

BACKGROUND

Glaucoma filtration procedures (trabeculectomy, tube shunts, micro-shunts) lower IOP and *preserve* remaining vision. Published cohorts emphasise transient post-operative VA decline with return to baseline; durable gains beyond baseline are seldom a principal finding.

Isolated case reports describe striking VA recovery after rapid, sustained IOP reduction in eyes with very poor pre-operative acuity — pointing to reversible RGC dysfunction, medication/BAK ocular-surface toxicity, and macular perfusion as contributing mechanisms.

Knowledge gap: No study has specifically quantified the *frequency* and *durability* of VA gain after filtration surgery in a defined low-vision cohort (BCVA <6/24) across procedure types.

AIM

To evaluate whether glaucoma filtration surgery can deliver clinically meaningful VA improvement in low-vision eyes, and whether gains are sustained over 24 months.

METHODS

Retrospective Case Series — Moorfields Eye Hospital, Jan–Dec 2023

- Any glaucoma filtration procedure: Preserflo MicroShunt, aqueous shunt, trabeculectomy
- BCVA <6/24 (logMAR ≥0.6) at time of surgical listing
- VA improvement documented at 1 month post-operatively
- Minimum 12-month follow-up; uncomplicated primary surgery
- Excluded:** prior filtration surgery; concurrent vitreoretinal procedure

Outcomes: BCVA & IOP at 1, 3, 6, 12, 18, 24 months. Primary: VA change & durability of ≥0.2 logMAR improvement (Kaplan–Meier).

Statistics: Friedman test; Wilcoxon signed-rank + Holm correction (T0 vs m12, m24); Kaplan–Meier survival; Spearman ρ + linear regression (Δ IOP vs Δ BCVA). IBM SPSS v31. $\alpha = 0.05$.

PATIENT CHARACTERISTICS (N = 65)

Parameter	Value
Patient Factors	
Age (years)	62 [48.5–71]
Sex	Male 35 (54%) · Female 30 (46%)
Ethnicity	Caucasian 22 (34%) · AfroCaribb 14 (22%) · Not stated 19 (29%)
Glaucoma Factors	
Glaucoma type	Secondary 36 (55%) · POAG 22 (34%)
Lens status	Pseudophakia 38 (58%) · Phakia 24 (37%) · Aphakia 3 (5%)
Prior laser	No 43 (66%) · Yes 22 (34%)
Medications (classes)	3 [3–4]
Pre-op IOP (mmHg)	29 [18.5–39]
Pre-op BCVA (logMAR)	0.90 [0.78–1.54]
VF Mean Deviation (dB)	−20.18 [−24.48 to −10.14]
Cup:Disc ratio	0.8 [0.75–0.90]
Procedure	
Aqueous shunt	35 (54%)
Trabeculectomy	17 (26%)
Preserflo MicroShunt	3 (5%)

343 consecutive low-vision patients identified; 65 (19%) showed VA improvement at 1 month. Values: median [IQR] unless stated.

VISUAL ACUITY — KEY STATISTICS

p<0.001 Friedman overall $\chi^2(6)=39.28$, n=29	r=0.70 Effect size T0 vs m12 (large)	r=0.55 Effect size T0 vs m24 (large)
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Both pre-specified Wilcoxon paired comparisons (T0 vs m12: $Z=-4.975$, $p<0.001$; T0 vs m24: $Z=-2.874$, $p=0.004$) remained significant after Holm correction. Negative Z confirms lower logMAR = better BCVA at follow-up.

IOP outcome: Friedman $\chi^2(7)=58.27$, n=31, $p<0.001$ (Kendall's $W=0.27$). Wilcoxon: T0 vs m12 $p<0.001$ ($r=0.77$, N=62); T0 vs m24 $p<0.001$ ($r=0.85$, N=35).

