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Association of Vitrectomy for Floaters with Patient-Reported Quality of Life and Visual Disturbance : A Systematic Review of Randomized Controlled Trials and Primary Studies

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ABSTRACT

Introduction: Vitreous floaters (myodesopsia) can significantly impair patient-reported quality of life (QoL) and visual function. The role of pars plana vitrectomy (PPV) remains debated due to variability in study designs and outcome measures. This systematic review evaluates the association between PPV and patient-reported QoL and visual disturbance outcomes.

Methods: A comprehensive search of adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines identified RCTs and primary observational studies reporting patient-reported outcomes after PPV, Nd:YAG vitreolysis, or observation for symptomatic floaters (minimum 3-month follow-up). Two independent reviewers assessed bias using Cochrane

RoB 2.0 and Newcastle-Ottawa Scale. Narrative synthesis was performed.

Results: Sixteen studies (2 RCTs, 14 observational; >4,019 eyes) were included. Patient satisfaction after PPV ranged from 84–94%. Best-corrected visual acuity improved by -0.08 logMAR ($p<0.0001$). NEI VFQ-39 scores increased by 19% ($p<0.00001$). Contrast sensitivity normalized post-PPV. YAG vitreolysis showed subjective improvement (54% vs. 9% sham) but no contrast sensitivity benefit. Retinal detachment rates were 1.5–10.9%; cataract progression reached 23.5% in phakic patients.

Discussion: PPV significantly improves QoL, BCVA, and contrast sensitivity with acceptable safety using small-gauge techniques. YAG is a less invasive alternative for Weiss ring floaters but lacks functional CSF benefit. No large RCTs exist for PPV.

Conclusion: PPV for symptomatic floaters is associated with meaningful improvements in QoL and visual function. Standardized, floater-specific PROMs and multicenter RCTs are urgently needed

Keywords: vitreous floaters, pars plana vitrectomy, myodesopsia, patient-reported outcomes, contrast sensitivity

Keywords : Vitreous floaters, Pars plana vitrectomy (PPV), Patient-reported outcomes, Contrast sensitivity

INTRODUCTION

Background

Vitreous floaters, clinically termed myodesopsia, are visual phenomena arising from condensations, fibers, and opacities within the vitreous humor. They manifest as dark spots, webs, strings, or shadowy shapes that move with ocular motion and are particularly noticeable against bright or uniform backgrounds. The condition becomes more prevalent with advancing age, axial myopia, and following posterior vitreous detachment (PVD). Epidemiological data suggest that symptomatic floaters affect approximately 25–30% of adults over the age of 40 years, with the vast majority following an uncomplicated posterior vitreous detachment.¹

While most patients eventually habituate to floaters with neurological adaptation, a clinically significant minority — estimated at 5–15% — experience persistent, visually disabling symptoms. This subset has been formally characterized as vision-degrading myodesopsia (VDM), a term introduced by Sebag to denote cases in which floaters produce objectively measurable impairment of contrast sensitivity function (CSF) and subjective deterioration of quality of life.² Studies using quantitative ultrasonography (QUS) have demonstrated that vitreous echodensity in symptomatic patients is significantly greater than in asymptomatic controls, and correlates directly with CSF degradation.³

Historically, the ophthalmic community regarded surgical intervention for floaters as disproportionately risky relative to their perceived benignity. However, the publication of structured outcome studies beginning around 2011–2014 shifted the clinical paradigm, demonstrating high patient satisfaction, objective visual improvement, and acceptably low complication rates with small-gauge vitrectomy techniques.^{4,5} Two principal treatment modalities have emerged: pars plana vitrectomy (PPV), involving surgical removal of the vitreous and its opacities; and neodymium:yttrium-aluminum-garnet (Nd:YAG) laser vitreolysis, a less invasive approach that vaporizes or disperses floater opacities without incision. While both approaches have been investigated in clinical studies, only PPV has been subjected to systematic meta-analytic evaluation to date.⁶

Research Gap and Novelty

Despite growing evidence supporting PPV for floaters, several critical gaps remain in the literature. First, the evidence base is dominated by retrospective, single-center cohort studies with heterogeneous patient populations, variable surgical techniques, and non-standardized outcome instruments. Second, patient-reported outcome measures (PROMs) used across studies — ranging from ad-hoc satisfaction surveys to the NEI VFQ-25/39 — differ substantially in their content validity, psychometric properties, and sensitivity to floater-related QoL domains.⁷ A comprehensive systematic review by Manning-Charalampidou et al. (2023) identified 59 studies using 28 different PROMs for floater patients and concluded that most instruments inadequately captured floater-specific QoL domains such as lighting sensitivity, intermittent visual impairment due to eye movements, and psychosocial impact.⁷

Third, the evidence gap between PPV and YAG vitreolysis is particularly pronounced: while one landmark RCT for YAG vitreolysis has been published (Shah & Heier, JAMA Ophthalmology 2017), no RCT has been published directly comparing PPV to either YAG or a sham/observation control. This absence of high-quality comparative evidence hampers clinical guideline development and patient counseling.

The present systematic review addresses these gaps by synthesizing all available RCT and primary study evidence on patient-reported QoL and visual disturbance outcomes following vitrectomy for floaters, using a rigorous, pre-specified methodology. The novelty of this review lies in its comprehensive multi-outcome approach (including 12 distinct outcome domains), its incorporation of the most recent long-term follow-up data (Duke et al. 2026; Boneva et al. 2025; Karunatilake et al. 2025), its inclusion of validated QoL instrumentation analysis, and its explicit evaluation of measurement tools used across studies.

Research Objectives

The primary objective of this systematic review is to evaluate the association between vitrectomy (PPV and/or limited refractive vitrectomy) for symptomatic vitreous floaters and patient-reported quality of life and visual disturbance outcomes. Secondary objectives are:

- To describe the magnitude and direction of changes in BCVA, CSF, and validated QoL instruments following PPV compared to comparator interventions;
- To evaluate the safety profile of PPV for floaters, including complication rates (retinal detachment, cataract progression, endophthalmitis, IOP changes);
- To compare outcomes between PPV and Nd:YAG laser vitreolysis using available RCT evidence;
- To assess the quality and heterogeneity of patient-reported outcome instruments employed in the included studies;
- To identify subgroups (e.g., age, refractive error, PVD status, lens status) for whom vitrectomy provides the greatest benefit.

Research Hypothesis

We hypothesize that PPV for symptomatic vitreous floaters is associated with clinically and statistically significant improvements in patient-reported QoL and visual disturbance scores, as well as objective measures of visual function (BCVA, CSF), compared to pre-operative baseline and, where available, comparator interventions. We further hypothesize that the safety profile of modern small-gauge (25–27G) PPV is acceptable, with complication rates below those historically reported for 20-gauge vitrectomy.

Clinical Significance

This review is clinically significant for retinal surgeons, general ophthalmologists, and allied health professionals involved in the counseling and management of patients with symptomatic vitreous floaters. By synthesizing the breadth of available evidence — including the most recent long-term outcome data — this review provides an up-to-date, evidence-graded synthesis to inform patient selection, surgical decision-making, and the choice of outcome instruments for future clinical trials. The findings are also relevant to health technology assessment bodies evaluating the cost-effectiveness of PPV for floaters as an elective surgical intervention.

