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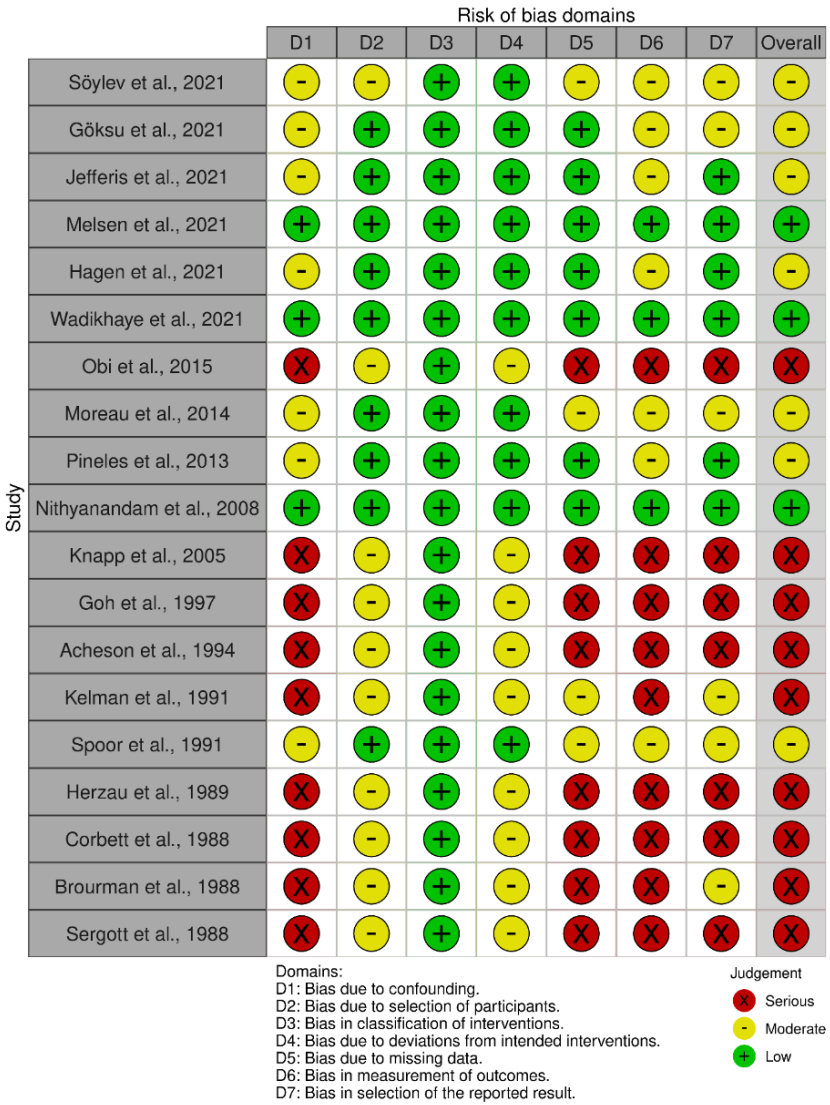

