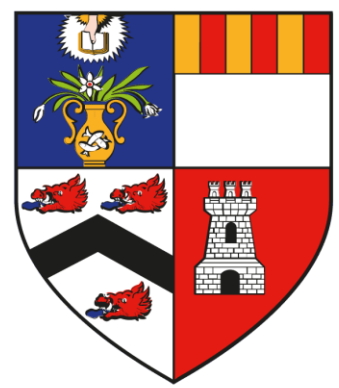




Non-speculum intravitreal injection methods versus conventional speculum-based techniques: a systematic review and meta-analysis of manual and device-assisted approaches

Abdulwahab Alomar¹, Ahmad Dhiaaaldeen¹, Fatemah Almuhanna¹, Fatimah Alkhaleedi¹, Lulwa Almulla¹, Dhari Alhulaibi¹, Rehab Ismail^{1,2}

¹University of Aberdeen, School of Medicine, Aberdeen, Scotland 2- Aberdeen Royal Infirmary, Aberdeen, Scotland



TAKE-HOME MESSAGE: While non-speculum and device-assisted IVI techniques show promise in reducing patient discomfort, the current evidence base is highly heterogeneous and exploratory; definitive conclusions regarding procedural superiority or safety cannot yet be drawn.

Introduction

- Intravitreal injections (IVIs) are rapidly increasing, with UK projections suggesting 83,000 injections annually by 2029.
- The eyelid speculum is frequently cited as the most uncomfortable step of the procedure, which can negatively affect patient adherence and clinical workflow.
- Aim:** To evaluate the safety, tolerability, and efficiency of non-speculum IVI methods (manual retraction and device-assisted) versus conventional speculums.

Methods

- Design:** Systematic review and meta-analysis comparing non-speculum techniques (manual and device-assisted) to conventional speculums.
- Total study screened:** 265 records
- Included:** 11 studies (7 RCTs, 4 observational cohorts) comprising 713 adult patients.
- Outcomes:** Primary outcomes were patient-reported pain (VAS) and procedure-related safety.

Results (primary Outcomes)

Intervention (vs. Speculum)	Patient Pain Reduction (SMD)	Safety & Complication Profile (RR)
Manual Retraction	Figure A; Significant Reduction (SMD −0.78; p < 0.0005)	Comparable to Speculum (RR 1.82; p = 0.29)
Device-Assisted	Figure B : Favorable but Non-Significant (SMD −0.26; p = 0.39)	Significantly Reduced Hemorrhage (RR 0.51; p = 0.005) & faster procedure times

