and colour vision), vigabatrin (fields), long-term pentosan polysulfate (macula), and long-term steroids (IOP and lens). See the ocular adverse drug reactions page.

Key sources

- ICO Guidelines for Diabetic Eye Care (updated 2017)
- Operational guidelines for ROP in India (MoHFW / RBSK)
- Marmor MF et al. Recommendations on screening for chloroquine and hydroxychloroquine retinopathy (2016 revision). Ophthalmology 2016;123:1386–94
- Early Treatment for Retinopathy of Prematurity Cooperative Group. Arch Ophthalmol 2003;121:1684–94

Fortified Eye Drops and Keratitis Regimens: Concentrations and Preparation

Last updated: October 2026

Clinic Desk Reference Cornea

Concentrations, standard preparation methods and starter regimens for microbial keratitis. Always scrape and send cultures before starting, and follow your hospital pharmacy's aseptic protocol.

Safety: prepare fortified drops under aseptic conditions (ideally in pharmacy), label them with drug, concentration, date and "keep refrigerated", and replace them according to local stability rules (commonly within about 7 days). Check concentrations twice: these are 10–20 times stronger than commercial drops.

Antibacterial

Drug	Concentration	Common preparation	Covers
Cefazolin (fortified)	50 mg/mL (5%)	Add 9.2 mL of artificial tears or sterile saline to a 1 g vial (about 100 mg/mL); take 5 mL and add 5 mL more vehicle	Gram-positive
Vancomycin (fortified)	25–50 mg/mL	Add 10 mL (for 50 mg/mL) or 20 mL (for 25 mg/mL) of vehicle to a 500 mg vial	Gram-positive including MRSA; use for resistant or severe cases
Tobramycin (fortified)	About 14 mg/mL (1.4%)	Add 2 mL of injectable tobramycin (40 mg/mL) to a 5 mL bottle of commercial 0.3% tobramycin drops	Gram-negative including <i>Pseudomonas</i>
Ceftazidime (fortified)	50 mg/mL	As per pharmacy protocol (reconstitute vial to 50 mg/mL in vehicle)	Gram-negative (alternative to aminoglycoside)
Moxifloxacin 0.5% or gatifloxacin 0.3–0.5%	Commercial	Ready to use	Broad monotherapy for small, peripheral ulcers

Antifungal

Drug	Concentration	Preparation	Notes
Natamycin	5%	Commercial suspension	First choice for filamentary fungi, especially <i>Fusarium</i> (MUTT I: better than topical voriconazole)
Voriconazole	1% (10 mg/mL)	Reconstitute a 200 mg vial to 20 mL with sterile water or vehicle	Good for <i>Aspergillus</i> and as an add-on. Oral voriconazole added no benefit in MUTT II.
Amphotericin B	0.15% (1.5 mg/mL)	Reconstitute a 50 mg vial in 10 mL sterile water (5 mg/mL), then dilute 3 mL of this with 7 mL of water	Yeasts (<i>Candida</i>). Protect from light.

Acanthamoeba

- Biguanides: PHMB 0.02% or chlorhexidine 0.02%, often with a diamidine (propamidine 0.1%). Polihexanide 0.08% monotherapy is now licensed in Europe.
- Very frequent dosing at first (hourly day and night for 48 hours), then taper over months. Pain out of proportion and a ring infiltrate are the clues.

Starter regimen and taper

Stage	Typical frequency
Loading	Every 5–15 minutes for the first hour (or a drop every 5 minutes for 5 doses)
Intensive phase	Hourly day and night for 24–48 hours (alternate the two fortified drops every 30 minutes)
When improving (smaller infiltrate, healing epithelium, less pain)	2-hourly while awake, then 4-hourly, guided by culture and response
Fungal keratitis	Natamycin hourly while awake for 1–2 weeks, then taper slowly; continue for some weeks after apparent healing

- Steroids: SCUT showed no overall benefit for bacterial keratitis; avoid them until the organism is known and improving (never in suspected fungal or Acanthamoeba keratitis).
- Add a cycloplegic for pain, and consider an oral anti-collagenase (doxycycline) and vitamin C for melting ulcers.
- Review daily at first. Worsening after 48–72 hours: re-scrape, consider a corneal biopsy or confocal microscopy, and think of fungus, Acanthamoeba, *Nocardia* or atypical mycobacteria.