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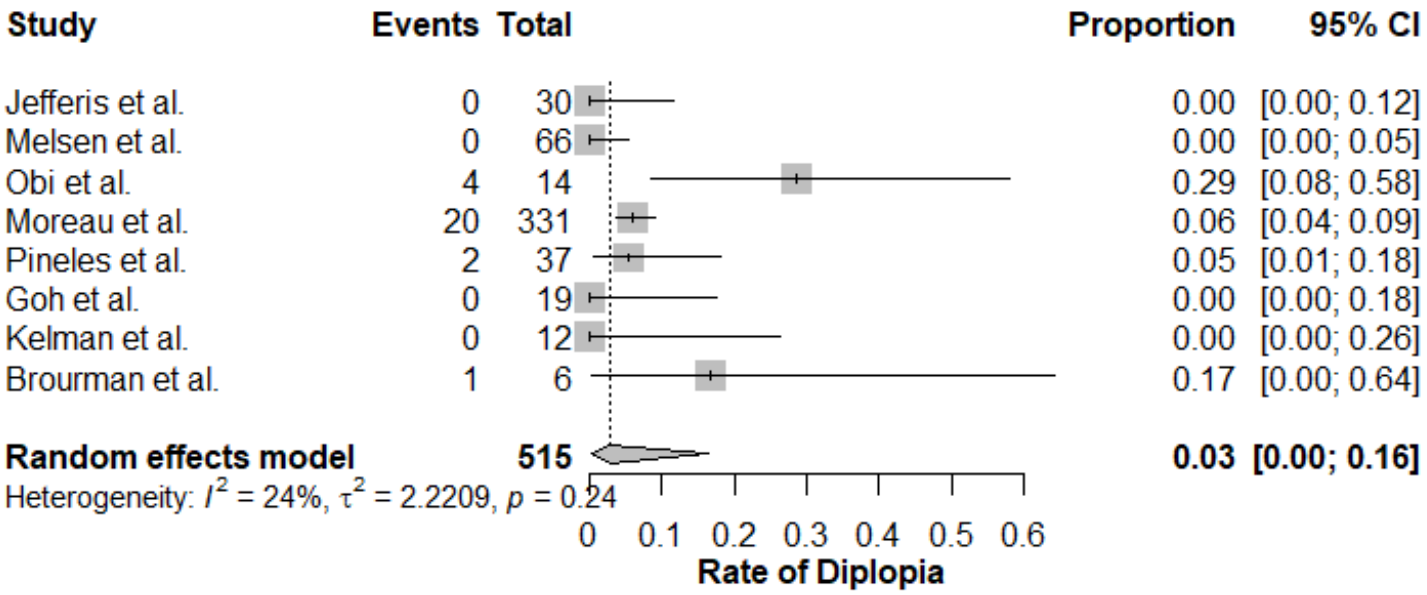

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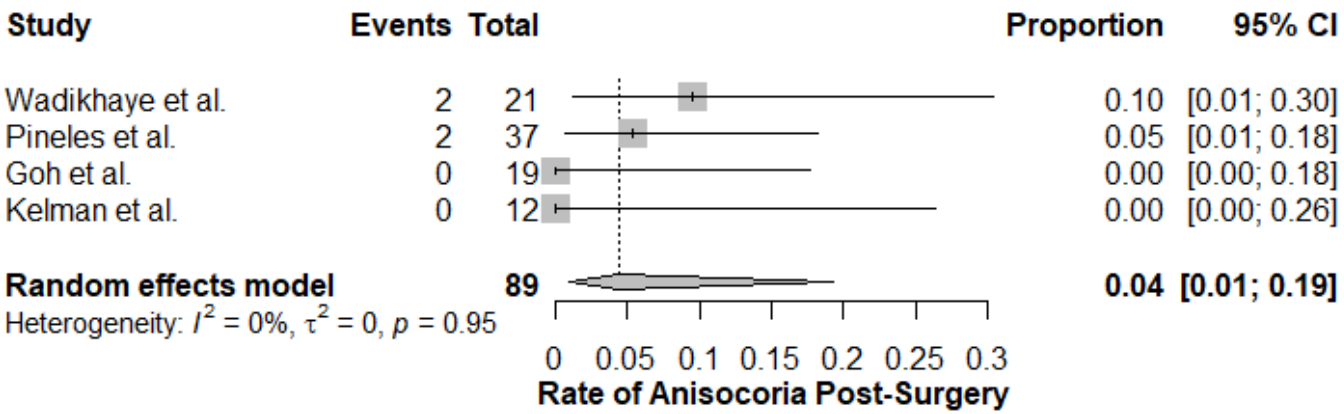