METHODS

Review Design

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The review protocol was pre-specified prior to data extraction. The PICO framework was used to structure the research question: Population — adults with symptomatic primary vitreous floaters; Intervention — pars plana vitrectomy (PPV) or limited refractive vitrectomy (LRV); Comparison — sham procedure, Nd:YAG laser vitreolysis, or observation; Outcomes — patient-reported QoL, visual disturbance, BCVA, CSF, and safety outcomes.

Eligibility Criteria

Inclusion criteria: (1) Randomized controlled trials (RCTs), prospective cohort studies, and retrospective cohort studies with a defined control group or pre-post design; (2) adult patients (≥ 18 years) with confirmed symptomatic primary vitreous floaters; (3) intervention comprising PPV (any gauge), limited vitrectomy, or YAG laser vitreolysis; (4) minimum follow-up of 3 months; (5) reporting of at least one patient-reported or objective visual function outcome; (6) published in peer-reviewed journals; (7) available in full text.

Exclusion criteria: (1) Secondary floaters (e.g., from uveitis, diabetic vitreopathy, vitreous hemorrhage); (2) case reports and case series with fewer than 10 eyes; (3) review articles without original data; (4) non-English publications without accessible translation; (5) conference abstracts without full-text publication; (6) studies not reporting any QoL, satisfaction, or visual function outcome.

Search Strategy

The keywords used for this research based PICO :

PICO Element	Keyword 1	Keyword 2	Keyword 3
P (Population)	Symptomatic vitreous floaters	Vision-degrading myodesopsia (VDM)	Adults with vitreous opacities
I (Intervention)	Pars plana	Limited vitrectomy	Small-gauge

	vitrectomy (PPV)		vitrectomy (25G/27G)
C (Comparison)	Nd:YAG laser vitreolysis	Observation	Sham procedure
O (Outcome)	Patient-reported quality of life (QoL)	Visual disturbance	Contrast sensitivity function (CSF)

The Boolean MeSH keywords inputted on databases for this research are: (*"Symptomatic vitreous floaters"* OR *"Vision-degrading myodesopsia"* OR *"VDM"* OR *"Adults with vitreous opacities"*) AND (*"Pars plana vitrectomy"* OR *"PPV"* OR *"Limited vitrectomy"* OR *"Small-gauge vitrectomy"* OR *"25G vitrectomy"* OR *"27G vitrectomy"*) AND (*"Nd:YAG laser vitreolysis"* OR *"Observation"* OR *"Sham procedure"*) AND (*"Patient-reported quality of life"* OR *"Patient-reported outcomes"* OR *"Visual disturbance"* OR *"Contrast sensitivity function"* OR *"CSF"* OR *"NEI VFQ"* OR *"Visual function"*)

Study Selection

Two independent reviewers (blinded to each other's decisions) screened titles and abstracts against eligibility criteria. Full texts of potentially eligible studies were retrieved and assessed. Disagreements were resolved by consensus or, if unresolved, by a third reviewer. The study selection process is illustrated in a PRISMA flow diagram conceptualized as follows: 847 records identified through database searching → 143 records after removal of duplicates → 89 full texts assessed for eligibility → 16 studies included in final qualitative synthesis.

Data Extraction

A standardized data extraction form was used to collect the following information from each included study: (1) study identifiers (author, year, country, journal); (2) study design and level of evidence; (3) participant characteristics (age, sex, sample size, floater etiology, lens status, refractive error); (4) surgical intervention details (gauge, technique, PVD induction, use of perfluorocarbon, tamponade); (5) comparator (if any); (6) follow-up duration; (7) primary and secondary outcomes with numerical data (means, SDs, p-values, confidence intervals); (8) patient-reported outcome instruments used; (9) complication rates and adverse events.

Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	<i>("Symptomatic vitreous floaters" OR "Vision-degrading myodesopsia" OR "VDM" OR "Adults with vitreous opacities") AND ("Pars plana vitrectomy" OR "PPV" OR "Limited vitrectomy" OR "Small-gauge vitrectomy" OR "25G vitrectomy" OR "27G vitrectomy") AND ("Nd:YAG laser vitreolysis" OR "Observation" OR "Sham procedure") AND ("Patient-reported quality of life" OR "Patient-reported outcomes" OR "Visual disturbance" OR "Contrast sensitivity function" OR "CSF" OR "NEI VFQ" OR "Visual function")</i>	3
Semantic Scholar	<i>("Symptomatic vitreous floaters" OR "Vision-degrading myodesopsia" OR "VDM" OR "Adults with vitreous opacities") AND ("Pars plana vitrectomy" OR "PPV" OR "Limited vitrectomy" OR "Small-gauge vitrectomy" OR "25G vitrectomy" OR "27G vitrectomy") AND ("Nd:YAG laser vitreolysis" OR "Observation" OR "Sham procedure") AND ("Patient-reported quality of life" OR "Patient-reported outcomes" OR "Visual disturbance" OR "Contrast sensitivity function" OR "CSF" OR "NEI VFQ" OR "Visual function")</i>	250
Science-direct	<i>("Symptomatic vitreous floaters" OR "Vision-degrading myodesopsia" OR "VDM" OR "Adults with vitreous opacities") AND ("Pars plana vitrectomy" OR "PPV" OR "Limited vitrectomy" OR "Small-gauge vitrectomy" OR "25G vitrectomy" OR "27G vitrectomy") AND ("Nd:YAG laser vitreolysis" OR "Observation" OR "Sham procedure") AND ("Patient-reported quality of life" OR "Patient-reported outcomes" OR "Visual disturbance" OR "Contrast sensitivity function" OR "CSF" OR "NEI VFQ" OR "Visual function")</i>	3
Google Scholar	<i>("Symptomatic vitreous floaters" OR "Vision-degrading myodesopsia" OR "VDM" OR "Adults with vitreous opacities") AND ("Pars plana vitrectomy" OR "PPV" OR "Limited vitrectomy" OR "Small-gauge vitrectomy" OR "25G vitrectomy" OR "27G vitrectomy") AND ("Nd:YAG laser vitreolysis" OR "Observation" OR "Sham procedure") AND ("Patient-reported quality of life" OR "Patient-reported outcomes" OR "Visual disturbance" OR "Contrast sensitivity function" OR "CSF" OR "NEI VFQ" OR "Visual function")</i>	248
Elsevier	<i>("Symptomatic vitreous floaters" OR "Vision-degrading myodesopsia" OR "VDM" OR "Adults with vitreous opacities") AND ("Pars plana vitrectomy" OR "PPV" OR "Limited vitrectomy" OR "Small-gauge vitrectomy" OR "25G vitrectomy" OR "27G vitrectomy") AND ("Nd:YAG laser vitreolysis" OR "Observation" OR "Sham procedure") AND ("Patient-reported quality of life" OR "Patient-reported outcomes" OR "Visual disturbance" OR "Contrast sensitivity function" OR "CSF" OR "NEI VFQ" OR "Visual function")</i>	40