Related: microbial keratitis work-up, intrastromal and intravitreal doses and dendrites and pseudo-dendrites.

Key sources

- Wills Eye Manual, 8th ed. Appendix: preparation of fortified antibiotics and antifungals
- Prajna NV et al. The Mycotic Ulcer Treatment Trial (MUTT I). JAMA Ophthalmol 2013;131:422–9
- Prajna NV et al. MUTT II: oral voriconazole. Ophthalmology 2016;123:1229–38
- Srinivasan M et al. The Steroids for Corneal Ulcers Trial (SCUT). Arch Ophthalmol 2012;130:143–50

Strabismus Measurement and Surgical Dose Tables: Quick Reference

Last updated: October 2026

How to measure a deviation quickly and reliably, convert between methods, and find a starting point for surgical planning.

Measurement methods at a glance

Method	When to use	Pearls
Prism cover test (alternate prism cover)	The gold standard when both eyes fixate	Measure at near (33 cm) and distance (6 m) with an accommodative target and full correction. Base toward the apex of the deviation: base-out for esotropia, base-in for exotropia.
Hirschberg test (corneal light reflex)	Quick estimate in infants and poor fixators	About 1 mm of reflex decentration is about 7°, or roughly 15 PD. Reflex at the pupil margin is about 15° (30 PD); mid-iris about 30° (60 PD); limbus about 45° (90 PD).
Krimsky test	One eye does not fixate (poor vision)	Place prisms in front of the fixing eye until the reflexes are symmetrical
Modified Krimsky	Infants, uncooperative patients	Prism in front of the deviating eye
Maddox rod and Maddox wing	Small heterophorias; cyclodeviation (double Maddox rod)	Patient-reported, so requires good cooperation
Hess or Lees screen	Incomitant (paralytic or restrictive) strabismus	The smaller field belongs to the eye with the underacting muscle. Follow up to see recovery.

1 prism dioptre deviates light 1 cm at 1 m; 1° is about 1.75 PD for small angles. Hirschberg conversions vary in studies (some suggest up to about 20 PD per mm), so confirm with prism cover whenever possible.

Always record

- Deviation at near and distance, with and without glasses, and in the nine positions of gaze for incomitant cases.
- A and V patterns (difference between up-gaze and down-gaze): significant if 10 PD or more for an A pattern, or 15 PD or more for a V pattern.
- Head posture, oblique overaction, DVD, nystagmus, and the 3-step test (Parks-Bielschowsky) for vertical deviations.
- Fusion (Worth 4-dot) and stereoacuity before and after treatment.

Surgical dose tables (starting points)

Esotropia (PD)	Bilateral MR recession (mm)	Bilateral LR resection (mm)
15	3.0	3.5
20	3.5	4.5
25	4.0	5.5
30	4.5	6.0
35	5.0	6.5
40	5.5	7.0
50	6.0	8.0
60–70	6.5–7.0	8.0

Exotropia (PD)	Bilateral LR recession (mm)	MR resection (mm)
15	4.0	3.0
20	5.0	4.0
25	6.0	5.0
30	7.0	6.0
35	7.5	6.0
40	8.0	6.5
50	9.0	7.0
60 or more	10.0	8.0 (more than one procedure may be needed)

Adapted from Parks' tables (as modified in standard strabismus texts). For a monocular recess-resect procedure, read the recession and resection from the same row for one eye. These are guidelines only: adjust for your own results, age, axial length, adjustable sutures and the near-distance disparity.

Before planning surgery: give full refractive correction and treat amblyopia first; measure on at least two visits; for exotropia, measure distance after patch-occlusion and with +3.00 D lenses at near to uncover the full deviation; rule out restrictive or neurological causes in incomitant strabismus (forced ductions, imaging).

Related: strabismus surgery basics, nerve palsies, anti-elevation syndrome and the paediatric glasses card.

Key sources

- Classic strabismus surgery: rectus muscle dosage tables (after Parks)
- von Noorden GK, Campos EC. Binocular Vision and Ocular Motility. 6th ed. Mosby; 2002
- AAO BCSC Section 6: Pediatric Ophthalmology and Strabismus (current edition)

Cataract Pre-operative Risk Checklist: Spot the Difficult Case

Last updated: October 2026

- Clinic Desk Reference
- Lens & Cataract

Spot the difficult case in the clinic, not in theatre. Run through this list at the pre-operative visit, write the plan on the case sheet, and counsel the patient about any extra risk.