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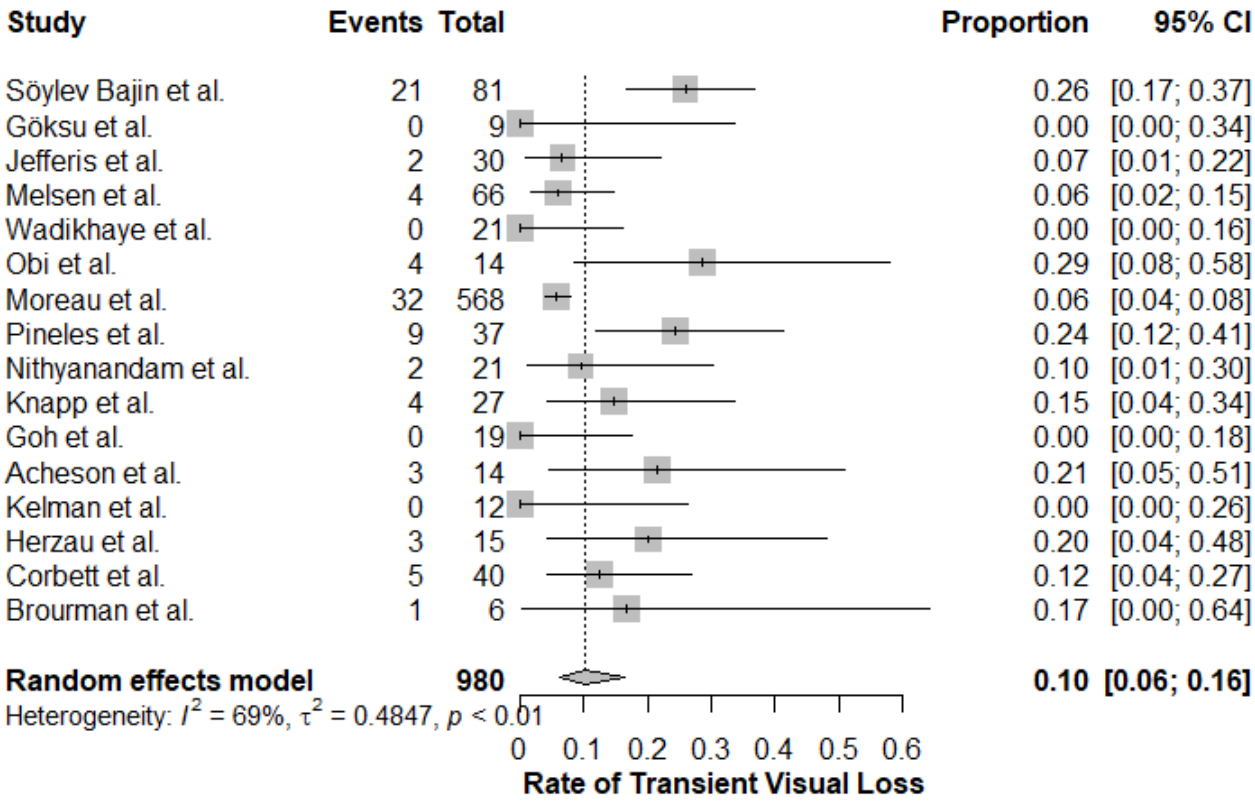

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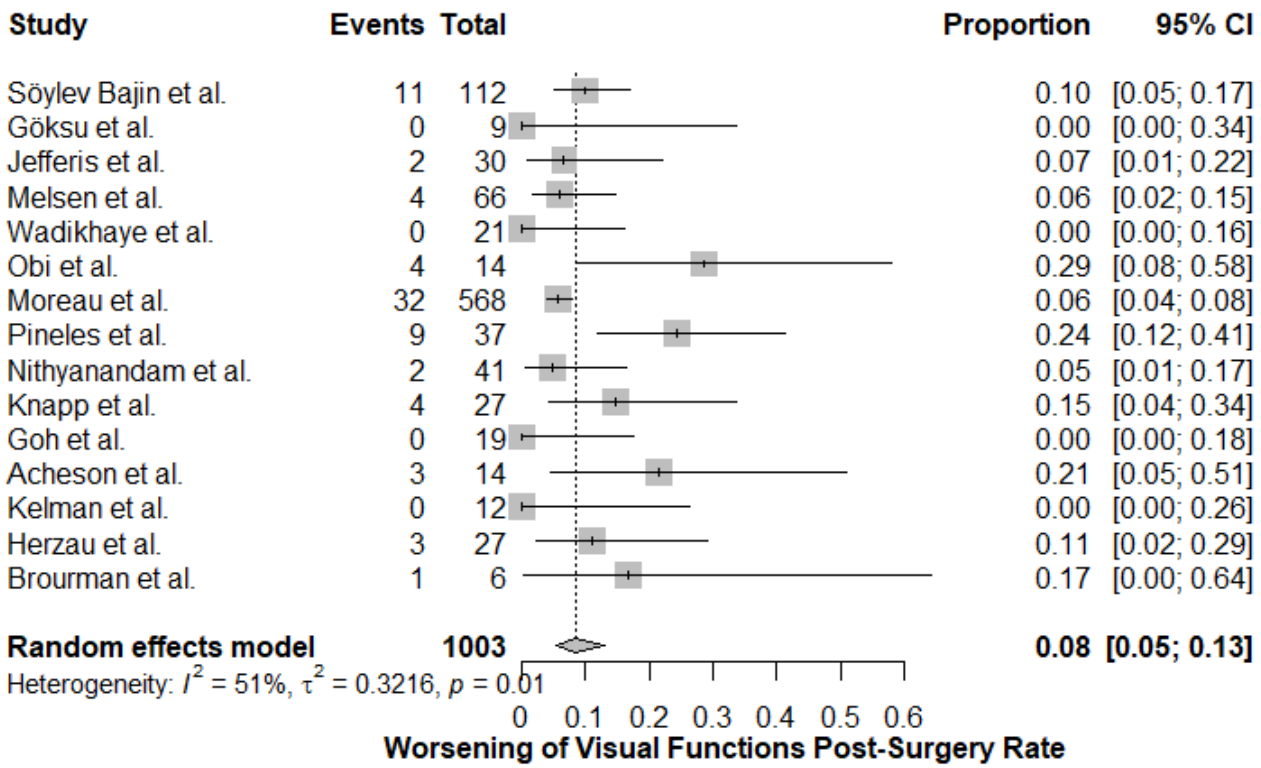