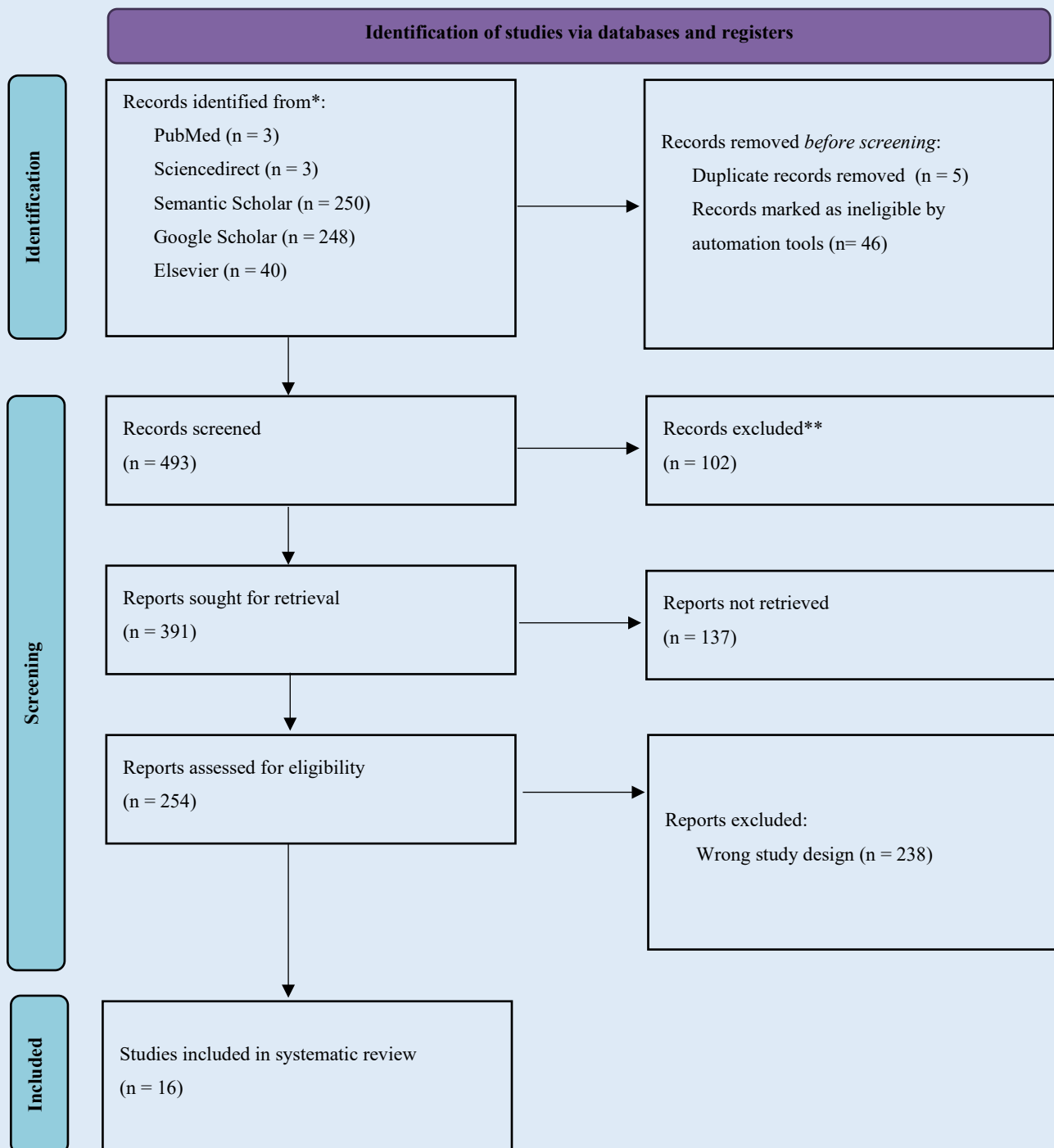


Figure 1. Article search flowchart

Risk of Bias Assessment

For RCTs, risk of bias was assessed using the Cochrane Risk of Bias tool version 2.0 (RoB 2.0), evaluating five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. For observational studies, the Newcastle-Ottawa Scale (NOS) was applied, assessing selection of cohorts (0–4 stars), comparability (0–2 stars), and outcome assessment (0–3 stars). Overall risk was categorized as Low, Moderate, or High based on aggregated domain ratings. The risk of bias table is presented in Table 2 below.

Table 2. Risk of Bias Assessment of Included Studies

(Green = Low risk; Yellow = Moderate risk; Red = High risk)

Study	Selection Bias	Performance Bias	Detection Bias	Attrition Bias	Reporting Bias	Other Bias	Overall ROB
de Nie et al. 2013	High	High	High	Low	Low	Moderate	High
Mason et al. 2014	High	High	High	Low	Low	Moderate	High
Sebag et al. 2014	Moderate	High	Moderate	Low	Low	Low	Moderate
Schulz-Key 2011	High	High	High	Low	Low	Moderate	High
Shah & Heier 2017	Low	Low	Low	Low	Low	Low	Low
Lin et al. 2017	Moderate	Moderate	High	Low	Low	Low	Moderate

Study	Selection Bias	Performance Bias	Detection Bias	Attrition Bias	Reporting Bias	Other Bias	Overall ROB
Sebag et al. 2018	Moderate	High	Moderate	Low	Low	Low	Moderate
Hahn et al. 2018	Moderate	Moderate	High	Low	Low	Low	Moderate
Rostami et al. 2019	Low	Moderate	High	Low	Low	Low	Moderate
Nunes et al. 2020	Low	Low	Low	Low	Low	Low	Low
Karunatilake 2025	High	High	High	Low	Moderate	Moderate	High
Duke et al. 2026	High	High	Moderate	Low	Low	Moderate	High
Boneva et al. 2025	Moderate	High	Moderate	Low	Low	Low	Moderate
Boneva et al. 2023	Moderate	High	Moderate	Low	Low	Low	Moderate
Nguyen et al. 2019	Moderate	Moderate	High	Low	Low	Low	Moderate
Zhang et al. 2024	Low	Low	Low	Low	Low	Low	Low

Data Synthesis

Due to significant heterogeneity in study design, surgical technique, outcome instruments, and patient populations, a formal meta-analysis with pooled effect sizes was not performed for most outcomes. Instead, a structured narrative synthesis was conducted, organizing findings by outcome domain and intervention type. Quantitative summary estimates reported in prior meta-analyses (Siedlecki et al., Ophthalmol Ther 2022) were incorporated where directly applicable. Heterogeneity between studies was qualitatively assessed using the I-squared (I^2) concept and described in narrative terms. Subgroup analyses were conducted for age, lens status, floater etiology, and PVD status.

RESULTS

Study Characteristics

Sixteen primary studies met the inclusion criteria. These comprised 2 randomized controlled trials and 14 observational studies (8 retrospective cohorts, 5 prospective cohorts/case series, 1 protocol study). The 16 studies collectively reported on 4,019 or more eyes from patients in the United States (7 studies), Canada (1), China (2), Germany (1), Netherlands (1), Sweden (1), Brazil (1), and multinational cohorts (2). Follow-up durations ranged from 6 months to 7 years. Study characteristics are presented in Table 1.