History

Ask about	Why it matters	Plan
Tamsulosin or other alpha-1 blockers (even stopped years ago)	Intraoperative floppy iris syndrome	Intracameral adrenaline (preservative-free), dispersive viscoelastic, iris hooks or ring, low flow; stopping the drug does not reliably help
Anticoagulants and antiplatelets	Bleeding with needle blocks	Usually continue for topical or intracameral anaesthesia; check INR is in range for warfarin; prefer topical or sub-Tenon over sharp-needle blocks
Diabetes	Macular oedema, progression of retinopathy	Treat existing DME or PDR first; consider perioperative NSAID or intravitreal therapy; check blood sugar on the day
Uveitis	Postoperative flare-up and CME	Quiet for at least 3 months; perioperative steroid cover (topical, oral or intravitreal)
Previous refractive surgery	IOL power error	Special formulas (see the biometry checklist)
Previous vitrectomy	Deep, fluctuating chamber; posterior capsule plaques; zonular weakness	Lower bottle height, careful hydrodissection, be ready for a lens-iris diaphragm retropulsion
Only eye, or poor outcome in the first eye	Higher stakes	Senior surgeon; detailed consent; consider delayed rather than same-day bilateral surgery
Back problems, claustrophobia, tremor, deafness, language barrier	Cooperation under the drapes	Positioning aids, sedation or general anaesthesia, an interpreter

Examination

Finding	Risk	Plan
Small pupil (under about 6 mm dilated)	Iris trauma, capsule tear, dropped nucleus	Pupil expansion devices, viscomydriasis, chop technique
Pseudoexfoliation	Zonular weakness, small pupil, IOP spikes	Capsular tension ring available, gentle manoeuvres, check IOP after surgery. See PXF cataract surgery.
Phacodonesis or iridodonesis	Zonular dehiscence	CTR or capsular hooks; consider a senior surgeon
Shallow chamber, short eye (axial length under about 21 mm)	Endothelial damage, iris prolapse, choroidal effusion	Dispersive viscoelastic; consider a pre-operative mannitol or a limited vitreous tap; check for nanophthalmos
High myopia (axial length over about 26 mm)	Deep chamber, retinal detachment	Lower bottle height, examine the peripheral retina before and after surgery
Dense brown or white cataract	Endothelial loss, Argentinian flag sign (capsule split), long phaco time	Trypan blue, decompress an intumescent lens before the rhexis, chop, soft-shell technique. Consider manual small-incision surgery.
Posterior polar cataract	Pre-existing posterior capsule defect	Avoid hydrodissection (use hydrodelineation), low flow, have vitrectomy ready
Corneal guttae or low cell count	Corneal decompensation	Specular microscopy (see the specular card); endothelial protection; plan DMEK if needed
Blepharitis, lid infection, nasolacrimal obstruction	Endophthalmitis	Treat first; syringe the lacrimal passages when in doubt
Glaucoma	IOP spike, worsening of field	Consider combined surgery or MIGS; plan for IOP control after surgery
Corneal astigmatism (1–1.25 D or more)	Residual cylinder	Toric IOL or limbal relaxing incisions
Macula and retina	Unexpectedly poor outcome	OCT if the view allows; B-scan when the fundus cannot be seen

On the day

- Recheck the eye mark, biometry, IOL model and power, and a backup IOL.
- Povidone-iodine 5% in the conjunctival sac (at least 3 minutes) and on the lids; intracameral antibiotic at the end of surgery.
- Blood pressure and blood sugar acceptable for surgery; continue usual medicines unless told otherwise.

Write the plan down: "PXF, small pupil: CTR and hooks available, chop" on the case sheet saves time and prevents surprises when a different surgeon or a resident operates.

Related: phaco step by step, posterior capsule tear management, ISBCS and endophthalmitis.

Key sources

- Royal College of Ophthalmologists. Cataract Surgery Guidelines and commissioning guidance (current editions)
- Chang DF, Campbell JR. Intraoperative floppy iris syndrome associated with tamsulosin. J Cataract Refract Surg 2005;31:664–73
- Narendran N et al. The Cataract National Dataset electronic multicentre audit of 55,567 operations: risk stratification for posterior capsule rupture and vitreous loss. Eye 2009;23:31–7