

Spontaneous Closure of Macular Holes

*Idiopathic, Inflammatory, and Traumatic Etiologies —
Evidence, Predictors, and Clinical Decision-Making*

9.2%

spontaneous closure rate, idiopathic FTMH (Neubauer 2024)

44 d

median time to closure after diagnosis

55%

closure at 2 months when diameter < 150 μm

Synthesized from 3 sources (Ebrahimi 2022; Eaton 2023; Neubauer 2024)

Audience: Retina specialists & ophthalmologists · 18 slides

What this deck covers

A clinical synthesis of three recent peer-reviewed reports on spontaneous closure across idiopathic, inflammatory, and traumatic macular holes.

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|----|---|--------------|
| 01 | Background & Definitions
Epidemiology, IVTS classification, pathogenesis of macular holes. | SLIDES 3–5 |
| 02 | Idiopathic FTMH: Natural History
Neubauer 2024 — 338 eyes, closure rates, Kaplan-Meier, reopening risk. | SLIDES 6–11 |
| 03 | Secondary Etiologies
Inflammatory MH (Ebrahimi 2022, 5 cases) and traumatic MH (Eaton 2023, fastest closure on record). | SLIDES 12–14 |
| 04 | Mechanisms of Closure
Müller cell bridging, traction release, CME resolution — current hypotheses. | SLIDES 15–16 |
| 05 | Clinical Takeaways
Watchful waiting criteria, follow-up schedule, when to operate. | SLIDES 17–18 |
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CHAPTER 01 / 05



Macular hole — a vitreomacular interface disease

Full-thickness defect of all neurosensory retinal layers in the fovea; central scotoma and metamorphopsia are the hallmarks.

EPIDEMIOLOGY Idiopathic FTMH is more frequent in women over 65, with an incidence of about 8 eyes per 100,000 per year (Forsaa 2018). Bilateral involvement at first visit or during follow-up occurs in roughly 4% of patients in large cohorts (Neubauer 2024). Female predominance and post-menopausal status suggest hormonal and structural cofactors in vitreous liquefaction and PVD evolution.

PATHOLOGY The foveola lacks internal limiting membrane support and depends on Müller cell cone integrity. Tangential and antero-posterior vitreous traction, cystoid macular edema, and Muller cell weakness converge to dehiscence the central retina. Secondary forms share the endpoint but differ in trigger — inflammation, trauma, surgery, or laser.

IVTS CLASSIFICATION RATIONALE The International Vitreomacular Traction Study (IVTS) Group classification (Duker 2013) standardized diameter-based grading on SD-OCT and is now the universal currency for prognosis, surgical planning, and natural-history reporting.

IVTS GRADE	DIAMETER	VMT STATUS
Small	≤ 250 μm	with or without VMT
Medium	251 – 400 μm	with or without VMT
Large	> 400 μm	with or without VMT

WHY IT MATTERS

Small iFTMHs (≤ 250 μm) are the only size group in which spontaneous closure was observed in the Neubauer 2024 cohort. Diameter is the single independent predictor of closure (OR 0.97 per μm, 95% CI 0.96–0.98).

How does a macular hole form?

Three mechanisms — antero-posterior traction, tangential traction, and inner retinal layer weakness — converge to produce a full-thickness foveal defect. They differ in relative weight between idiopathic and secondary forms.



01

Antero-Posterior Traction

Vitreous liquefaction triggers posterior vitreous detachment (PVD). Persistent vitreofoveal adhesion during PVD exerts antero-posterior force that lifts the foveolar tissue and precipitates dehiscence. In inflammatory MH, vitreous inflammation accelerates liquefaction and abnormal PVD. A thin operculum — representing avulsed inner retinal tissue — often marks the exit point on OCT.



02

Tangential Traction

Epiretinal membrane (ERM) — common in uveitis and post-surgical eyes — exerts centripetal tangential force that opens the foveal defect. ERM contraction pulls on already-compromised foveolar tissue, and is frequently co-located with cystoid spaces at the hole margins. Counterintuitively, contractile ERM has also been reported to assist closure by re-approximating edges once the dehiscence forms.



03

Inner Retinal Layer Weakness

Müller cell cone vulnerability is the substrate on which traction acts. Cystoid macular edema separates the inner Müller cell layer from the outer nuclear layer at the foveola, weakening tissue. Longstanding or recurrent cysts fatigue the retinal scaffold until a full-thickness defect opens. RPE pump failure further destabilizes the environment. This mechanism dominates in inflammatory and post-surgical MH.

