Gonioscopy-Assisted Transluminal Trabeculotomy for Glaucoma: 1-Year Outcomes and Success Predictors

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Précis: Our results suggest gonioscopy-assisted transluminal trabeculotomy (GATT) as an effective and safe option for the surgical management of open-angle glaucoma (OAG). Older age was the only risk factor for failure in our analysis.

Purpose: To report 12-month clinical outcomes, safety profile and success predictors of GATT in patients with OAG.

Patients and Methods: A retrospective study of patients (18 y old and above) with medically uncontrolled OAG who underwent GATT as a solo procedure or combined with phacoemulsification (PHACO-GATT) between January 2018 and January 2020. Success at 12 months (primary outcome) was defined as intraocular pressure (IOP) <15 mm Hg, with an IOP reduction of at least 20%, OR a reduction of at least 2 glaucoma medications, compared with baseline. Secondary outcomes were success predictors and safety parameters.

Results: A total of 73 eyes (GATT = 38; PHACO-GATT = 35) from 58 patients with a mean age of 54.8 ± 11.6 years were included. Overall, after 12 months of follow-up, the mean IOP was reduced from 24.9 ± 8.5 to 12.1 ± 2.1 mm Hg ($P < 0.001$). The mean number of glaucoma medications was reduced from 3.5 ± 0.7 to 1.2 ± 1.2 ($P < 0.001$). The success rate was 87% at 12 months, with no significant differences between GATT (85%) and PHACO-GATT (91%) eyes ($P = 0.330$). Age was the only factor significantly associated with surgical success (hazard ratio = 1.35; $P = 0.012$; after adjusting for preoperative IOP and number of glaucoma medications). Patients older than 60 years had a significant greater chance of failure (hazard ratio = 10.96; $P = 0.026$) compared with those younger than 60 years. The most common postoperative complication was transient hyphema (39%; median duration, 5 d). No sight-threatening adverse event was documented.

Conclusions: GATT was effective and safe at lowering IOP with or without cataract extraction in OAG. Patients 60 years or older had a higher risk of failure compared with those younger in age.

Key Words: open-angle glaucoma, trabecular meshwork, aqueous humor

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Glaucoma is a multifactorial optic neuropathy characterized by the slow, progressive degeneration of retinal ganglion cells and axon loss. Since elevated intraocular pressure (IOP) is a risk factor strongly related to the development and progression of damage, IOP reduction is the main strategy in the treatment of the disease to prevent further structural and functional impairment.[1,2]

The idea that the mechanical cleavage of the trabecular meshwork can relieve the resistance to aqueous flow—thus reducing IOP—is not new. Ab externo trabeculotomy has been indicated as an alternative among the surgical approaches to open-angle glaucoma (OAG) for decades.[3,4] However, only recently have ab interno trabeculotomy techniques emerged as less invasive options, since they spare conjunctival and scleral tissue from manipulation. They belong to the group of procedures defined as microinvasive glaucoma surgery, that seem to be faster and safer options for OAG cases where moderate IOP reductions are required.[5,6] Ab interno trabeculotomy, known as gonioscopy-assisted transluminal trabeculotomy (GATT), is a technique described by Grover et al[7] designed to treat open-angle, primary congenital and juvenile-onset glaucomas.[8] Overall, good outcomes regarding IOP control and reduction in the number of glaucoma medications have been reported so far.[7,9]

As the introduction of GATT in glaucoma management is relatively recent, few studies have described mid to long-term follow-up outcomes. In addition, little is known about which factors would be related to a better or worse surgical result. Therefore, we sought to investigate 1-year clinical outcomes, safety profile and success predictors of OAG patients undergoing GATT, either isolated or combined with cataract extraction.

PATIENTS AND METHODS

This retrospective chart review adhered to the tenets of the Declaration of Helsinki and to the Onofre Lopes Hospital institutional review board guidelines (Ethics Committee).

Patients and Data Collection

We conducted a noncomparative, interventional case series including patients older than 18 years old with medically uncontrolled OAG (either primary or secondary) who underwent GATT between January 2018 and January 2020, as a solo procedure or combined with phacoemulsification and intraocular lens implantation (PHACO-GATT). A patient was considered to be medically uncontrolled based on recent anatomic and/or functional progression (detected by retinography or perimetry, respectively) or if IOP values were above the target range defined by the attending

physician based on the magnitude of anatomic and/or functional damage, age, and risk factors, in accordance with the European Glaucoma Society guidelines.[10] Preoperative and postoperative IOP values, number of glaucoma medications, endothelial cell count, visual field mean deviation, surgical complications, and any subsequent related events or procedures were recorded. Baseline IOP was defined as the average of 3 measurements taken on different days preoperatively. Only patients with a minimum follow-up of 12 months were included.