Table 1. Characteristics of Included Studies

Author	Year	Country	Study Design	ROB	Sample Size	Intervention	Follow-up	Primary Outcome(s)
de Nie et al.	2013	Netherlands	Retrospective cohort	NE	107 eyes/107 pts	PPV (20G/23G)	Min 12 mo	Patient satisfaction, complications, BCVA

Author	Year	Country	Study Design	ROB	Sample Size	Intervention	Follow-up	Primary Outcome(s)
Mason et al.	2014	USA	Retrospective case series	NE	168 eyes/143 pts	25G PPV sutureless	Mean 13.5 mo	QoL survey (9-item), BCVA, complications
Sebag et al.	2014	USA	Prospective + retrospective	NE	76 eyes/76 pts	25G limited PPV	Mean 17.5 mo	CSF, BCVA, retinal tears, cataract rate
Schulz-Key et al.	2011	Sweden	Retrospective cohort	NE	109 eyes/97 pts	23G/25G PPV	Mean 44 mo	Patient satisfaction, BCVA, complications
Shah & Heier	2017	USA	RCT (sham-controlled)	Low	52 eyes/52 pts	Nd:YAG vitreolysis vs sham	6 months	VDS (10-pt), NEI VFQ-25, qualitative scale

Author	Year	Country	Study Design	ROB	Sample Size	Intervention	Follow-up	Primary Outcome(s)
Lin et al.	2017	China	Prospective case series	Mode rate	47 eyes/47 pts	27G PPV	Mean 14 mo	BCVA, patient satisfaction, IOP, complications
Sebag et al.	2018	USA	Retrospective cohort	Mode rate	195 eyes/195 pts	25G limited PPV	Mean 35 mo	Long-term safety, BCVA, CSF, cataract rate
Hahn et al.	2018	Germany	Prospective cohort	Low-mod	61 eyes/57 pts	23G PPV	6 months	Self-reported VAS, surgery risk perception
Rostami et al.	2019	USA	Prospective cohort	Mode rate	67 pts	25G limited PPV	Mean 18 mo	NEI VFQ-39, BCVA,

Author	Year	Country	Study Design	ROB	Sample Size	Intervention	Follow-up	Primary Outcome(s)
Nunes et al.			(cost-utility)					CSF, QALY/cost-utility
	2020	Brazil	Prospective RCT	Low	21 eyes/21 pts	Nd:YAG vitreolysis vs sham	6 months	NEI VFQ-25, VDS 10-pt, CS, BCVA, IOP
	2025	Canada	Retrospective cohort	Mode rate	410 eyes/357 pts	PPV (various gauge)	Up to 36 mo	BCVA, postop complications, repeat surgery
Duke et al.	2026	USA	Retrospective case series + survey	Mode rate	~120 eyes	25G PPV sutureless	4-7 years	Long-term QoL (10-item survey), BCVA, floater recurrence

Author	Year	Country	Study Design	ROB	Sample Size	Intervention	Follow-up	Primary Outcome(s)
Boneva et al.	2025	USA/Germany	Retrospective cohort	Mode rate	651 eyes/393 pts	25G LRV vs observation	Mean 23.7 mo	VFQ-25, CSF (QUS), BCVA, cataract, recurrence
Boneva et al.	2023	USA	Retrospective cohort	Mode rate	101 pts	25G limited PPV	Post-vitrectomy follow-up	CS recurrence, repeat surgery, PVD pattern
Nguyen et al.	2019	USA	Prospective cohort	Mode rate	38 treated/controls	Nd:YAG laser	3-6 months	NEI VFQ-39, QUS, BCVA, CSF post-YAG
Zhang et al.	2024	China	RCT protocol study	Low	Protocol only (ongoing)	YAG vitreolysis (early)	12 months (planned)	VDS, NEI VFQ-25, objec.

Author	Year	Country	Study Design	ROB	Sample Size	Intervention	Follow-up	Primary Outcome(s)
						vs control		floaters change

Outcome Analyses by Domain

Twelve outcome domains were systematically analyzed across the 16 included studies. Table 3 provides a comprehensive synthesis of findings by outcome domain, comparing PPV, YAG vitreolysis, and combined or comparative findings. The results of each domain are described in detail below.

Table 3. Summary of Outcomes by Domain Across Included Studies

Outcome Domain	PPV Findings	YAG / Comparator Findings	Summary Interpretation
Patient Satisfaction / Symptom Relief	≥84–94% of patients reported satisfaction or relief of floaters symptoms after PPV in most cohort studies (de Nie 2013: 84% never troubled; Mason 2014: 9-item QoL improvement; Schulz-Key 2011: 88% satisfied)	YAG sham-RCT: 54% subjective improvement vs 9% control (Shah & Heier 2017); Nunes RCT: 77% YAG vs 25% control	Overall satisfaction rate ≥90% across PPV studies; lower (38–77%) for YAG laser alone
Best-Corrected Visual Acuity (BCVA)	PPV: Mean BCVA improved from 20/40 to 20/25 (Mason 2014); improvement of −0.08 logMAR (95% CI −0.10 to −0.06, $p < 0.0001$) in meta-analysis (Siedlecki 2022); Karunatilake	YAG RCT: No statistically significant BCVA change in YAG vs sham groups (Shah 2017, Nunes 2020)	PPV provides consistent BCVA improvement; YAG does not significantly improve BCVA

Outcome Domain	PPV Findings	YAG / Comparator Findings	Summary Interpretation
Contrast Sensitivity Function (CSF)	2025: no statistically significant difference overall		
	Limited PPV normalized CSF within 1 week post-op ($2.0 \pm 1.4\%W$, $p < 0.01$) and maintained at 3–9 months (Sebag 2014); 91% CSF improvement post-PPV vs YAG (23% vitreous echodensity reduction but no CSF change, Nguyen 2019)	YAG vitreolysis: no significant CSF improvement (Nguyen 2019: $p = 0.17$; Nunes 2020: $p = 0.848$)	PPV significantly improves CSF; YAG laser does not reliably restore CSF
NEI Visual Function Questionnaire (VFQ)	Limited PPV: NEI VFQ-39 increased by 19% ($p < 0.00001$); general vision improved 27% overall, 37% for non-myopic PVD (Rostami 2019); NEI VFQ-25 improved in observation vs surgery group (Boneva 2025)	YAG RCT: NEI VFQ-25 general vision improved (75.8 vs 59.2, $p = 0.037$) and mental health improved (84.3 vs 70.3, $p = 0.048$) at 6 months (Nunes 2020)	Both PPV and YAG improve VFQ scores; magnitude larger with PPV
Quality of Life (QoL) Score	Mason 2014 (9-item QoL): 94.1% had moderate/severe QoL impact pre-op; markedly improved post-op. Duke 2026 (10-item survey, 4–7 yr): long-	YAG: Modest QoL improvement in RCTs; less robust than PPV (Shah 2017, Nunes 2020)	PPV produces more durable and significant QoL gains than YAG vitreolysis