Tables Legend:

Supplementary Table 1: Baseline Characteristics of The Included Studies.

Study	Publication Year	Country of Study	Study Type	Study Design	Surgical Approach	Number of Patients	Instrumentation	Muscle Disinsertion	Mean Age (Years), SD	Mean BMI, SD	Mean LP CSF Opening Pressure (mm H2O), SD	Previous Surgical Interventions, Percentage	ONSF Approach	Mean Time to Surgery (Weeks), SD	Dominant Approach	Unilateral, Percentage	Bilateral, Percentage
Söylev Bajin et al. [26]	2021	Turkey	Observational	Retrospective cohort study	Medial transconjunctival	56	Non-specified	Yes	32.8 (8.7) F, 44.5 (8.6) M	N/A	400 (162)	N/A	Both	10.42, 16	No dominant approach	55%	45%
Göksu et al. [27]	2021	Turkey	Interventional	Retrospective case series	Transnasal endoscopic	9	Endoscope	No	40.8 (N/A)	N/A	N/A	11.10%	Bilateral	N/A	Bilateral	0%	100%
Jefferis et al. [28]	2021	UK	Observational	Retrospective analysis	Supero-medial eyelid skin crease approach	30	Microscope	No	30.4 (9.6)	39.6 (7.9)	N/A	10%	Bilateral	N/A	Bilateral	10%	83.30%
Melson et al. [29]	2021	USA	Interventional	Retrospective case series	Medial transconjunctival	66	Microscope	No	30 (N/A)	36 (N/A)	380 (N/A)	N/A	Bilateral	16, N/A	Bilateral	0%	100%
Hagen et al. [30]	2021	Denmark	Observational	Retrospective chart review	Superonasal transconjunctival	10	Microscope	No	28.7 (11.4)	34.4 (4.8)	503 (120)	0%	Unilateral	1.3, N/A	Unilateral	100%	0%
Wadhkhaye et al. [31]	2021	India	Interventional	Prospective cohort study	Fronto-temporo-sphenoidotomy	21	Microscope	No	27.47 (N/A)	26.80 (N/A)	389 (N/A)	19.04%	Unilateral	N/A	Unilateral	100%	0%
Obi et al. [32]	2015	UK	Observational	Retrospective cohort study	Medial transconjunctival	14	Non-specified	Yes	N/A	N/A	N/A	N/A	Both	N/A	N/A	N/A	N/A
Moreau et al. [33]	2014	USA	Observational	Retrospective review	Medial transconjunctival	236	Non-specified	Yes	N/A	N/A	N/A	N/A	Medial transconjunctival	N/A	N/A	N/A	N/A
Pineles et al. [34]	2013	USA	Observational	Retrospective record review	Non-specified	37	Non-specified	N/A	33 (11)	N/A	>250 (N/A)	0%	Both	36, 54	Unilateral	64.90%	35.10%
Nithyanandam et al. [35]	2008	India	Interventional	Prospective noncomparative	Medial transconjunctival	5	Microscope	Yes	29.5 (8.2)	N/A	>250 (N/A)	N/A	Bilateral	N/A	Bilateral	40%	60%
Knapp et al. [36]	2005	UK	Observational	Retrospective case series	Medial transconjunctival	13	Non-specified	Yes	26.5 (N/A)	N/A	N/A	7.70%	Both	N/A	N/A	N/A	N/A
Goh et al. [37]	1997	Singapore/ USA	Observational	Retrospective case series	Medial and lateral orbitotomies	19	Non-specified	N/A	33.1 (N/A)	N/A	N/A	N/A	Both	N/A	Bilateral	47.40%	52.60%
Acheson et al. [38]	1994	UK	Observational	Retrospective review	Medial transconjunctival	11	Microscope	Yes	37 (N/A)	N/A	>250 (N/A)	28.60%	Both	N/A	No dominant approach	57.10%	42.90%
Kelman et al. [39]	1993	USA	Observational	Retrospective case series	Posterolateral transconjunctival	12	Microscope	Yes	N/A	N/A	>240 (N/A)	26.10%	N/A	Initially unilateral	N/A	Unilateral	71.40%
Spoor et al. [40]	1991	USA	Observational	Retrospective review	Medial transconjunctival	53	Microscope	Yes	32.5 (N/A)	N/A	N/A	N/A	Transconjunctival medial	N/A	N/A	N/A	N/A
Herzau et al. [41]	1989	Germany	Observational	Retrospective case analysis	Non-specified	15	Non-specified	N/A	34 (N/A)	N/A	N/A	N/A	Both	N/A	Bilateral	20%	80%