The primary study outcome was the success rate at the 12 months of follow-up. In accordance with the World Glaucoma Association Guidelines on Design and Reporting Clinical Trials,[11] we defined success as IOP <15 mm Hg. In addition, it was required an IOP reduction of at least 20%, OR a reduction of at least 2 glaucoma medications, compared with baseline. Surgical failure was determined whenever these criteria were not fulfilled in 2 consecutive follow-up visits, in the presence of loss of light perception, or if IOP-lowering reoperations were required. Secondary outcomes were success predictors and safety parameters.

Surgical Procedure

All surgeries were performed by one of the authors (B.M.F.) at one single center (Onofre Lopes University Hospital), in a standardized fashion. Briefly, after superior nasal and temporal corneal paracentesis, a solution of lidocaine and carbachol was injected into the anterior chamber. Subsequently, the anterior chamber was filled with viscoelastic (methylcellulose 2%). Using the tip of a 26-G needle, a nasal goniotomy was created. A thermally blunted 5-0 polypropylene suture was then inserted through the goniotomy and circumferentially advanced with the aid of a serrated tip 23-G microsurgical forceps. The distal tip of the suture was advanced 360 degrees and was retrieved at the nasal goniotomy site and extracted from the anterior chamber creating a circumferential trabeculotomy. In some cases where anatomic resistance was detected while advancing the suture, a new goniotomy was created to retrieve the distal tip, creating a circumferential trabeculotomy that varied from 90 to 360 degrees. The viscoelastic was then removed from the anterior chamber using anterior chamber irrigation with balanced saline solution. Acute hypotony and hyphema were controlled using anterior chamber viscoelastic injection. The amount of viscoelastic left in the eye was based on the degree of blood reflux and the presence and degree of the episcleral venous fluid wave.

In cases where GATT was combined with cataract extraction (PHACO-GATT group), phacoemulsification with intraocular lens implantation was performed first, and then the trabecular meshwork was accessed with a nasal goniotomy, followed by the ab interno trabeculotomy. Intraoperative intracameral carbachol was used at the end of the phacoemulsification, before initiating the GATT procedure. The same paracenthesis was used for both the goniotomy and the phacoemulsification. All patients (GATT and PHACO-GATT) were treated postoperatively with topical moxifloxacin (4 times daily for a week), pilocarpine 2% (2 times daily for 2 wk), and corticosteroid (prednisolone 1%). The topical corticosteroids were initially applied every 2 hours, and this dose was then gradually tapered over the first month.

Statistical Analysis

Descriptive analysis was used to present demographic and clinical data. D'Agostino-Pearson test was performed to determine whether data had a normal distribution. Normally distributed data were presented as mean and SD, whether non-normally distributed data were presented as median and interquartile intervals. Regarding the comparison between groups, continuous data were compared using the paired *t* test or the Wilcoxon test, depending on the data distribution. Kaplan-Meier survival analysis was used to estimate success rates along the postoperative follow-up period. The log-rank test was used to compare the survival of patients undergoing GATT versus PHACO-GATT. Cox proportional-hazards regression was used to investigate factors associated with surgical success. Computerized statistical analysis was performed using the MedCalc software (MedCalc Inc., Mariakerke, Belgium) and statistical significance was set at $P < 0.05$.

RESULTS

A total of 73 eyes (GATT = 38; PHACO-GATT = 35) from 58 patients with a mean age of 54.8 ± 11.6 years (range, 18–69 y) were included. Clinical and demographic characteristics of study patients are provided in Table 1. Overall, after 12 months of follow-up, the mean IOP was reduced from 24.9 ± 8.5 to 12.1 ± 2.1 mm Hg ($P < 0.001$). The mean number of glaucoma medications was reduced from 3.5 ± 0.7 to 1.2 ± 1.2 ($P < 0.001$). The success rate was 87% at 12 months (Fig. 1), with no significant differences between GATT (85%) and PHACO-GATT (91%) eyes ($P = 0.330$; Fig. 2). Complete 360 degrees trabeculotomy was performed in 58 eyes (79.5%). Age was the only factor significantly associated with surgical success (hazard ratio = 1.35; $P = 0.012$; after adjusting for preoperative IOP and number of glaucoma medications). Patients older than 60 years had a significantly greater chance of failure (hazard ratio = 10.963; $P = 0.026$) compared with those younger than 60 years (Fig. 3). Other variables investigated (combination of GATT and cataract extraction, number of previous surgeries, GATT extension, type of glaucoma, and level of damage) were not predictive of success or failure. A mean reduction in endothelial cell count values of 5.4% was documented at 12 months ($P = 0.021$), with no significant differences between eyes undergoing GATT (4.9%) and PHACO-GATT (5.7%; $P = 0.221$). There was no significant difference between visual field mean deviation values at baseline (-10.8 ± 8.1 dB) and at the last follow-up visit (-11.1 ± 8.2 dB; $P = 0.320$). Twelve-month postoperative outcomes are summarized in Table 2.