BEST-CORRECTED VISUAL ACUITY OVER 24 MONTHS — FIGURE 1

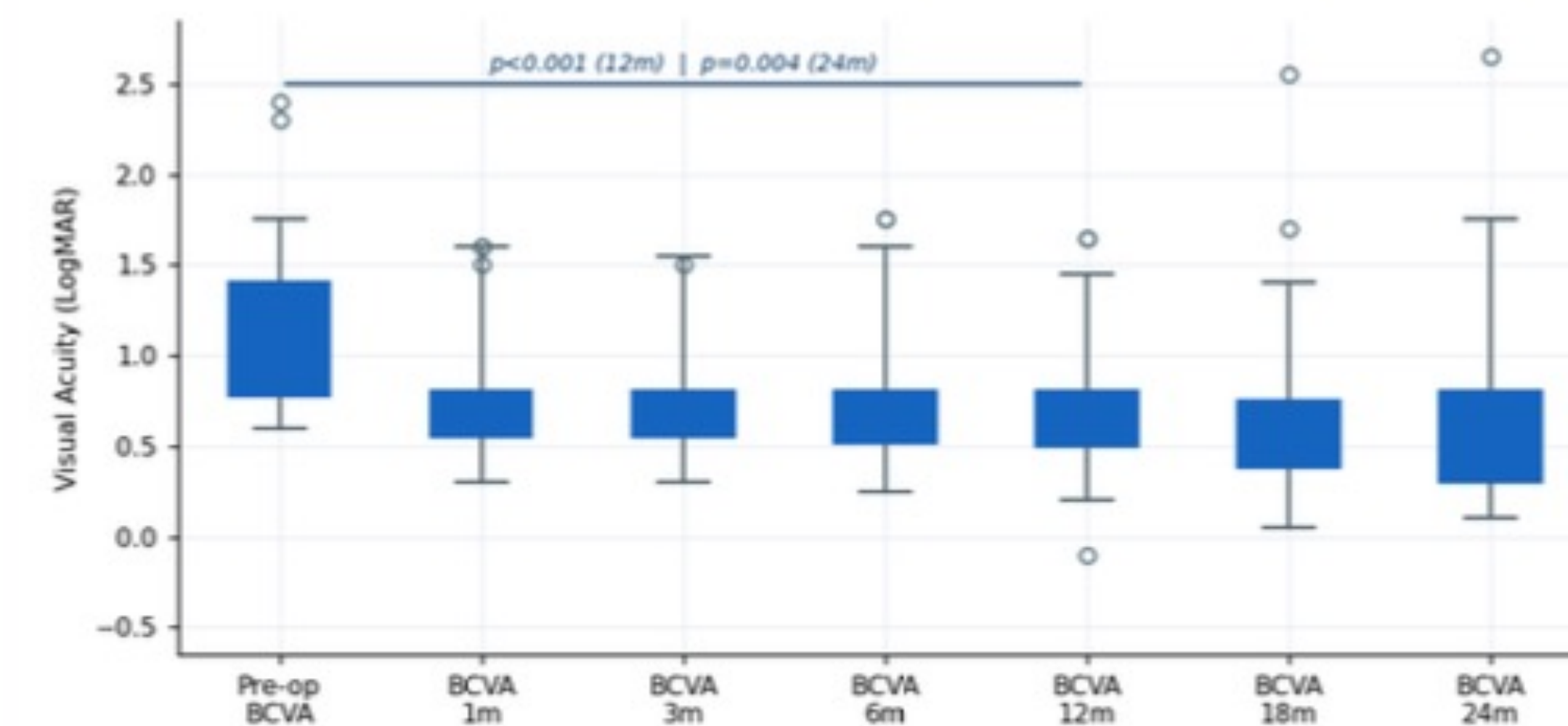


Fig 1. BCVA (logMAR) at each timepoint. Downward shift in medians indicates improvement. Wilcoxon (Holm-adjusted): T0 vs m12 $p<0.001$, $r=0.70$; T0 vs m24 $p=0.004$, $r=0.55$, n=51 and n=27 at respective timepoints.