CLINICAL COROLLARY Anywhere traction is relieved or cystoid edema is dried, the substrate for closure improves. This unifies pharmacologic and surgical strategies.

CHAPTER 02 / 05



Neubauer et al. 2024 — largest OCT-era natural history series

Retrospective review of all consecutive patients presenting with iFTMH at the University of Tübingen, August 2008 – August 2019 (Graefes Arch Clin Exp Ophthalmol 262:2859).

 COHORT

Of 1,256 eyes screened, 338 met inclusion criteria (338 eyes of 324 patients; 199 women, mean age 68.9 years, range 40–90). Bilateral involvement at first visit or follow-up: 14 patients (4.1%). Phakic 73%, pseudophakic 27%.

 INCLUSION / EXCLUSION

Inclusion: SD-OCT at first presentation and at every follow-up; OCT the day before scheduled surgery.
Exclusion: prior intravitreal pharmacotherapy, ocular trauma, prior vitreoretinal surgery or laser, myopia worse than –6 D, secondary FTMH, poor OCT quality.

 IMAGING & GRADING

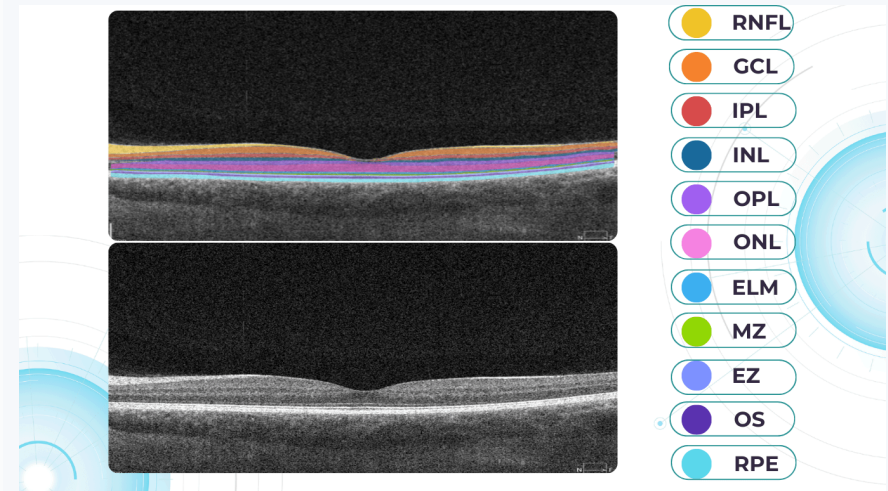
Heidelberg SD-OCT — volume scan (25 cross-sections, 61 µm spacing) plus 6 or 12 radial scans. IVTS Group classification (Duker 2013) used for grading. Two-independent-reader diameter measurement: intraclass correlation 0.95.

 PRIMARY OUTCOME & FOLLOW-UP

Spontaneous closure detected on OCT. Median time from diagnosis to surgery: 34 days. Median follow-up of patients who declined surgery: 149 days (range 16–1849).

SD-OCT LAYER SEGMENTATION

ILLUSTRATIVE



Color-coded SD-OCT retinal layer segmentation — the imaging substrate of IVTS grading (illustrative).

Spontaneous closure is not anecdotal — it is quantifiable

In the 338-eye cohort, 31 eyes (9.2%) closed without intervention — all of them small iFTMHs.

9.2%

SPONTANEOUS CLOSURE RATE

31 of 338 eyes

44 d

MEDIAN TIME TO CLOSURE

range 5 – 1,013 days

98.9 μm

MEAN DIAMETER OF CLOSED HOLES

range 30 – 249 μm

0.4 → 0.29

BCVA IMPROVEMENT (LOGMAR)

p = 0.031

BASELINE CHARACTERISTICS

Comparison of eyes with vs without spontaneous closure

VARIABLE	NO CLOSURE (N = 307)	SPONTANEOUS CLOSURE (N = 31)	P
Age (mean, years)	69.1	66.8	0.13
Female (%)	60	48	0.25
Baseline BCVA (logMAR)	0.68	0.40	< 0.0001
Mean diameter (μm)	345.6	98.9	< 0.0001
IVTS small (≤ 250 μm)	30%	100%	—
VMT present (%)	30	45	0.10
Epiretinal membrane (%)	27	35	0.40

Diameter is the only independent predictor of closure

Logistic regression of age, baseline BCVA, lens status, VMT, and iFTMH diameter — only diameter reached significance.