The most common postoperative complication was transient hyphema (39%; median duration, 5 d). In one case, anterior chamber washout was required. In 7 eyes (9.6%), additional IOP-lowering procedures were necessary (5 of these 7 eyes underwent micropulse transscleral cyclophotocoagulation and 2 underwent trabeculectomy), and no sight-threating adverse event was documented during the entire follow-up.

DISCUSSION

As previously underscored, GATT has been used for the management of uncontrolled OAG cases for a few years only. Therefore, more robust data regarding mid to long-term follow-up outcomes, the influence of simultaneous cataract extraction and success/failure predictors are still building up. In our study, evaluating OAG patients undergoing GATT or PHACO-GATT with a minimum follow-up of 1 year, the proportion of eyes that met our relatively strict success criteria was noteworthy (87%). This success rate was similar to

TABLE 1. Baseline Demographic and Ocular Characteristics of Study Patients

Variables	Value, Patients (n = 58), Eyes (n = 73)
Age (y)	54.8 ± 11.5*
Male/female (patients)	38/20
Caucasian/mixed race (patients)	47/11
POAG/SOAG (eyes)	54/19
Intraocular pressure (mm Hg)	24.8 ± 8.5*
Visual field mean deviation (dB)	−10.8 ± 8.1*
No. medications	3.5 ± 0.7*
Endothelial cell density (cells/mm^2)	2114.6 ± 463.5*

*Values expressed in mean ± SD.
POAG indicates primary open-angle glaucoma; SOAG, secondary open-angle glaucoma.

that of some other authors that investigated GATT outcomes in OAG, despite the differences in the definition of success adopted. Cubuk and Unsal[12] obtained success in 91.8% of the eyes after a 12-month follow-up. Aktas et al,[13] in a follow-up averaging nearly 19 months, observed success in 83.7% of the cases. In a 24-month outcomes publication, Sharkawi et al[14] revealed a success rate of 89.2% in eyes with pseudoexfoliative glaucoma. Guo et al,[15] in a recently published meta-analysis, found a combined surgical success rate of 85% (with a more pronounced reduction in the subgroup of studies with a follow-up longer than 12 mo).

On average, IOP nearly halved and more than 2 glaucoma medications were removed after 1 year. A substantial decrease in IOP has been reported by most of the investigations of GATT outcomes published to date.[9,12,14,16,17] It must be stated, however, that such notable IOP reduction occurs partially due to the high baseline mean IOP observed in almost every study on GATT. Besides, when defining baseline IOP, this unsteady variable should be measured more than once, and a mean value should be calculated for each eye included in the study (to mitigate the influence of regression to the mean). Since the studies rarely report how baseline IOP was obtained, it is assumed that only one measurement was considered for each patient. In a retrospective analysis—the design of most of the published works on GATT to date—one might consider the possibility of bias produced by the collection of preoperative IOP at its peak.

After adjusting for preoperative IOP and the number of glaucoma medications, Cox proportional hazard model identified lower age as a significant predictor of success. We hypothesize that this finding may be related to the pathophysiological sequence implicated in aqueous outflow resistance. Trabecular meshwork malfunction seems to prompt a reduction in the dimension of the Schlemm canal and collector channel network.[18,19] Therefore, it is speculated that a distal downstream pathway restriction to aqueous flow can be more pronounced in eyes with longer exposure to the disease.[19,20] In this context, age would be considered a surrogate measurement for the time of exposure to the disease. Hence, younger individuals with less functional damage to the collector downstream system would benefit the most from goniotomy. In line with this rationale, Salimi et al[17] also reported younger age as a success predictor for GATT.