INTRAOCULAR PRESSURE OVER 24 MONTHS — FIGURE 2

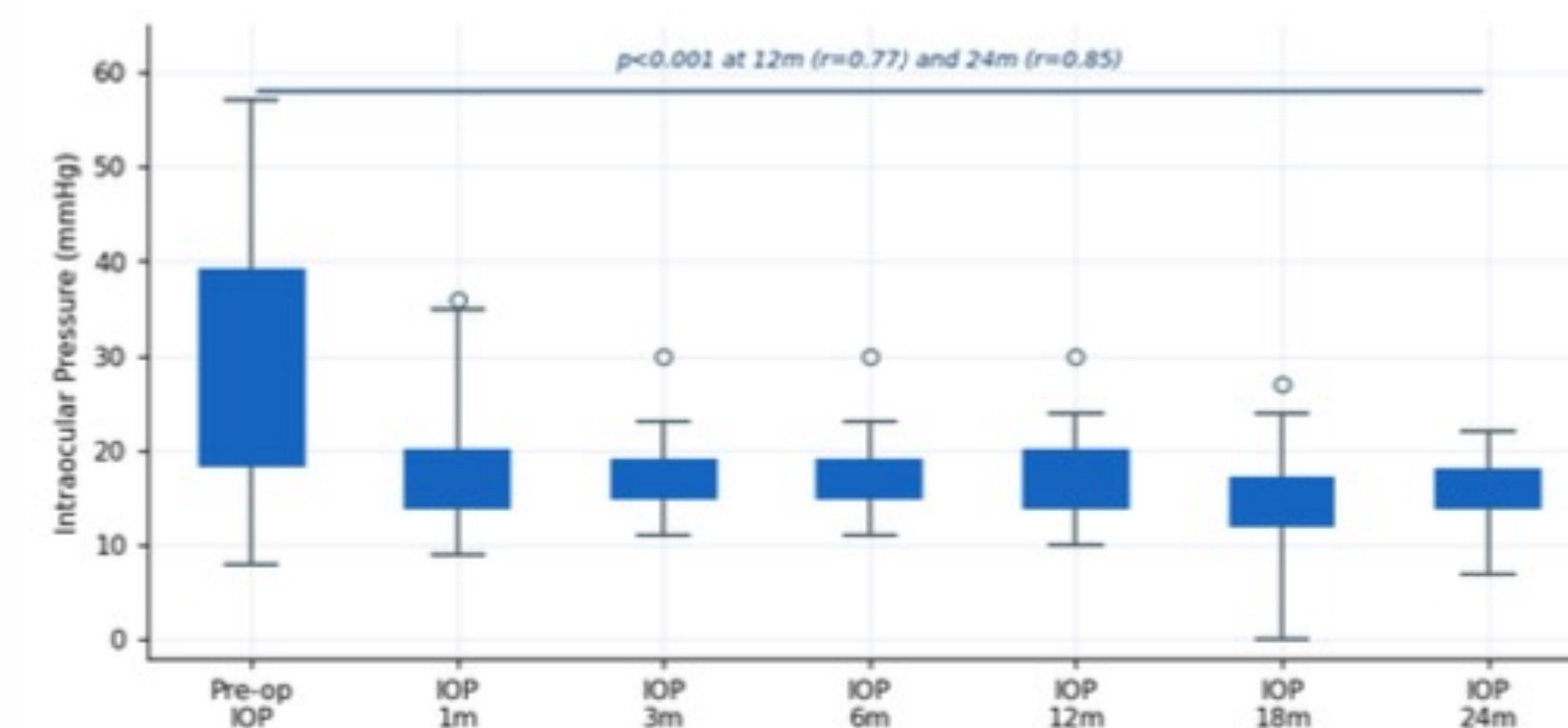


Fig 2. IOP (mmHg) from listing to 24 months. Friedman $\chi^2(7)=58.27$, $p<0.001$. Wilcoxon: T0 vs m12 $p<0.001$ ($r=0.77$); T0 vs m24 $p<0.001$ ($r=0.85$). Sustained IOP reduction confirmed across all timepoints.