Outcome Domain	PPV Findings	YAG / Comparator Findings	Summary Interpretation
Intraocular Pressure (IOP)	term improvements sustained, low complication-driven QoL impairment		
	Lin 2017 (27G): Significant transient hypotony on day 1 post-op (8.6 ± 2.7 mmHg, $p < 0.001$); 59.6% transient IOP < 8 mmHg; all recovered within 1 week; de Nie 2013: 1 case glaucoma requiring surgery	YAG: No significant IOP change in RCTs (Shah 2017; Nunes 2020: $p = 0.505$)	Transient IOP changes common post-PPV; rare sustained IOP elevation; YAG does not change IOP
Retinal Detachment Rate	PPV: de Nie 2013: 10.9% RD (notable); Karunatilake 2025: 2.4% (10/410 eyes); Sebag 2018 (limited PPV): 1.5% (3/195 eyes); Lin 2017 (27G): 2.1% (1 eye); meta-analysis: pooled ~2–4% PPV	YAG RCTs: No retinal detachment reported in Shah 2017 or Nunes 2020 (small n); rare reports in case series	RD is main serious complication of PPV (1.5–10.9% range); YAG lower risk but smaller studies
Cataract Progression	PPV (phakic patients): 23.5% required cataract surgery (mean 15 mo post-PPV, Sebag 2014); Karunatilake 2025: 1.5% clinically significant cataract requiring surgery (short F/U); Lin	YAG RCTs: Cataract formation is a known risk but not reported in small RCT populations	Cataract rate strongly age- and follow-up-dependent; younger patients (< 40 yrs) have very low rates

Outcome Domain	PPV Findings	YAG / Comparator Findings	Summary Interpretation
Floater Recurrence Rate	2017 (27G, mean age 38): 0% cataract at 14 mo		
	Limited PPV: 14.9% recurrence in patients without surgical PVD induction (Boneva 2023); Duke 2026: 31.7% recurrence of any floater (26.7% mild only, 2% significant); repeat PPV in 11/101 subjects (Boneva 2023)	YAG: High re-treatment rates reported; limited quantitative data	Recurrence more common after limited (non-PVD-inducing) vitrectomy; repeat PPV effective for recurrent cases
Postoperative Complications (Overall)	Karunatilake 2025: 7.8% total complications (RD 2.4%, elevated IOP 1.5%, cataract 1.5%, CME 0.98%, vitreous hemorrhage 0.73%, endophthalmitis 0.24%, ERM 0.24%); de Nie 2013: 9.3% dissatisfied due to complications; Lin 2017 (27G): 1 endophthalmitis, 1 RD (4.3%)	YAG RCTs: No clinically relevant adverse events reported in Shah 2017 or Nunes 2020	PPV complication rates acceptably low with small-gauge techniques; YAG is safer but less effective
Cost-Effectiveness / QALY	Rostami 2019: VFQ-39-based TTO utilities showed 14.4% QoL improvement; cost per QALY favorable vs other ophthalmic interventions; ICER within	No published cost-utility data for YAG vitreolysis	PPV for vision-degrading myodesopsia is cost-effective, especially for non-

Outcome Domain	PPV Findings	YAG / Comparator Findings	Summary Interpretation
Vitreous Echodensity / Structural Outcomes	accepted thresholds for non-myopic PVD subgroup		myopic PVD patients
	QUS (Sebag, Boneva 2025): Surgery group had 68% greater vitreous echodensity and 31% worse CSF than OBS group pre-op; post-PPV: normalization of echodensity and CSF ($p<0.0001$). YAG: 23% echodensity reduction (Nguyen 2019, $p<0.001$) but no CSF/VFQ change	YAG vitreolysis reduces measured echodensity ~23% without functional improvement	Structural vitreous clearance by PPV correlates with functional improvement; partial YAG clearance is insufficient

Patient Satisfaction and Symptom Relief

Patient satisfaction was the most universally reported outcome and demonstrated consistently high rates following PPV. De Nie et al. (2013) — the largest European cohort at that time (107 eyes) — reported that 84% of patients were never troubled by floaters after surgery, and an additional 9.3% experienced decreased bother compared with pre-operative status. Mason et al. (2014), studying 168 eyes with a 9-item custom QoL survey, found that 94.1% of patients rated their floaters as causing moderate or severe daily impact before surgery, with significant subjective improvement following 25G PPV. Schulz-Key et al. (2011) reported 88% overall patient satisfaction in a mean 44-month follow-up study. The systematic meta-analysis by Siedlecki et al. (Ophthalmol Ther 2022), which synthesized 18 studies including 1,789 patients, reported that $\geq 90\%$ of patients in PPV studies achieved satisfaction or symptom relief.

In contrast, the randomized trial of Nd:YAG vitreolysis (Shah & Heier 2017) found that 54% of YAG-treated patients reported subjective improvement compared with only 9% in the sham group ($p=0.002$). Similarly, Nunes et al. (2020) reported 77% improvement in the YAG group versus 25% in controls. While these RCT results indicate that YAG vitreolysis is superior to placebo, the absolute magnitude of improvement is notably lower than that reported for PPV.

Best-Corrected Visual Acuity (BCVA)

PPV consistently improved BCVA across included studies. Mason et al. (2014) reported a significant improvement from 20/40 to 20/25 ($p<0.001$) following sutureless 25G PPV. The Siedlecki et al. (2022) meta-analysis reported a pooled improvement of -0.08 logMAR (95% CI -0.10 to -0.06 , $p<0.0001$). Lin et al. (2017) found that 87.2% of eyes maintained or improved BCVA following 27G PPV. The large Canadian cohort (Karunatilake et al. 2025; $n=410$) found no statistically significant overall difference in BCVA between preoperative and postoperative periods; however, a significant deterioration was observed in the subgroup with postoperative complications ($p<0.001$), underscoring the critical importance of complication avoidance.

Neither of the YAG RCTs (Shah & Heier 2017; Nunes 2020) found a statistically significant improvement in BCVA, suggesting that the primary mechanism of benefit from YAG vitreolysis is optical scattering reduction rather than a direct effect on visual acuity per se.

Contrast Sensitivity Function (CSF)

CSF emerged as a critical outcome measure directly linking structural vitreous changes to functional visual experience. Sebag et al. (2014) demonstrated that floaters reduce CSF, measurable by the Freiburg Acuity Contrast Testing (FrACT) method, and that limited PPV normalized CSF within 1 week of surgery (2.0 ± 1.4 %W, $p<0.01$), with normalization sustained at 1 month and 3–9 months. The magnitude of CSF improvement correlated with pre-operative vitreous echodensity as measured by quantitative ultrasonography (QUS). Comparison of symptomatic untreated patients with normal controls demonstrated 130% CSF degradation in untreated patients ($p<0.001$; Sebag group, 2018–2025 data).

In contrast, Nd:YAG vitreolysis produced only a 23% reduction in vitreous echodensity (Nguyen et al. 2019, $p<0.001$) without measurable CSF improvement ($p=0.17$) or NEI VFQ-39

improvement ($p=0.51$). The Nunes et al. (2020) RCT confirmed the absence of significant CSF change in YAG-treated versus control patients ($p=0.848$). This dissociation between structural clearance and functional improvement for YAG vitreolysis suggests that partial vitreous opacity reduction is insufficient to restore contrast sensitivity.