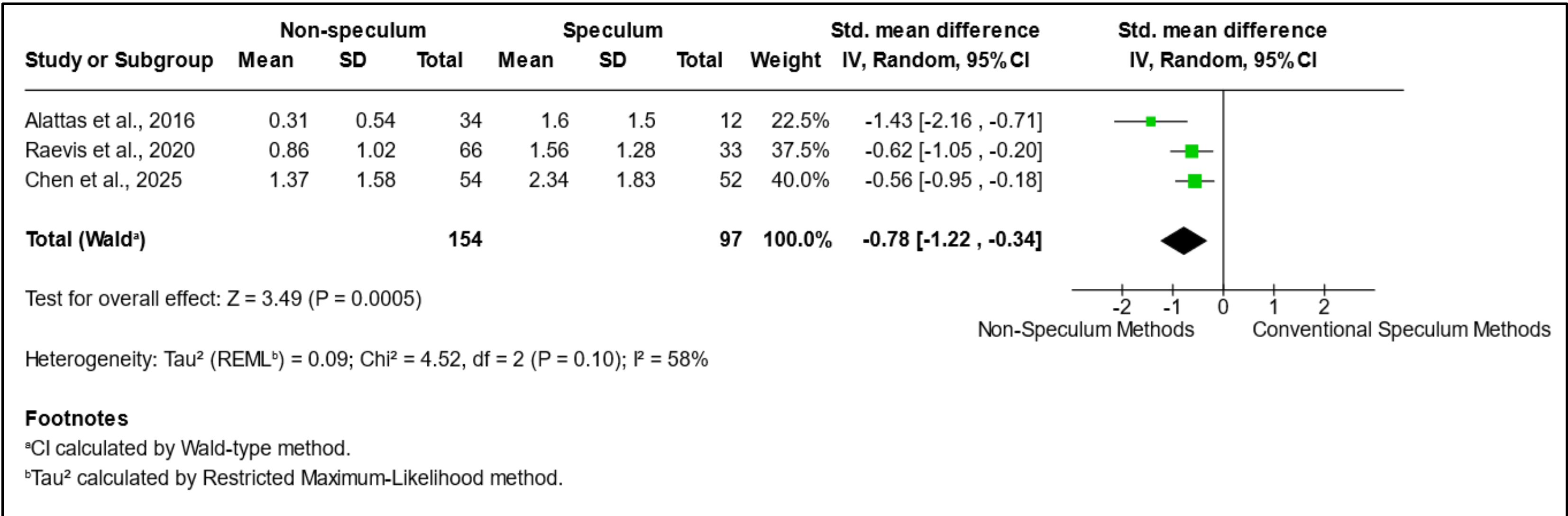


Figure A: Pain outcomes comparing the manual non-speculum technique with the conventional speculum method.

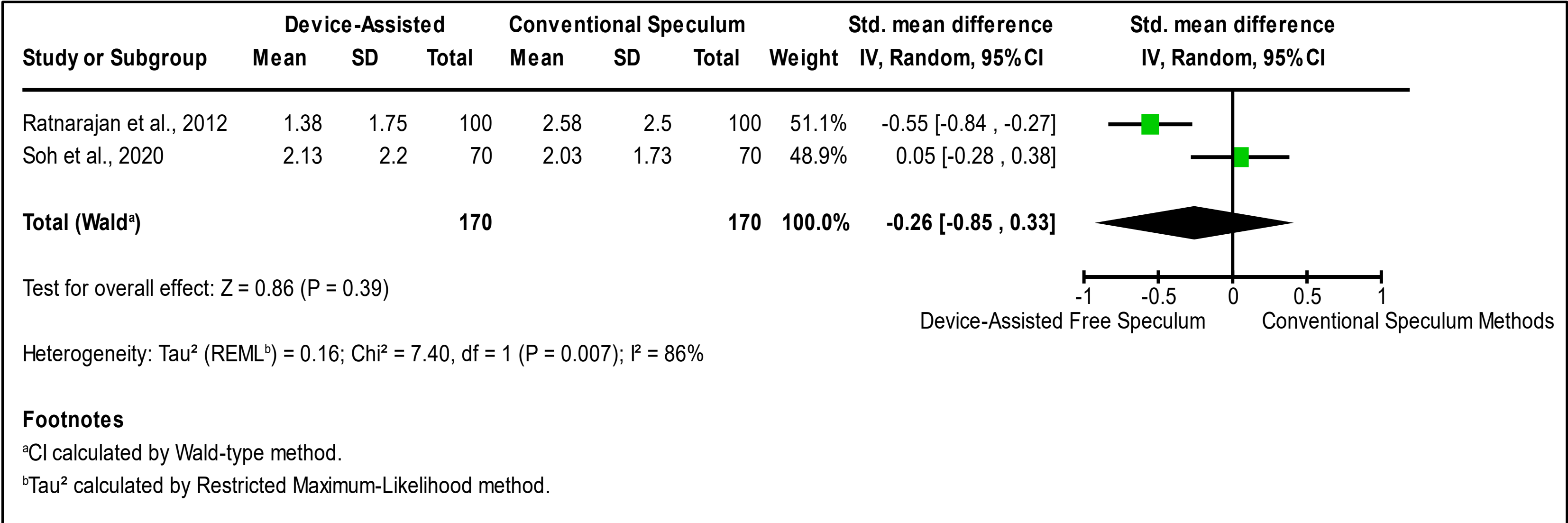


Figure B: Pain outcomes comparing the device-assisted non-speculum technique with the conventional speculum method.