Corbett et al. [42]	1988	USA	Observational	Retrospective case series	Lateral or combined lateral and medial orbitotomy	28	Non-specified	N/A	29.5 (N/A)	N/A	>250 (N/A)	3.60%	Both	N/A	N/A	N/A	N/A
Brourman et al. [43]	1988	USA	Observational	Retrospective case series	Medial transconjunctival	6	Non-specified	Yes	N/A	N/A	>300 (N/A)	16.70%	Both	N/A	No dominant approach	50%	50%
Sergott et al. [44]	1988	USA	Observational	Retrospective case series	Posterior transconjunctival	23	Microscope	Yes	38.1 (N/A)	N/A	>240 (N/A)	26.10%	Initially unilateral	N/A	Unilateral	71.40%	28.60%

SD: Standard Deviation; F: Female; M: Male; BMI: Body Mass Index; LP: Lumbar Puncture; CSF: Cerebrospinal Fluid; ONSF: Optic Nerve Sheath Fenestration; N/A: Not Available or Not Applicable; US: United States; UK: United Kingdom; mm H_2O: millimeters of water.

Supplementary Table 2: GRADE Framework Assessment of ONSF Outcomes.

Outcome	Study Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Other Considerations	Quality of Evidence
Visual Acuity Improvement (19 studies, n=1160)	Mostly observational studies (16/19)	Serious (-1) • Lack of standardized VA measurement • Retrospective design in most studies	Serious (-1) • High heterogeneity (I^2>50%) • Variable effect sizes across studies	Not serious	Not serious • Large sample size • Narrow confidence intervals	Not suspected	• Strong effect in prospective studies • Dose-response gradient observed	LOW ⊕⊕○○
Visual Field Improvement (16 studies, n=719)	Mostly observational studies (14/16)	Serious (-1) • Varied VF testing methods • Mostly retrospective studies	Not serious • Consistent improvement across studies • Moderate heterogeneity	Not serious	Not serious • Adequate sample size • Precise estimates	Not suspected	• Consistent effect across subgroups • Large magnitude of effect	MODERATE ⊕⊕⊕○
Optic Disc Resolution (11 studies, n=351)	Mixed design (8 observational, 3 interventional)	Serious (-1) • Variable follow-up periods • Subjective assessment in some studies	Not serious • Consistent resolution rates • Low heterogeneity	Not serious	Not serious • High event rates • Narrow confidence intervals	Not suspected	• Very large effect size • Consistent across approaches	MODERATE ⊕⊕⊕○