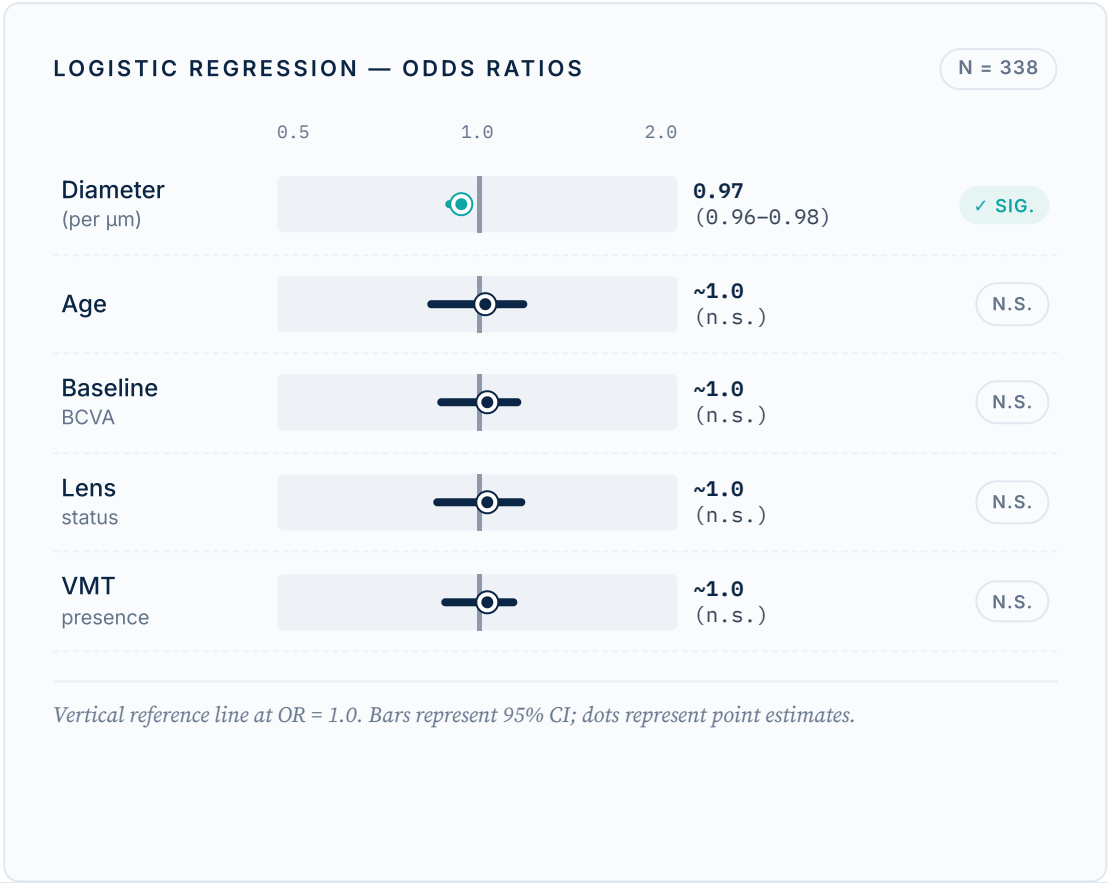
In univariate analysis, eyes with spontaneous closure had a higher baseline BCVA (0.40 vs 0.68 logMAR, $p < 0.0001$) and smaller mean diameter (98.9 μm vs 345.6 μm , $p < 0.0001$). Age, sex, lens status, VMT presence, and ERM presence did not differ between groups.

— WHAT THE LOGISTIC REGRESSION SHOWED

- Diameter (per μm increase): OR 0.97, 95% CI 0.96 – 0.98 (significant)
- Age, baseline BCVA, lens status, VMT — not significant in the multivariable model
- All spontaneous closures occurred in eyes with small iFTMHs ($\leq 250 \mu\text{m}$)
- Mean diameter in closure group: 98.9 μm (range 30 – 249 μm)

— CLINICAL INTERPRETATION

Every 10 μm decrease in hole diameter raises the odds of spontaneous closure by roughly 26% ($\text{OR} \approx 0.97^{10} \approx 0.74$). The diameter effect dominates over all other examined factors, including traction status.