Limitations

- Risk of Bias:** Included non-randomised studies carry serious confounding risks, and subjective pain outcomes lacked blinding.
- Statistical Power:** Small pooled sample sizes increase the risk of Type II errors and restrict meaningful sensitivity analyses.
- Incomplete Safety Data:** Variable, short follow-ups risk the under-ascertainment of delayed or rare complications (e.g., endophthalmitis, lens touch).

CLINICAL DECISION FRAMEWORK

- First-Time or Anxious Patients:** Favor manual lid retraction to minimize tissue strain, maximize comfort, and reduce procedural anxiety.
- High-Volume Clinics / Repeated IVIs:** Consider device-assisted techniques to standardize the procedure, significantly reduce hemorrhage, and improve time efficiency.
- RCOphth Guideline Adherence:** Regardless of the technique chosen, all methods must strictly adhere to core Royal College of Ophthalmologists principles: rigorous asepsis, effective eyelid control, and clear visualization of the injection site.

Conclusion

Caution is warranted given the exploratory evidence, yet non-speculum techniques offer a safe, patient-preferred alternative to conventional methods. Manual retraction consistently minimizes patient discomfort, while device-assisted methods significantly reduce subconjunctival hemorrhage and streamline workflows in high-volume clinics.

References

- Raevis J, Karl M, Parendo A, et al. Eyelid retraction discomfort with cotton-tipped applicator, unimanual and speculum intravitreal injection techniques: Eyelid retraction technique randomized comparison trial (Eyelid RETRACT). Indian J Ophthalmol. 2020;68(8):1593. doi:10.4103/ijo.IJO_2043_19
- Chen HRQ, de Andrade GC, Arimori LK, Lerner FK. Comparison of intravitreal injection techniques with and without a speculum using eyelid retraction with a cotton-tipped applicator. Int J Retina Vitreous. 2025;11(1):119. doi:10.1186/s40942-025-00739-5
- Alattas K. Patients' tolerance of bimanual lid retraction versus a metal speculum for intravitreal injections. Clinical Ophthalmology. 2016;Volume 10:1719-1721. doi:10.2147/OPTH.S113326
- SIZMAZ S, FILIZ K, EBRU E, NIHAL D. Ocular surface bacterial load in intravitreal injections: lid speculum vs. manually assisted retraction. Journal of Retina-Vitreous. 2020;29(2):123. doi:10.37845/ret.vit.2020.29.22
- Rahimy E, Fineman MS, Regillo CD, et al. Speculum versus Bimanual Lid Retraction during Intravitreal Injection. Ophthalmology. 2015;122(8):1729-1730. doi:10.1016/j.ophtha.2015.02.001
- Uy H, Artiaga JCM. Comparison of Two Different Intravitreal Injection Techniques. Clinical Ophthalmology. 2021;Volume 15:2383-2389. doi:10.2147/OPTH.S309501
- Wasser LM, Roditi E, Weiss AR, et al. Anxiety and pain perception using a speculum-free eyelid retraction technique for intravitreal injection. Graefes's Archive for Clinical and Experimental Ophthalmology. 2022;260(6):2023-2028. doi:10.1007/s00417-021-05422-7
- Blyth M, Innes W, Mohsin-Shaikh N, Talks J. A Comparison of Conventional Intravitreal Injection Method vs InVitra Intravitreal Injection Method. Clinical Ophthalmology. 2020;Volume 14:2507-2513. doi:10.2147/OPTH.S238529
- Waqar S, Ayaz A, Karamat I, Anwar S, McLeod J, McLeod A. A novel device for rapid, safe and precise delivery of intravitreal injections. BMJ Innov. 2019;5(1):8-12. doi:10.1136/bmjinnov-2018-000337
- Soh YQ, Chiam NPY, Tsai ASH, et al. Intravitreal Injection with a Conjunctival Injection Device: A Single-Center Experience. Transl Vis Sci Technol. 2020;9(8):28. doi:10.1167/tvst.9.8.28
- Ratnarajan G, Nath R, Appaswamy S, Watson SL. Intravitreal injections using a novel conjunctival mould: a comparison with a conventional technique. British Journal of Ophthalmology. 2013;97(4):395-397. doi:10.1136/bjophthalmol-2012-302155