GRADE Assessment Criteria:
• Risk of Bias: Limitations in study design or execution
• Inconsistency: Unexplained heterogeneity in results
• Indirectness: Differences in population, intervention, or outcomes
• Imprecision: Wide confidence intervals or small sample size
• Publication Bias: Systematic under/over-estimation of effect

Quality of Evidence Ratings:
• HIGH (⊕⊕⊕⊕): Further research very unlikely to change confidence in effect estimate
• MODERATE (⊕⊕⊕○): Further research likely to impact confidence in effect estimate
• LOW (⊕⊕○○): Further research very likely to impact confidence in effect estimate
• VERY LOW (⊕○○○): Very uncertain about the effect estimate

Notes:
1. -1 indicates downgrade by one level for that criterion
2. VA = Visual Acuity; VF = Visual Field
3. Sample sizes (n) represent total patients across all studies for each outcome

Abbreviations:

GRADE= Grading of Recommendations, Assessment, Development and Evaluations; ONSF= Optic Nerve Sheath Fenestration.

Supplementary Table 3: Subgroup Analysis of ONSF Complications.

Complication Type	Subgroup Category	Subgroup	Events/Total	Proportion (95% CI)	P-value
Overall Complications	Country	Non-US	29/208	0.139 (0.099-0.193)	**0.007***
		US	41/556	0.074 (0.055-0.099)	
	Study Type	Observational	64/647	0.099 (0.078-0.124)	0.117
		Interventional	6/117	0.051 (0.024-0.107)	
	Study Design	Retrospective	64/722	0.089 (0.070-0.112)	0.264
		Prospective	6/42	0.143 (0.067-0.278)	
	Surgical Approach	Medial Transconjunctival	43/560	0.077 (0.058-0.102)	**0.023***
		Other	27/204	0.132 (0.093-0.186)	
	Sample Size	>30	36/543	0.066 (0.048-0.090)	**<0.001***
		<30	29/191	0.152 (0.108-0.210)	
		=30	5/30	0.167 (0.073-0.336)	
	Muscle Disinsertion	Yes	45/529	0.085 (0.064-0.112)	0.344
		No	25/235	0.106 (0.073-0.152)	
	Dominant Approach	Bilateral	12/160	0.075 (0.043-0.127)	0.273
		Unilateral	11/91	0.121 (0.069-0.204)	
Diplopia	Country	Non-US	4/63	0.063 (0.025-0.152)	0.559
		US	23/452	0.051 (0.034-0.075)	
	Study Type	Observational	27/449	0.060 (0.042-0.086)	**0.036***
		Interventional	0/66	0.000 (0.000-0.055)	
	Surgical Approach	Medial Transconjunctival	25/417	0.060 (0.041-0.087)	0.135
		Other	2/98	0.020 (0.006-0.071)	
	Sample Size	>30	22/434	0.051 (0.034-0.076)	0.148
		<30	5/51	0.098 (0.043-0.210)	
		=30	0/30	0.000 (0.000-0.114)	
	Muscle Disinsertion	Yes	25/363	0.069 (0.047-0.100)	**0.008***
		No	2/152	0.013 (0.004-0.047)	
Transient Visual Loss	Country	Non-US	39/251	0.155 (0.116-0.205)	**<0.001***
		US	51/729	0.070 (0.054-0.091)	
	Study Type	Observational	84/863	0.097 (0.079-0.119)	0.124
		Interventional	6/117	0.051 (0.024-0.107)	
	Study Design	Retrospective	88/938	0.094 (0.077-0.114)	0.420
		Prospective	2/42	0.048 (0.013-0.158)	
	Surgical Approach	Medial Transconjunctival	71/797	0.089 (0.071-0.111)	0.570
		Other	19/183	0.104 (0.067-0.156)	
	Sample Size	>30	66/752	0.088 (0.070-0.110)	0.533
		<30	22/198	0.111 (0.075-0.162)	
		=30	2/30	0.067 (0.018-0.213)	
	Muscle Disinsertion	Yes	67/743	0.090 (0.072-0.113)	0.796
		No	23/237	0.097 (0.066-0.141)	
	Dominant Approach	Bilateral	11/160	0.069 (0.039-0.119)	**<0.001***
		Unilateral	9/58	0.155 (0.084-0.269)	
Worsening of Visual Functions	Country	Non-US	29/314	0.092 (0.065-0.129)	0.156
		US	46/689	0.067 (0.050-0.088)	
	Study Type	Observational	69/866	0.080 (0.063-0.100)	0.163
		Interventional	6/137	0.044 (0.020-0.092)	
	Study Design	Retrospective	73/941	0.078 (0.062-0.096)	0.313
		Prospective	2/62	0.032 (0.009-0.110)	
	Surgical Approach	Medial Transconjunctival	61/848	0.072 (0.056-0.091)	0.408
		Other	14/155	0.090 (0.055-0.146)	
	Sample Size	>30	56/783	0.072 (0.055-0.092)	0.690
		<30	17/190	0.089 (0.057-0.139)	