Smaller holes close faster — and more often

Kaplan-Meier estimate of cumulative spontaneous closure, stratified by baseline diameter.



Among eyes with small iFTMHs ($\leq 250\text{ }\mu\text{m}$, $n = 124$), approximately 25% closed spontaneously within two months. When the diameter threshold was tightened to $< 150\text{ }\mu\text{m}$ ($n = 48$), the closure probability rose to 55% within the same window — more than doubling.

— TIME-COURSE INSIGHTS

- Median time to closure: 44 days (range 5 – 1,013)
- Smaller diameter correlated with shorter time to closure (Pearson $r = 0.37$, $p = 0.0377$)
- No significant difference in closure rate or timing between eyes with vs without VMT ($p = 0.40 / 0.55$)
- Closure was observed in eyes both with and without vitreofoveal traction

— IMPLICATION FOR PRACTICE

For sub-150 μm iFTMHs with good baseline BCVA, a 4–8 week watchful waiting window captures the majority of closures. Beyond 8 weeks, the marginal gain is small and the surgical option should be revisited.

Spontaneous closure is not always permanent

Re-opening occurred in 16% of eyes after a median of 136 days — most within the first year.

Of the 31 eyes that closed spontaneously, 5 (16.1%) re-opened after a median of 136 days post-closure (range 23 – 708 days). All five re-opened eyes underwent macular surgery and showed subsequent anatomical closure. Median follow-up after spontaneous closure (available for 23 patients, 74.1%) was 406 days.

— KEY OBSERVATIONS

- 5 of 31 eyes (16.1%) re-opened after spontaneous closure
- Median time to re-opening: 136 days (range 23 – 708)
- All re-opened holes achieved closure after vitrectomy
- Statistical analysis of OCT features was not feasible due to small sample
- Previous reports describe re-opening between 3 months and 3 years after closure (with or without surgery)

— FOLLOW-UP PROTOCOL AT TÜBINGEN

Patients were advised follow-up at 2-week intervals for the first 6 weeks after diagnosis. Thereafter, ophthalmologic examinations alternated with local ophthalmologists at 4-week intervals, provided an OCT examination was available.

 RE-OPENING AT A GLANCE

16.1%

RE-OPENING RATE

5 of 31 eyes

136 d

MEDIAN TIME TO RE-OPEN

range 23 – 708 days

100%

SURGICAL CLOSURE AFTER RE-OPEN

all 5 eyes closed post-PPV

Re-opening can occur months to years after spontaneous closure — prolonged OCT surveillance is mandatory.

Secondary Etiologies

Inflammatory and traumatic macular holes — different biology, different closure dynamics.

Inflammatory macular holes can close with anti-inflammatory therapy alone

Ebrahimi et al. 2022 — 5 eyes of 5 patients with uveitis-associated FTMH (Ocul Immunol Inflamm 30:966). All 5 achieved closure with corticosteroids ± immunomodulatory therapy.

CASE	AGE / SEX	ETIOLOGY	TREATMENT	OUTCOME
1	60 F	Occlusive vasculitis, both eyes	Intravitreal steroid + bevacizumab both eyes; systemic azathioprine + cyclosporine	Closed at 3 months; left eye re-opened at 2 yr → PPV, closed at 4 yr
2	65 M	Posterior uveitis + ERM, left eye	Subtenon triamcinolone + oral methotrexate	Closed at 1 month; stable
3	52 M	First-episode anterior uveitis, left eye	Topical betamethasone, dorzolamide, ketorolac, homatropine	Closed at 2 months; BCVA 4/10 → 10/10
4	57 F	Vitreous cells, right eye	Patient declined injection; observation only	Spontaneous closure at 2 months after inflammation control

5	56 F	Post-scleral-buckle CME → FTMH, left eye	Intravitreal steroid + bevacizumab	Closed at 2 months; BCVA 5/10 → 7/10
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PROPOSED MECHANISMS OF IMH

- PVD induced by inflammation (antero-posterior traction)
- ERM-mediated tangential traction
- CME unroofing — outward displacement of foveal edges
- Müller cell layer weakness from chronic cysts

LITERATURE CONTEXT

A review identified 55 reported cases of posterior uveitis-associated macular hole — 35 of them in Behçet’s disease. The literature on IMH management is sparse; medical closure is reported but reopening occurs.