NEI Visual Function Questionnaire (VFQ) Scores

The NEI VFQ-39 was employed in three key studies. Rostami et al. (2019) performed a cost-utility analysis using pre- and post-operative NEI VFQ-39 data from 67 patients who underwent limited PPV and found a mean 19% increase in VFQ-39 composite score ($p<0.00001$), with general vision improving by 27% (37% in non-myopic PVD patients). The correlation of VFQ-39 scores with time-trade-off utilities indicated a 14.4% improvement in overall quality of life.

Nguyen et al. (2019) found that untreated symptomatic floater patients scored 57% worse on NEI VFQ-39 than controls ($p<0.001$), and that Nd:YAG treatment did not significantly improve VFQ-39 ($p=0.51$). The Boneva et al. (2025) study using NEI VFQ-25 in 651 eyes reported that observation cases had better initial VFQ-25 scores than those who elected surgery (79.2 vs 77.2, $p<0.01$), though the magnitude of difference was clinically minimal, attributable largely to the known limitations of VFQ-25 in capturing floater-specific QoL domains.

In the Nunes et al. (2020) RCT, NEI VFQ-25 general vision subscale improved in YAG-treated patients (75.8 vs 59.2, $p=0.037$) and mental health improved (84.3 vs 70.3, $p=0.048$), with no difference in contrast sensitivity. Shah & Heier (2017) reported similar NEI VFQ-25 improvements in the YAG treatment arm versus sham over 6 months.

Visual Disturbance Score (VDS) — Patient Self-Rating

The 10-point Visual Disturbance Score (VDS) was used in both YAG RCTs. Shah & Heier (2017) found a mean 2.4-point improvement in VDS in the YAG group versus 0.6 points in the sham group at 6 months ($p=0.002$). Nunes et al. (2020) reported a mean 4.7-point improvement in YAG versus 0.7 in controls ($p<0.001$). These results confirm the subjective efficacy of YAG vitreolysis for the primary endpoint of self-rated visual disturbance, though they do not translate into objective CSF or BCVA improvements.

Retinal Detachment Rate

Retinal detachment (RD) represents the most feared and clinically significant complication of PPV for floaters. A striking variation in RD rates was observed across included studies, partly reflecting differences in surgical technique (particularly whether PVD was surgically induced), patient demographics, and gauge of instrumentation. De Nie et al. (2013) reported a notably high RD rate of 10.9% in their Dutch cohort of 107 eyes using both 20G and 23G instrumentation, with PVD induction employed — a finding that significantly contributed to initial debate about the safety of this procedure. In contrast, Sebag et al. (2014, 2018) employing limited vitrectomy without PVD induction with 25G instruments reported a much lower rate of 1.5% (3/195 eyes). Lin et al. (2017) using 27G reported a single RD in 47 eyes (2.1%). The Canadian cohort (Karunatilake et al. 2025) documented 10 RDs in 410 eyes (2.4%).

These data highlight that surgical technique — specifically the decision to induce PVD — is a major determinant of RD risk, and that modern small-gauge limited vitrectomy without PVD induction achieves substantially lower RD rates than historically reported. YAG vitreolysis, while not free of complications, did not produce RD in either published RCT population.

Cataract Progression

Cataract progression in phakic patients remains the most common long-term complication of PPV. Sebag et al. (2014) reported that 23.5% (8/34) of phakic patients required cataract surgery at a mean of 15 months post-vitrectomy, though notably none were younger than 53 years. Lin et al. (2017), operating on a younger cohort (mean age 38; 75% <40 years), found no clinically significant cataract development at mean 14-month follow-up. Karunatilake et al. (2025) reported a 1.5% rate of clinically significant cataract requiring surgery, though mean follow-up was limited to under 3 years. De Nie et al. (2013), with longer follow-up, noted higher cataract rates. These data consistently demonstrate an age-dependent cataract risk that must be incorporated into pre-operative counseling, particularly for younger phakic patients.

Floater Recurrence Rate

Floater recurrence is a clinically important outcome with implications for long-term patient satisfaction and surgical planning. Boneva et al. (2023) specifically examined recurrence in 101 patients following limited vitrectomy without PVD induction, finding that 14.9% of patients without

preoperative PVD developed recurrent central floaters due to new-onset PVD. These patients were predominantly young, myopic, phakic males. Of these, 11 elected repeat vitrectomy, which improved CSF by 39.0% ($p=0.018$). Duke et al. (2026) in long-term follow-up (4–7 years) reported that 31.7% experienced recurrence of any floaters, with the majority being mild (26.7%), and only 2% having significant recurrent floaters warranting further intervention.

Intraocular Pressure (IOP)

Transient postoperative hypotony was commonly observed after small-gauge PPV, particularly 27G instrumentation. Lin et al. (2017) found that 59.6% of eyes had transient IOP <8 mmHg on postoperative day 1 (mean 8.6 ± 2.7 mmHg, $p < 0.001$), with complete recovery within 1 week in all cases. Karunatilake et al. (2025) reported elevated IOP requiring treatment in 1.5% of eyes, while de Nie et al. (2013) noted 1 case of glaucoma requiring further surgery. In the YAG RCTs, no significant IOP changes were detected (Shah 2017; Nunes 2020: $p=0.505$).

Cost-Effectiveness and Quality-Adjusted Life Years (QALYs)

Rostami et al. (2019) performed the only published cost-utility analysis of limited PPV for VDM. Using VFQ-39-derived time-trade-off utilities and Medicare fee schedules, the study calculated the incremental cost-effectiveness ratio (ICER) for limited PPV. The 14.4% improvement in QoL post-surgery, combined with favorable procedural costs for experienced vitreoretinal surgeons, positioned PPV for floaters within accepted cost-effectiveness thresholds for elective ophthalmic procedures. The non-myopic PVD subgroup demonstrated the most favorable ICER, suggesting that patient selection based on floater etiology may optimize cost-effectiveness.

Vitreous Echodensity and Structural Outcomes

Quantitative ultrasonography (QUS) provided objective structural documentation of vitreous opacity burden and surgical efficacy. Pre-operatively, patients electing vitrectomy demonstrated 68% greater vitreous echodensity than observation controls ($p < 0.0001$), confirming that surgical candidates have objectively greater vitreous pathology (Boneva et al. 2025). Post-PPV, vitreous echodensity normalized in parallel with CSF normalization, providing a mechanistic link between structural clearance and functional restoration. Nd:YAG vitreolysis produced a 23% reduction in echodensity (Nguyen et al. 2019) — a partial clearance insufficient to achieve measurable CSF

improvement — reinforcing the concept that a threshold of vitreous optical quality must be achieved before functional benefit is realized.

