

Commentary: Implantable collagen devices in optimizing filtering success - The holy grail?

Notwithstanding the many advances in glaucoma filtering surgery, including minimally invasive glaucoma surgery and nonpenetrating deep sclerectomy, trabeculectomy continues to be the gold standard surgical procedure in containing progressive visual loss in glaucoma.^[1] The success of this filtering procedure depends on constant shunting of aqueous humor from the anterior chamber to the subconjunctival space through the creation of a surgical fistula, and excessive subconjunctival scarring is the predominant cause of failure of trabeculectomy to consistently achieve low eye pressures. Intraoperative use of antimetabolites like Mitomycin^[2] have largely addressed the issue of excessive subconjunctival scarring, significantly increasing the likelihood of long-term success of filtering surgery. The widespread use of antimetabolites in glaucoma filtering surgery has nevertheless resulted in sight-threatening complications,^[3] including prolonged wound leaks, hypotony, and maculopathy, bleb-related complications including bleb leaks, blebitis, and endophthalmitis. Considering that trabeculectomy is a filtering surgery that can address the varied mechanisms contributing to elevated IOP and progressive visual field loss across the spectrum of different types of glaucoma, it is crucial to optimize its outcomes. A continued area of focus in glaucoma filtering surgery is the evolution of newer modalities and devices to improve long-term success and lower the rate of serious complications. In concomitant glaucoma surgery with cataract surgery and intraocular lens implantation, the likelihood of long-term surgical success is further diminished owing to increased intraoperative manipulation and inflammation.

In a study comparing the bleb morphology by anterior segment optical coherence tomography and clinical outcomes after phacotrabeculectomy with mitomycin C or Ologen implant, Chelerkar *et al.*^[4] have studied the evolution of the morphology of the filtering bleb by ASOCT and compared the clinical outcomes in eyes undergoing phacotrabeculectomy with either MMC or collagen matrix implant and followed up for 1 year. They need to be commended for the useful and

additional information they have been able to collate on the role of adjunctive *Mitomycin and implantable collagen* in combined cataract and glaucoma filtering surgery. The authors observed that bleb morphology, mean IOP, and medications at 1 year were comparable in the two groups. This is largely in agreement with the earlier studies^[5-8] comparing collagen matrix and Mitomycin in phacotrabeculectomy published in other populations. In a prospective randomized control trial of phacotrabeculectomy using Collagen matrix or Mitomycin, Wlaz *et al.*^[7] had observed that the former provides similar surgical outcomes compared with Mitomycin and concluded it to be safe and effective alternative to Mitomycin for combined phacotrabeculectomy surgery. These results were in predominantly Caucasian eyes and may not necessarily be applicable across all ethnic groups. In a study by Narayanaswamy *et al.*,^[6] the overall performance of Collagen matrix in combined phacotrabeculectomy was suboptimal compared with combined surgery with mitomycin C. Eyes in the Ologen group required more frequent bleb needling procedures. There was similar frequency (<10%) of adverse events in both groups, and there were no complications directly related to the collagen implant. Although in the study by Chelerkar *et al.*^[4] the mean postoperative IOP and medications at end point were comparable between the two groups, the proportion with surgical failure was significantly higher in the Collagen matrix group. Surgical failure in the Collagen matrix group (10%) was more than 5 times as in the Mitomycin group (1.8%). It is possible that ethnic differences between the populations studied could contribute to the differences in surgical outcomes following Collagen matrix and Mitomycin as adjunctive to glaucoma filtering surgery.

Major concerns with Mitomycin-augmented trabeculectomies have been ocular hypotony, hypotony-related maculopathy, thin cystic blebs, bleb leaks, and bleb-related endophthalmitis, in particular, in eyes with high myopia, low scleral rigidity, connective tissue disorders and in young individuals with Juvenile open-angle glaucoma. Much of the search for alternative modalities of wound modulation and innovations in glaucoma surgery in the past 2–3 decades have been to optimize IOP control while eliminating complications due to overfiltration arising out of excessive inhibition of fibroblastic response to wound healing following glaucoma surgery. Whereas Collagen matrix has been observed to cause comparable IOP control