KEY MESSAGE

Inflammatory MH should be managed with the least manipulative strategy first. Vitrectomy remains the rescue option for refractory or re-opened holes, ideally after inflammation is controlled.

A 4-day spontaneous closure — fastest traumatic MH closure on record

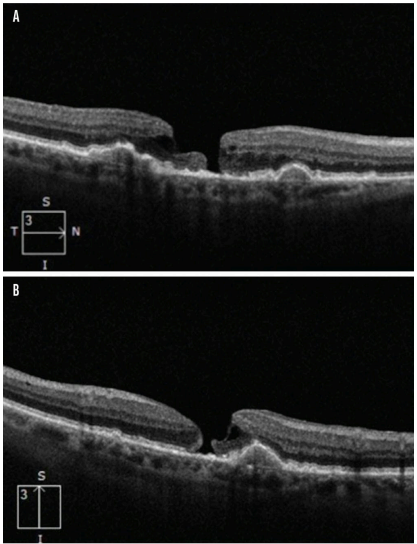
Eaton & de Ribot 2023 — *Indian J Ophthalmol Case Rep* 3:572. Man in his 20s, paintball-gun blunt trauma to the right eye.

CASE AT A GLANCE

- Patient: male, 20s, paintball-gun blunt trauma to right eye
- Baseline VA: 1/60 · IOP: 14 mmHg · anterior segment normal
- OCT findings: full-thickness elliptical MH · base width 1,969 μm · narrowest internal diameter 148 μm · vitreomacular adhesion with operculum · localized neurosensory detachment · no cystic edema at hole margin
- Day 4 follow-up: spontaneous closure · complete PVD · apposed hole edges · increased retinal thickness with atrophic changes
- 3-month VA: 1/60 (limited by severity of initial trauma + inferotemporal macular atrophy) · foveal pit restored

OCT PREDICTORS OF CLOSURE

- Absence of PVD at time of injury (allows vitreous to act as a scaffold)
- Absence of cystic edema at the hole margin (less tissue loss)
- Small narrowest diameter (148 μm) despite large base
- Huang 2009 OCT-based classification of traumatic MH predicts closure likelihood



OCT A/B comparison format — illustrative of pre/post closure imaging in traumatic MH (Retina Today).

LITERATURE RANGE

Previous reports of spontaneous closure of traumatic MH range from 2 to 54 weeks; the previous fastest was 10 days. This case closed in 4 days, expanding the lower bound of the reported window.

Mechanisms of Closure

Why does the hole close? Müller cells, traction release, edema resolution — current hypotheses.

Four mechanisms — likely synergistic — explain spontaneous closure

The exact mechanism of spontaneous closure of iFTMH remains unknown. The current hypotheses converge on four processes, each supported by OCT observation and histopathological correlation.



Release of Vitreous Traction

Release of vitreofoveal traction decreases the vertical vector forces pulling the foveal edges apart, allowing flattening and convergence of the hole margins. However, ~45% of eyes that closed spontaneously still had VMT — and closure with persistent traction is reported — so this is contributory but not obligatory.



Müller Cell Bridging

A bridge-like structure at the edges of the hole is visible on OCT in many eyes before closure. This is interpreted as a reparative reaction of Müller cells — activation, proliferation, and formation of glial tissue spanning the defect. Bringmann 2020 elaborated the presumed role of Müller cells in small FTMH closure.



CME Resolution & Edge Reapposition

In inflammatory, post-surgical (Irvine-Gass), and trauma-related MH with intraretinal pseudocysts, resolution of cystoid edema removes the volume-occupying forces that displaced foveal edges outward. The separated retina can then reappose and resume tissue integrity — the working hypothesis for corticosteroid-induced closure.



Glial Proliferation & Contraction

Glial cell proliferation in the inner retina, occasionally including a contractile ERM, can re-approximate hole edges. In select reports, a contractile ERM has been considered contributory to closure — counterintuitively assisting the reparative process once the initial dehiscence has formed.

SYNTHESIS

Closure is most likely when several mechanisms coincide — small diameter (minimal tissue gap), traction release or persistence that favors apposition, and intact Müller cell reserve. In secondary MH, drying the CME is often the rate-limiting step.

A practical algorithm for the clinician

When to watch, when to treat medically, when to operate — distilled from the three source studies and the broader literature.