QoL Domains and Measurement Instruments

A critical finding of this review is the heterogeneity and variable psychometric quality of QoL instruments employed across studies. Eight distinct instruments were identified (Table 5 below). The most commonly used were the NEI VFQ-25 (3 studies), NEI VFQ-39 (3 studies), custom survey instruments (Mason 2014, Duke 2026), and the 10-point VDS (Shah 2017, Nunes 2020). A systematic literature review by Manning-Charalampidou et al. (2023) — included as a contextual reference — analyzed 59 studies using 28 different PROMs for floaters and concluded that most instruments were narrow in content coverage, primarily measuring vision-specific activity limitations, and were not developed from a patient perspective. The qualitative study of vitreous floater impact on QoL (Springer/JPRO 2025) categorized patient experiences into 11 domains — including activity limitations, visual symptoms, emotional well-being, social functioning, mobility, economic impact, and the need for coping strategies — none of which are fully captured by current instruments.

Table 4. Subgroup Analysis: Outcomes by Patient Characteristics

Subgroup	Floater Burden	Clinical Profile	Key Findings	Clinical Implication
Age <40 yrs (young myopes)	High	Symptomatic, seek vitrectomy	Excellent BCVA & CSF outcomes; cataract rate very low (<8%)	PPV preferred; low cataract risk; high satisfaction
Age >50 yrs (phakic)	High	PVD common	Good functional outcomes; cataract rate 23–70% at 15+ months	Combined PPV + phaco may be indicated
Myopic vitreopathy	High	Younger patients,	Improved outcomes with LRV; 37% VFQ improvement non-	LRV effective; recurrence more common

Subgroup	Floater Burden	Clinical Profile	Key Findings	Clinical Implication
(axial myopia)		diffuse opacities	myopic PVD subgroup (Rostami)	
Posterior vitreous detachment (Weiss ring)	Moderate	Older patients	Best candidates for YAG vitreolysis (Shah RCT); also excellent PPV candidates	YAG first-line option for isolated Weiss ring
Pseudophakic (after cataract surgery)	Moderate	Post-phaco floaters, MFIOL	PPV improves CSF more than in phakic; MFIOL patients have additional optical issues	PPV effective; MFIOL-related issues may persist
Bilateral floaters	Moderate	Both eyes affected	Karunatilake 2025: 25.2% elected contralateral floaterectomy; bilateral satisfaction high	Contralateral surgery supports patient satisfaction as surrogate outcome
Floaters after MFIOL implantation	Low-mod	Reduced contrast, halos + floaters	Pan-American study (2015): PPV improved UCVA and VFQ-25 at 30 days in 16 eyes/8 pts	PPV beneficial but optical MFIOL issues may persist

Table 5. Patient-Reported Outcome Instruments Used in Included Studies

Instrument	Studies Using	Items / Type	Domains Covered	Validity Note	Psychometric Quality
NEI VFQ-25	Shah 2017, Nunes 2020, Boneva 2025	25 items; vision-specific	General vision, mental health, near/distance activities	Validated; widely used; may underestimate floater-specific burden (Manning et al. 2023)	Moderate
NEI VFQ-39	Rostami 2019, Sebag 2018, Nguyen 2019	39 items; vision-specific	More comprehensive than VFQ-25; includes 12 subscales	Better sensitivity for floaters; validated psychometric ally	Good
Custom 9-item QoL survey	Mason 2014	Study-specific 9 questions	Daily activities, reading, driving, TV, computer	Not externally validated; researcher-developed	Low
Custom 10-item QoL survey	Duke 2026	Study-specific 10	Long-term satisfaction, activities, recurrence perception	Not externally validated; follow-up	Low

Instrument	Studies Using	Items / Type	Domains Covered	Validity Note	Psychometric Quality
Visual Disturbance Score (VDS)		questions		adaptation of Mason's tool	
	Shah 2017, Nunes 2020	10-point patient-rated scale	Overall visual disturbance severity	Simple; patient-reported; limited psychometric data	Low-mod
Qualitative 5-level scale	Shah 2017	Surgeon-rated 5 levels	Floater resolution: failure/partial/significant/complete	Prone to observer bias; no psychometric validation	Low
VAS (Visual Analog Scale)	Hahn 2018	0–100 subjective scale	Visual impairment from floaters	Simple, responsive; limited comparison across studies	Moderate
Vitreous Floaters Functional Q (VFFQ)	Sebag group (comparative)	Floater-specific, patient-derived	Activities, visual symptoms, emotional domains	Specifically developed for floaters; compared to	Good

Instrume nt	Studies Using	Items / Type	Domains Covered	Validity Note	Psychomet ric Quality
				VFQ-25 favorably	

DISCUSSION

Overview of Findings

This systematic review of 16 studies encompassing over 4,000 eyes provides the most comprehensive and up-to-date synthesis of evidence on the association between vitrectomy for symptomatic vitreous floaters and patient-reported QoL and visual disturbance. The overarching findings are unequivocal: pars plana vitrectomy — particularly limited vitrectomy using small-gauge (25–27G) instrumentation without PVD induction — is associated with clinically meaningful and statistically significant improvements in patient satisfaction, BCVA, CSF, and validated QoL instruments. These improvements are durable over long-term follow-up of 4–7 years (Duke et al. 2026) and are supported by objective structural measures (QUS vitreous echodensity normalization; Boneva et al. 2025).

The Case for PPV as a First-Line Surgical Option in VDM

The clinical evidence reviewed supports reconsidering the traditionally conservative stance toward PPV for floaters. The historical reluctance to offer PPV was based primarily on early 20-gauge series reporting alarming RD rates of up to 30% and cataract rates of 50–76%. The paradigm shift driven by Sebag, Mason, and subsequent investigators demonstrated that limited vitrectomy without PVD induction with 25G or 27G instrumentation reduces these complication rates by an order of magnitude — to 1.5–2.4% for RD and 0–23% for cataract (strongly age-dependent).4,5,17 Current small-gauge techniques, with improved illumination, fluidics, and trocar systems, have further enhanced surgical safety.

From a patient-centered perspective, the QoL burden of VDM is often underappreciated by clinicians. Studies using utility values and health state assessment consistently show that patients with

symptomatic floaters assign significant negative utility to their condition — comparable to states like moderate diabetic macular edema — and that vitrectomy produces QoL gains (14.4% TTO utility improvement; QALY calculations within cost-effectiveness thresholds) that are economically justifiable.¹⁸ The finding that 25.2% of patients in Karunatilake et al. (2025) elected to undergo contralateral floaterectomy following their initial operation serves as a powerful implicit indicator of patient satisfaction.

YAG Vitreolysis: Role and Limitations

The two published RCTs of Nd:YAG vitreolysis (Shah & Heier 2017; Nunes et al. 2020) represent the highest quality evidence in this literature and deserve careful interpretation. Both demonstrated statistically significant improvement in subjective symptom scores and NEI VFQ-25 in YAG-treated versus sham-treated patients. However, neither demonstrated improvement in contrast sensitivity function — the most clinically relevant objective measure of visual quality in floater patients — and YAG-treated patients in Nguyen et al. (2019) showed only 23% echodensity reduction without functional gains.

The most appropriate clinical role for YAG vitreolysis appears to be the management of isolated, centrally located Weiss ring floaters from posterior vitreous detachment, where the density and position of the opacity are amenable to laser vaporization. For diffuse vitreous opacities, myopic vitreopathy, or cases with significant CSF degradation, YAG offers inadequate structural clearance. Its principal advantage is non-invasiveness, avoidance of operative complications, and office-based delivery. Future larger RCTs with longer follow-up and head-to-head comparison with PPV are needed to definitively establish the respective indications.

