

## Short Communication

# Recent Advances in Minimally Invasive Glaucoma Surgery

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## Abstract

Traditional surgical methods in adults with open-angle glaucomas in which medical and or laser therapy fail include trabeculectomy with adjunctive anti-fibrotics or aqueous shunts. In pediatric cases, goniotomy, trabeculotomy or shunts are employed. While often effective methods to transiently control intraocular pressures, all these surgeries are relatively destructive to ocular anatomy and fraught with complications including rapid failure, conjunctival scarring, and especially wound leaks in adults receiving adjunctive anti-fibrotics during or after trabeculectomy, of great concern due to risk of late infection. New and evolving methods of minimally invasive glaucoma surgery (MIGS) are likely to greatly simplify glaucoma surgery with equivalent or satisfactory intraocular pressure (IOP) control and far fewer complications. The so-far FDA approved procedures include Trabectome (NeoMedix 2004), and iStent (Glaukos Corporation 2012). Other devices under development include the AquaSys Implant (Allergan) and the CyPass MicroStent (Transcend Medical).

## INTRODUCTION

The Trabectome instrument has been available the longest among the MIGS group and has been reported in numerous peer reviewed publications regarding its surgical outcomes [1-6]. Both Trabectome and iStent are trans-trabecular in concept, providing a short circuit through the site of main resistance to aqueous outflow, the juxtacanalicular connective tissue. The Trabectome procedure ablates the inner wall of Schlemm's canal allowing eye fluid (aqueous) direct access to the collector channels that return it to peripheral blood on the eye's surface.

These surgeries are remarkably free of complications and the long-term IOP control has been satisfactory although seldom providing IOPs as low as traditional trabeculectomy in adults. The need for extremely low IOPs in advanced glaucoma with the attendant risk of hypotony and its complications remains unproven, with the possible exception of low tension glaucoma. Trabectome and iStent have generally resulted in mid-teen IOPs, likely to greatly decelerate or stop ongoing optic nerve damage. These procedures have contraindications including extensive angle closure, especially that associated with diabetes and iris neovascularization or obscured visualization due to corneal disease.

## RESULTS/DISCUSSION

Mosaed<sup>3</sup> has summarized results in a meta-analysis of all national and international literature on Trabectome with 90 months follow-up published between 2005 and 2014. She summarized outcomes in 5,435 reported surgeries including baseline demographics, IOPs, number of glaucoma medications

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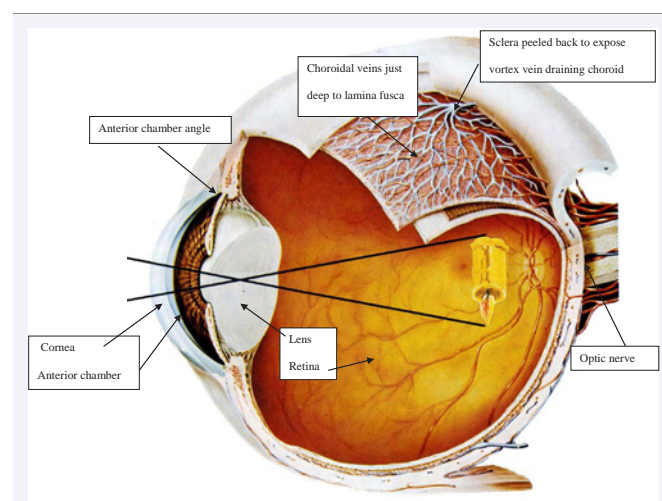
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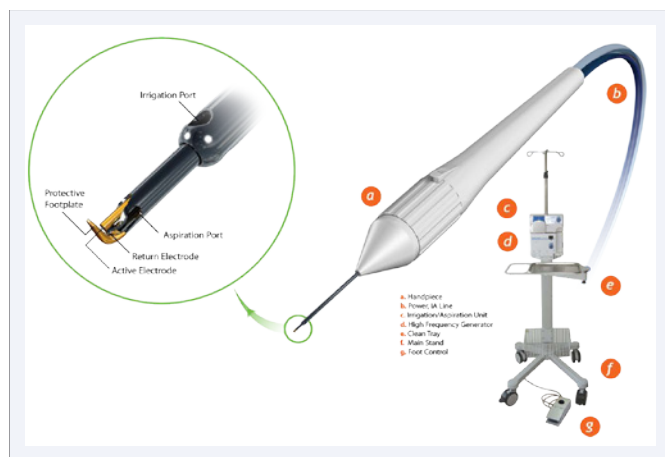
## Keywords

- Microinvasive Glaucoma surgery (MIGS)
- Trabectome®
- Glaukos iStent®
- Transtrabecular
- Suprachoroidal
- Shunts