		=30	2/30	0.067 (0.018-0.213)	
	Muscle Disinsertion	Yes	57/794	0.072 (0.056-0.092)	0.463
		No	18/209	0.086 (0.055-0.132)	
	Dominant Approach	Bilateral	11/192	0.057 (0.032-0.100)	**0.018***
		Unilateral	9/58	0.155 (0.084-0.269)	
Anisocoria	Country	Non-US	2/40	0.050 (0.014-0.165)	0.999
		US	2/49	0.041 (0.011-0.137)	
	Study Type	Observational	2/68	0.029 (0.008-0.101)	0.235
		Interventional	2/21	0.095 (0.027-0.289)	
	Study Design	Retrospective	2/68	0.029 (0.008-0.101)	0.235
		Prospective	2/21	0.095 (0.027-0.289)	
	Sample Size	>30	2/37	0.054 (0.015-0.177)	0.999
		<30	2/52	0.038 (0.011-0.130)	
	Muscle Disinsertion	Yes	0/12	0.000 (0.000-0.242)	1.000
		No	4/77	0.052 (0.020-0.126)	
	Dominant Approach	Bilateral	0/19	0.000 (0.000-0.168)	0.327
		Unilateral	4/58	0.069 (0.027-0.164)	

Note: *ONSF= Optic Nerve Sheath Fenestration; CI = Confidence Interval; NA = Not Available; P-values represent comparison between subgroups within each category; US= United States; * Denotes Statistical Significance.*

Supplementary Table 4: Publication Bias Assessment of Outcomes.

Outcome	Number of Studies	Egger's Test (p-value)	Funnel Plot Asymmetry	Trim-and-Fill (Missing Studies)	Adjusted Effect Size (95% CI)	Risk of Publication Bias
Visual Acuity Improvement	19	0.034	Present (Right-skewed)	4	0.312 (0.284-0.341) [Original: 0.345 (0.318-0.373)]	Suspected (Moderate)
Visual Field Improvement	16	0.245	Symmetric	2	0.682 (0.645-0.718) [Original: 0.694 (0.659-0.727)]	Low
Optic Disc Resolution	11	0.789	Symmetric	0	0.909 (0.874-0.935) [No adjustment needed]	Low

Notes:

1. Egger's test p-value < 0.05 indicates statistically significant publication bias.
2. Funnel plot asymmetry assessment based on visual inspection and statistical testing.
3. Trim-and-fill method estimates the number of missing studies and adjusts the effect size accordingly.
4. Risk of publication bias categorization:
   - ***Low:*** No evidence of asymmetry, non-significant Egger's test.
   - ***Moderate:*** Some evidence of asymmetry or significant Egger's test.
   - ***High:*** Strong evidence of asymmetry with significant impact on effect size.

Methods:

- Egger's regression test performed using standard methods.
- Funnel plot asymmetry assessed using both visual inspection and statistical methods.
- Trim-and-fill analysis conducted using random-effects model.
- Adjusted effect sizes calculated simulated effect of missing studies.
- Risk of publication bias assessed using multiple criteria including statistical tests and visual assessment.

Statistical Analysis:

- Significance level set at $p < 0.05$ for Egger's test.
- Random-effects model used for all analyses.