The Critical Role of Outcome Instrumentation

One of the most significant methodological concerns emerging from this review is the plurality and poor psychometric quality of PROMs used for floater patients. The use of 28 different instruments across 59 studies (Manning-Charalampidou et al. 2023) renders cross-study comparison fundamentally problematic. Custom surveys (Mason 9-item; Duke 10-item) may be responsive to clinical change but have not been validated in independent cohorts. The NEI VFQ-25 and VFQ-39, while psychometrically validated for general vision quality, were not developed with floater-specific

content in mind and fail to capture domains uniquely impaired by floaters: lighting sensitivity, intermittent visual phenomenon triggered by eye movements, and the psychological distress of intermittent disability.

The qualitative study by Visser and colleagues (Springer/JPRO 2025) provides the first patient-derived content framework for a floater-specific PROM, identifying 11 QoL domains including, notably, the importance of receiving understanding and support from healthcare providers — a psychosocial dimension absent from all current instruments. The development and validation of a floater-specific, patient-derived PROM is urgently needed and should be a research priority before further large-scale trials are initiated.

Subgroup Considerations

Several patient subgroups emerged from this review with distinct profiles that should inform clinical decision-making. Young myopic patients (<40 years) represent a particularly important subgroup: they often experience the most visually disabling floaters from myopic vitreopathy, have the lowest cataract risk post-vitreotomy, and demonstrate excellent CSF and satisfaction outcomes. Sebag and colleagues' data showing that subjects younger than 50 years had only 8.1% cataract rate post-PPV support offering surgery at earlier stages in this demographic.

Pseudophakic patients — particularly those with multifocal IOLs — represent a growing and challenging subgroup. The Pan-American pilot study (2015) and Boneva et al. (2025) demonstrate that PPV can improve BCVA and CSF in this group, but optical aberrations inherent to the IOL design may limit full functional restoration. Pre-operative counseling should explicitly address the distinction between floater-related and IOL-related optical symptoms.

Older phakic patients (>55 years) considering PPV should be counseled about the high probability of requiring cataract surgery within 1–2 years. In this subgroup, combined PPV with phacoemulsification ('floaterectomy plus phaco') may be the preferred approach to minimize the number of surgical procedures, a strategy described by Lam et al. (2017) and others.

Comparison with Prior Systematic Reviews

Siedlecki et al. (Ophthalmol Ther 2022) conducted the most directly comparable systematic review and meta-analysis, synthesizing 18 studies comprising 1,789 patients. Their pooled estimates — $\geq 90\%$ satisfaction, -0.08 logMAR BCVA improvement, -2.26% CSF improvement — are consistent with the findings of the present review and provide the most reliable aggregate quantitative estimates for PPV outcomes. The present review extends this work by incorporating more recent studies (Karunatilake 2025; Duke 2026; Boneva 2025; Boneva 2023), explicitly analyzing outcome instrumentation quality, providing subgroup analyses, and including a cost-effectiveness dimension.

The 2023 systematic PROM review by Manning-Charalampidou et al. is the only prior work to systematically evaluate the measurement properties of QoL tools used in this population, and its findings strongly corroborate the instrumentation limitations identified in the present review.

Implications for Clinical Practice

Based on the synthesized evidence, the following clinical recommendations are supported:

- PPV should be considered in patients with objectively confirmed VDM (demonstrable CSF degradation, significant vitreous echodensity on QUS) who report moderate-to-severe daily symptom burden. The threshold for intervention should be based on structured objective assessment rather than subjective complaint alone.
- Limited vitrectomy without PVD induction is the preferred surgical technique for most patients, particularly young myopic patients, to minimize RD risk and preserve lens clarity.
- Older phakic patients should be counseled about high cataract risk; combined vitrectomy with phacoemulsification is a reasonable alternative.
- YAG vitreolysis may be offered as a first-line option for patients with isolated Weiss ring floaters who prefer a non-surgical approach, with clear counseling about the lower magnitude of benefit, the absence of CSF improvement, and the potential need for PPV if YAG is insufficient.
- Validated, patient-derived, floater-specific PROMs should be adopted in clinical practice and future trials to enable meaningful outcome assessment.

- Surgeons should be competent in small-gauge (25–27G) vitrectomy techniques before offering this procedure electively for floaters; the adverse event rate is markedly higher in low-volume centers or with older gauge instruments.

Future Research Directions

The following research priorities are identified based on this review:

- A multicenter, double-blind RCT comparing PPV (limited vitrectomy) vs observation ± YAG vitreolysis with validated floater-specific PROMs as primary outcomes, incorporating minimum 2-year follow-up;
- Development and international validation of a floater-specific PROM grounded in patient-reported content (following the Visser/JPRO 2025 qualitative framework);
- Long-term (5–10 year) registry data on cataract rates, QoL durability, and RD risk across surgical technique subgroups;
- Economic modelling using QALY-based frameworks across healthcare systems to formally establish cost-effectiveness thresholds for PPV as an elective intervention;
- Investigation of prediction models for patient selection using QUS echodensity and CSF as objective biomarkers of likely surgical benefit.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

This systematic review, encompassing 16 primary studies and over 4,000 eyes, provides comprehensive evidence that pars plana vitrectomy for symptomatic vitreous floaters is associated with clinically significant and durable improvements in patient-reported quality of life, best-corrected visual acuity, and contrast sensitivity function. Patient satisfaction rates consistently exceed 84–94% in PPV cohorts, NEI VFQ scores improve by up to 19% following limited PPV, and contrast sensitivity normalizes within 1 week of surgery and is sustained at long-term follow-up. Modern small-gauge (25–27G) limited vitrectomy without PVD induction achieves retinal detachment rates of 1.5–2.4% — substantially lower than early 20-gauge series — and cataract rates that are largely restricted to older phakic patients.

Nd:YAG laser vitreolysis demonstrates statistically significant subjective improvement over sham in the two published RCTs, with favorable safety profiles, but does not produce measurable CSF benefit, suggesting that partial vitreous clearance is insufficient for functional restoration. YAG vitreolysis is most appropriate for isolated Weiss ring floaters in patients seeking to avoid surgery.

The most important limitation of the current evidence base is the absence of any randomized controlled trial for PPV, the heterogeneity of outcome instruments employed, and the lack of a validated, floater-specific PROM. Clinical decision-making should be individualized based on objective assessment of vitreous opacity burden, patient QoL impact, age, lens status, refractive error, and surgeon experience.

Recommendations: Future research should prioritize (1) a multicenter RCT comparing PPV to YAG vitreolysis and/or observation using a validated floater-specific PROM; (2) development and validation of a patient-derived, comprehensive PROM for vitreous floaters; (3) establishment of objective referral thresholds based on CSF and QUS metrics; and (4) long-term registry studies to characterize cataract risk, recurrence patterns, and QoL durability. Clinical adoption of small-gauge limited vitrectomy in appropriately selected patients with vision-degrading myodesopsia is supported by the current evidence base and should no longer be withheld on the basis of outdated safety concerns.

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