DURABILITY OF VA IMPROVEMENT — KAPLAN-MEIER — FIGURE 3

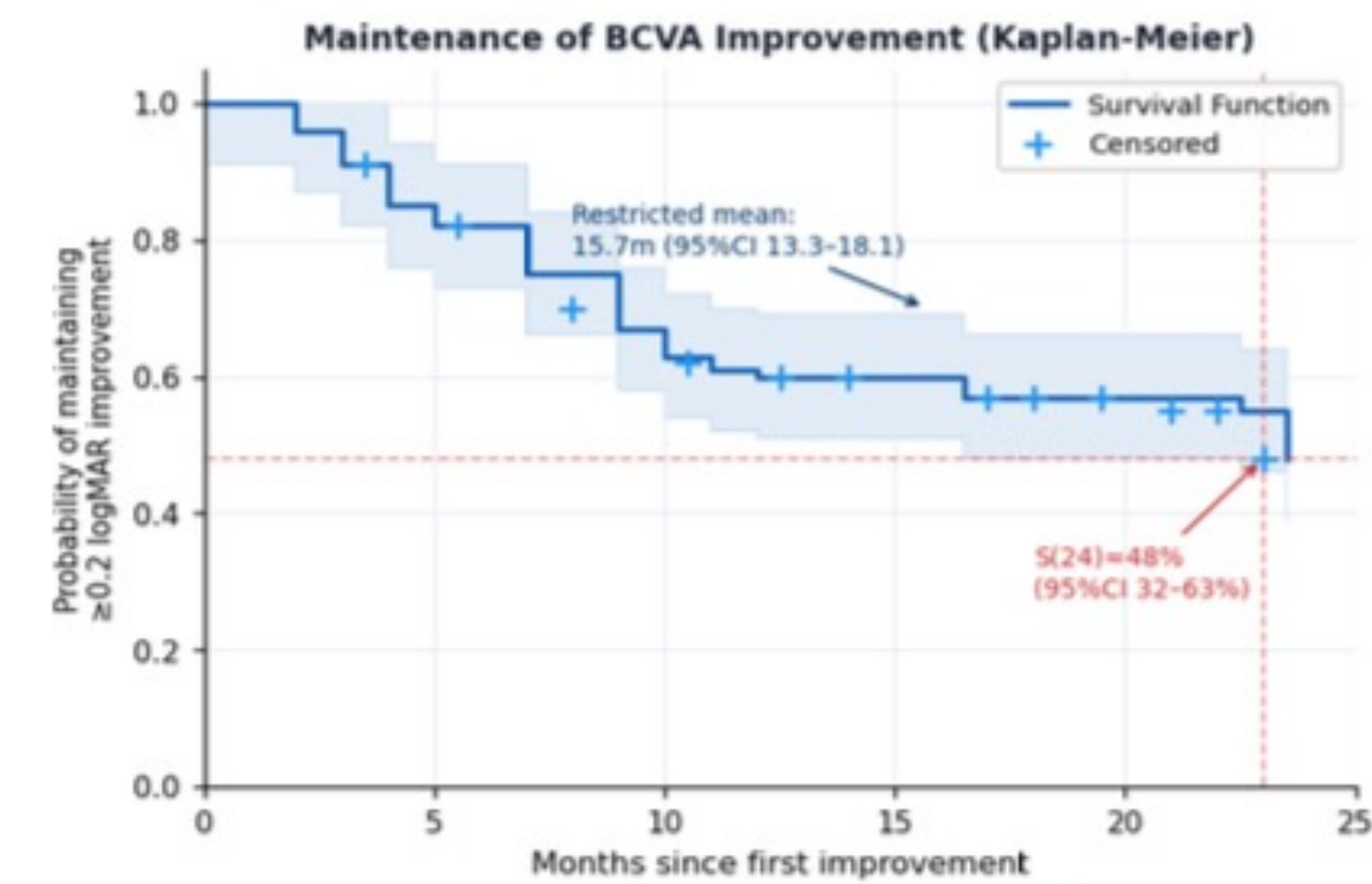


Fig 3. n=56 eyes (25 events, 31 censored). Restricted mean: **15.7 months** (95% CI 13.3–18.1). Median time to loss: **23.0 months**. Maintaining ≥0.2 logMAR gain at ~24 months: **~48%** (95% CI ~32–63%).