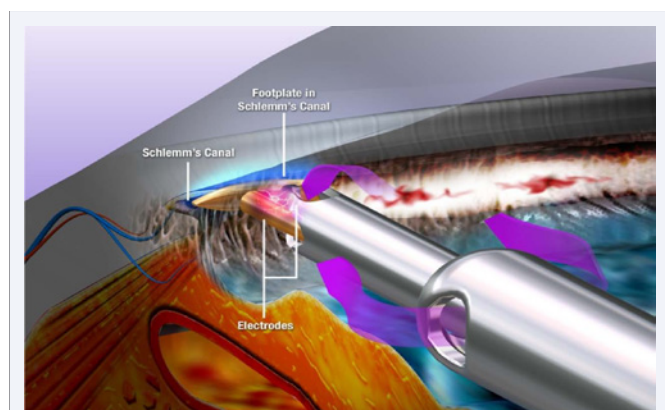
before and after surgery, secondary glaucoma surgeries if any, and complications. Survival analysis in this report defined success as IOP  $\leq 21$  mmHg, at least a 20 % IOP reduction from baseline, and no additional glaucoma surgery. At 90 months, IOP was reduced from an average of  $23.0 \pm 7.9$  mmHg to  $16.5 \pm 3.8$  mmHg (29 %) and the number of glaucoma medications was reduced from  $2.6 \pm 1.3$  to  $1.6 \pm 1.3$  (38 %). At 90 months, the survival rates were



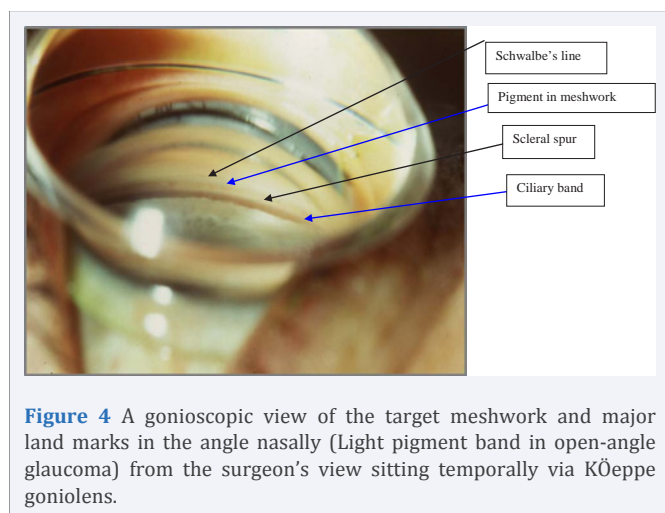
**Figure 1** Annotated cut-away diagram of normal eye with labels on relevant anatomical structures. (Courtesy of Chibret International 1998) Modified from Eine Repetition Für Ärzte mit Zeigefeln Für Patienten Zur Physiologie und Pathophysiologie des Auges by Lutjendrecoll E, Krey HF, Bräuer H. page 41.



**Figure 2** Diagram of Trabectome including bi-polar cautery tip, control console, and foot pedal. (With permission NeoMedix Corp).



**Figure 3** Diagram of gonioscopic angle view and Trabectome tip in during ablation of mid-nasal trabecular meshwork. (With permission NeoMedix Corp).



**Figure 4** A gonioscopic view of the target meshwork and major land marks in the angle nasally (Light pigment band in open-angle glaucoma) from the surgeon's view sitting temporarily via KÖeppe gonioscopes.

60 % for all cases, 76 % for combined Trabectome and cataract surgery cases and 50 % for Trabectome alone cases.

In recent analyses, Francis et al. reported the efficacy of Trabectome combined with cataract surgery and compared to cataract surgery alone [5,6]. These reports contradict the opinions of some that cataract surgery alone is sufficient in most cases of early open-angle glaucoma to control IOP.

Other MIGS in development will target the suprachoroidal space, between the sclera (hard outer eye coat) and the layers of veins in the choroid by expanding the lamina fusca, the relatively easily dissected pigment layer connecting the choroid and sclera. This approach may turn out to be efficacious and in theory even easier to perform than Trabectome or iStent.

## CONCLUSION

Trabectome has been well-established as a safe, relatively simple to learn and perform gonio surgery for normalizing IOP. Additional studies are needed to document visual field stabilization and better assess very long-term follow-up. Importantly this procedure does not interfere with or preclude subsequent standard filtering surgery such as trabeculectomy or aqueous shunts if IOP control is not adequate. Also it, like trabeculectomy, it can be performed with simple intracameral or even topical anesthesia avoiding general anesthesia except in children or difficult to manage adults.

## CONFLICT OF INTEREST

The author has been a non-stock owning medical advisor for NeoMedix, maker of Trabectome, since 2004.

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