with reduction in hypotony-related adverse effects in a Caucasian population, similar efficacy has not been seen in Asian and Indian eyes, although long-term hypotony in general has been significantly lesser in eyes which have had adjunctive collagen implants as opposed to those treated with Mitomycin.^[4,6-8] In lesser developed economies such as India and elsewhere, it is crucial to balance cost effectiveness with benefits from interventions to lower IOP and prevent progressive glaucoma. Collagen implants used in glaucoma filtering surgery are expensive and may not be as effective as Mitomycin^[5] in preventing subconjunctival bleb fibrosis and prolong bleb function to achieve lower-target pressures. Histopathology of Collagen implants studied in human eyes with failed trabeculectomies reveal presence of fibroblasts, myofibroblasts, and fibronectin within the implant and enclosure of the implants by collagenous pseudocapsule,^[9] contributing to increased resistance to aqueous flow.

Currently available evidence do not support routine use of collagen matrix implants to improve outcomes of phacotrabeculectomy. Data available from Asian and Indian eyes undergoing phacotrabeculectomy seem to suggest the current standard of care of using intraoperative Mitomycin to improve long-term surgical outcomes. Collagen matrix implants may, however, be preferred in eyes at risk of hypotony or maculopathy and thin avascular blebs at risk of sight-threatening complications like endophthalmitis, as in young myopic eyes with Juvenile glaucoma, where potent antimetabolites like Mitomycin are contraindicated.

R Krishnadas

Glaucoma Services, Aravind Eye Care System, Madurai,
Tamil Nadu, India

Correspondence to: Dr. R. Krishnadas,
Glaucoma Services, Aravind Eye Care System,
Anna Nagar, Madurai - 625 020, India.
E-mail Krishnadas@aravind.org

References

1. Razeghinejad MR, Fudenberg SJ, Spaeth GL. The changing conceptual basis of trabeculectomy: A review of past and current surgical techniques. *Surv Ophthalmol* 2012;57:1-25.
2. Yoon PS, Singh K. Update on antifibrotic use in glaucoma surgery, including use in trabeculectomy and glaucoma drainage implants and combined cataract and glaucoma surgery. *Curr Opin Ophthalmol* 2004;15:141-6.
3. Razeghinejad MR, Havens SJ, Katz LJ. Trabeculectomy bleb-associated infections. *Surv Ophthalmol* 2017;62:591-610.
4. Chelerkar VJ, Agrawal D, Kalyani VK, Deshpande M. Comparison of bleb morphology by anterior segment optical coherence tomography and clinical outcome after phacotrabeculectomy with mitomycin C or Ologen implant. *Indian J Ophthalmol* 2021;69:2734-9.
5. Boey P-Y, Narayanaswamy A, Zheng C, Perera SA, Htoon HM, Tun TA, *et al.* Imaging of blebs after phacotrabeculectomy with ologen collagen matrix implants. *Br J Ophthalmol* 2011;95:340-4.
6. Narayanaswamy A, Perera SA, Htoon HM, Hoh ST, Seah SK, Wong TT, *et al.* Efficacy and safety of collagen matrix implants in phacotrabeculectomy and comparison with mitomycin C augmented phacotrabeculectomy at 1 year. *Clin Exp Ophthalmol* 2013;41:552-60.
7. Wlaź A, Wilkos-Kuc A, Rozegnał-Madej A, Żarnowski T. Phacotrabeculectomy using collagen matrix implant (Ologen) versus mitomycin C: A prospective randomized controlled trial. *Acta Ophthalmol* 2019;97:e817-26.
8. Tanna AP, Rademaker AW, de Moraes CG, Godfrey DG, Sarkisian SR Jr, Vold SD, *et al.* Collagen matrix vs mitomycin-C in trabeculectomy and combined phacoemulsification and trabeculectomy: A randomized controlled trial. *BMC Ophthalmol* 2016;16:217.
9. Rosentreter A, Gaki S, Cursiefen C, Dietlein TS. Trabeculectomy using mitomycin C versus an atelocollagen implant: Clinical results of a randomized trial and histopathologic findings. *Ophthalmologica* 2014;231:133-40.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Access this article online	
Quick Response Code:	Website: www.ijo.in
	DOI: 10.4103/ijo.IJO_1304_21

Cite this article as: Krishnadas R. Commentary: Implantable collagen devices in optimizing filtering success - The holy grail? *Indian J Ophthalmol* 2021;69:2739-40.