IOP REDUCTION VS VA GAIN AT 12 MONTHS — FIGURE 4

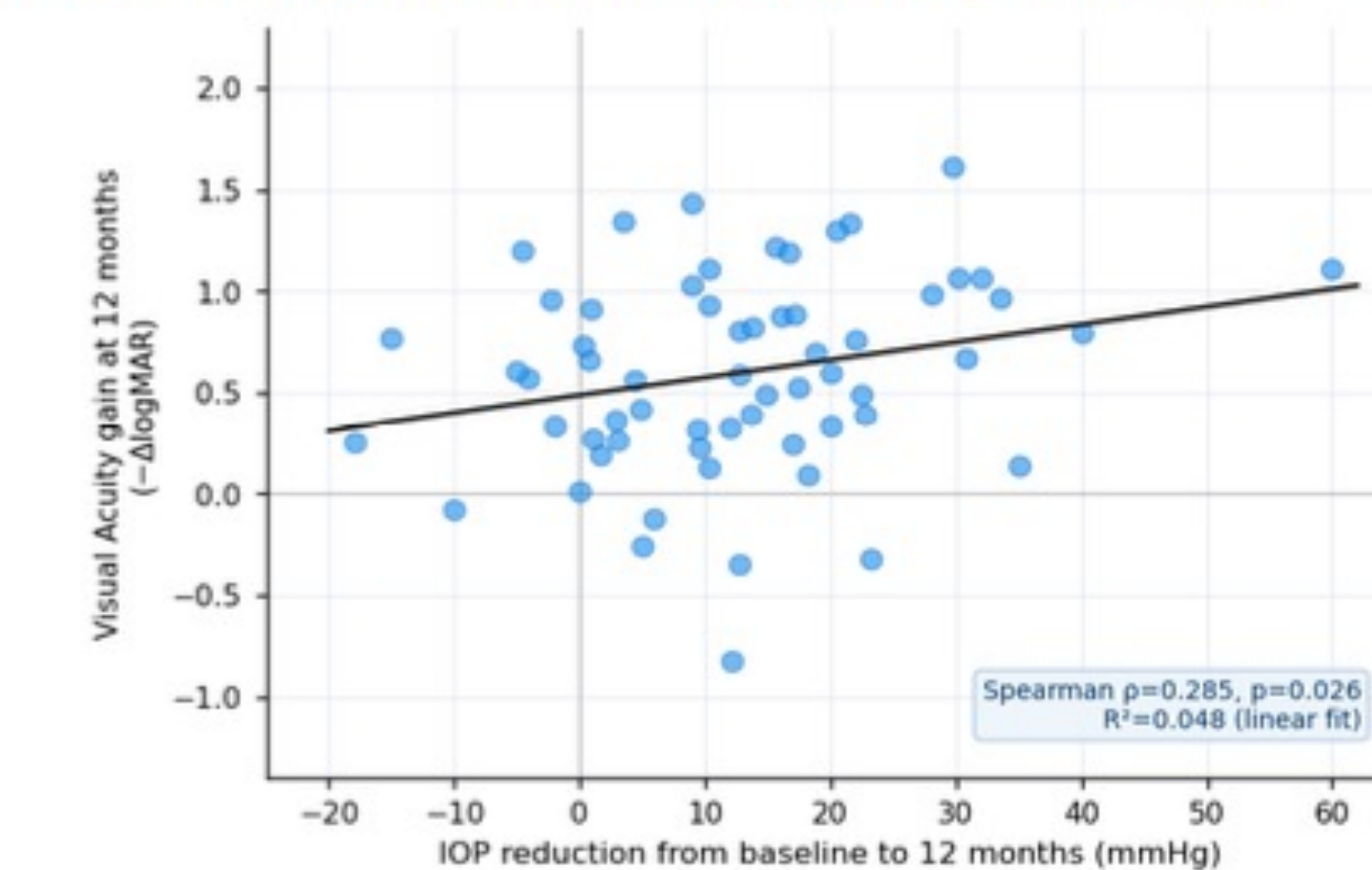


Fig 4. Spearman $p=0.285$, n=61, $p=0.026$ (bootstrap 95% CI −0.001 to 0.532). Small positive association at 12 months. Not significant at 24 months ($p=0.122$, $p=0.485$), reflecting heterogeneous mechanisms and reduced sample size.

DISCUSSION HIGHLIGHTS

- VA improves significantly** with large effect sizes — challenges assumption that filtration surgery only stabilises low-vision eyes
- Mixed mechanisms:** IOP-driven neural rescue; BAK/preserved-drop OSD; corneal oedema relief; improved tear stability
- Small IOP–VA correlation ($p=0.285$) confirms heterogeneous pathways beyond pressure alone
- Aligns with **TAGS trial**: primary trabeculectomy superior IOP control vs medical therapy; less progression at 5 years
- Best candidates:** reversible OSD/medication burden; residual macular potential; shorter severe VA loss duration
- Implication:** "Diode only" assumption should be challenged — incisional filtration is a vision-directed option in selected low-vision eyes

PRIMARY OUTCOMES AT A GLANCE

p<0.001
BCVA Friedman
 $\chi^2(6)=39.28$, n=29

r=0.85
IOP effect size
T0 vs 24 months

15.7m
Restricted mean VA
maintenance (KM)

~48%
Maintaining ≥0.2
logMAR at 24 months

STRENGTHS & LIMITATIONS

- Strengths:** Defined low-vision cohort; standardised 24-month follow-up; triangulated statistics (Friedman, Wilcoxon, KM, Spearman ρ); procedure diversity
- Limitations:** Retrospective design; modest n at later timepoints; no standardised OSD metrics (OSDI, TBUT, staining) or refraction protocol
- Future work:** Prospective studies with OSD endpoints, standardised refraction & mixed-effects models with time-varying medication burden

CONCLUSION

In low-vision glaucoma, filtration surgery produces **clinically meaningful, statistically significant VA improvement** alongside robust IOP lowering — with ~48% of eyes maintaining ≥0.2 logMAR gain at 24 months.

Filtration surgery should be offered not only as neuroprotection but as a **viable path to functional acuity recovery**. In settings where cyclophotocoagulation is reflexively favoured, our data support incisional filtration as a **vision-directed alternative** in carefully selected eyes.

SELECTED REFERENCES

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