WATCHFUL WAITING 01

👁️ WHEN

Small iFTMH ($\leq 250\text{ }\mu\text{m}$, ideally $< 150\text{ }\mu\text{m}$) · good baseline BCVA · patient reliable for follow-up · no high-VA occupational pressure

🕒 ACTION

OCT every 2 weeks $\times$ 6 weeks, then every 4 weeks. Counsel patient on metamorphopsia self-monitoring with Amsler grid. Re-evaluate surgical option at 8 weeks if no closure.

🛡️ EVIDENCE

Neubauer 2024 — 25% of small iFTMHs and 55% of $< 150\text{ }\mu\text{m}$ holes close within 2 months. Reopening rate 16% mandates continued OCT surveillance.

MEDICAL / CONSERVATIVE 02

👁️ WHEN

Inflammatory MH with active uveitis or CME · post-surgical MH with Irvine-Gass pattern · secondary MH with prominent intraretinal cysts and minimal traction

🩹 ACTION

Topical, periocular (subtenon triamcinolone), or intravitreal corticosteroid $\pm$ anti-VEGF. Systemic immunomodulatory therapy when uveitis is active. Re-image every 4–8 weeks.

🛡️ EVIDENCE

Ebrahimi 2022 — 5/5 inflammatory MHs closed with corticosteroid-based therapy; 1 re-opened at 2 years and required vitrectomy.

VITRECTOMY 03

👁️ WHEN

Medium / large iFTMH · persistent hole after 8-week observation · reopening after spontaneous closure · traumatic MH with tissue loss · failed medical therapy · patient preference for definitive treatment

🩹 ACTION

Pars plana vitrectomy + ILM peel + gas tamponade. Inverted ILM flap for large / refractory holes. Control intraocular inflammation preoperatively in uveitic cases.

🛡️ EVIDENCE

Literature — vitrectomy anatomical success 81% in uveitic MH (Callaway 2018); surgical outcomes remain favorable for small iFTMHs even after delayed intervention.

FOLLOW-UP CADENCE
POST-CLOSURE

OCT at 1 month, 3 months, 6 months, 12 months, then annually. Counsel on symptom recurrence (metamorphopsia, central scotoma). Any reopening detected early can be addressed surgically with high success.

Three studies, one clinical message

Spontaneous closure of macular holes is real, quantifiable, and clinically actionable — but it demands disciplined follow-up.

 FIVE THINGS TO REMEMBER

- 01 Spontaneous closure of iFTMH occurs in 9.2% of eyes (Neubauer 2024) — almost exclusively in small holes ($\leq 250\text{ }\mu\text{m}$), and 55% close within 2 months when $< 150\text{ }\mu\text{m}$.
- 02 Diameter is the single independent predictor of closure (OR 0.97 per μm); age, sex, lens status, VMT, and ERM presence are not.
- 03 Re-opening occurs in 16% of eyes after spontaneous closure — median 136 days — and all re-opened holes achieved surgical closure.
- 04 Inflammatory macular holes (Ebrahimi 2022) can close with corticosteroids $\pm$ immunomodulatory therapy alone; surgery is the rescue option for refractory or re-opened holes.
- 05 Traumatic MH can close hyperacutely — the fastest reported case closed in 4 days (Eaton 2023); absence of PVD and absence of cystic edema at the margins favor closure.

 PRIMARY SOURCES

- 1 Ebrahimi Z, Torkashvand A, Zarei M, et al. Treatment of Inflammatory Macular Hole: Case Series and Review of Literature. *Ocul Immunol Inflamm.* 2022;30(4):966–972. doi:10.1080/09273948.2020.1867871.
- 2 Eaton O, de Ribot FM. Spontaneous closure of a traumatic macular hole: The fastest yet? *Indian J Ophthalmol Case Rep.* 2023;3:572–573. doi:10.4103/ijo.IJO_1931_22.
- 3 Neubauer J, Gelisken F, Ozturk T, Bartz-Schmidt KU, Dimopoulos S. The time course of spontaneous closure of idiopathic full-thickness macular holes. *Graefes Arch Clin Exp Ophthalmol.* 2024;262:2859–2865. doi:10.1007/s00417-024-06465-2.

ACKNOWLEDGEMENTS

IVTS classification: Duker 2013. Müller cell hypothesis: Bringmann 2020. Traumatic MH
OCT classification: Huang 2009. Vitrectomy outcomes in uveitis: Callaway 2018.