Since IOP variations can occur on account of phacoemulsification alone,[21,22] it is important to compare IOP decreases obtained by isolated GATT procedure and PHACO-GATT. Bozkurt et al[23] revealed more pronounced reduction in IOP after stand-alone GATT compared with GATT associated with cataract extraction. However, the higher baseline IOP in the isolated GATT group and a higher mean age in the combined surgery group may in part explain the difference found in their study. Our analysis resulted in no significant difference in success rates between isolated and combined surgeries, in accordance with other authors.[7,12]

When it comes to the safety profile of any intraocular procedure, corneal endothelial cell layer preservation is a major concern. Even though our analysis demonstrated an overall statistically significant postoperative reduction in endothelial cell density, the percentage was small. It did not seem to be clinically significant since it did not result in loss of corneal

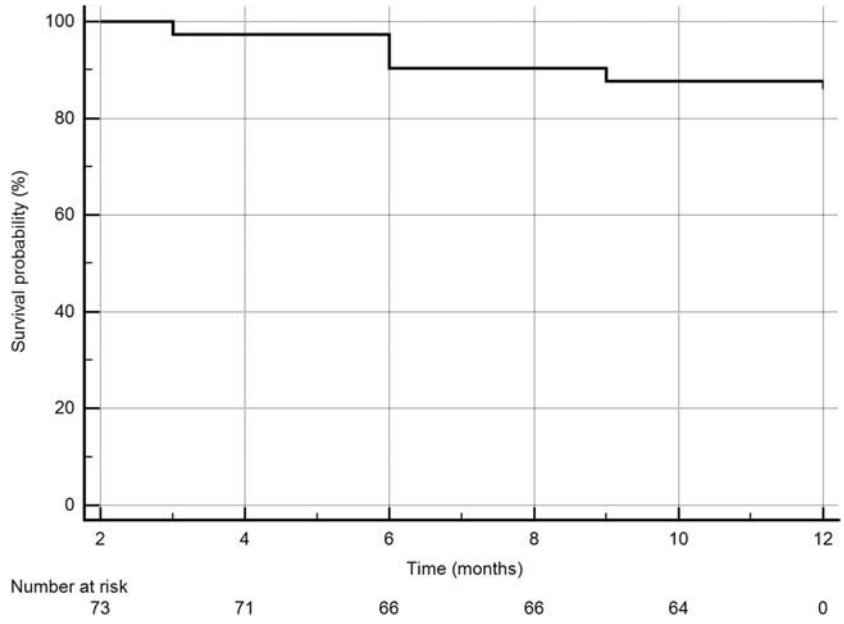

FIGURE 1. Kaplan-Meier survival curve showing overall probability of survival along the 12-month follow-up.

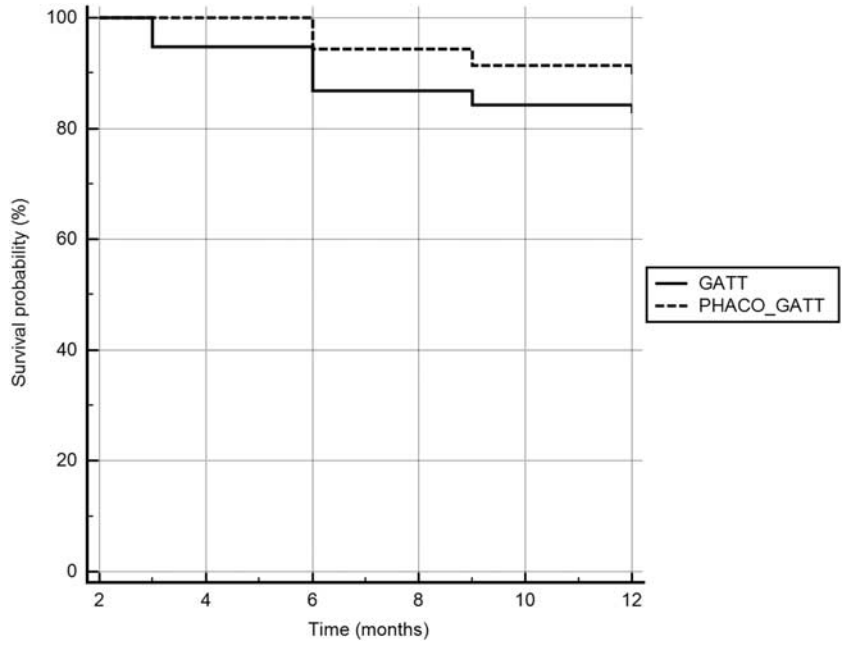

FIGURE 2. Kaplan-Meier survival curve showing no significant difference between survival of GATT and PHACO-GATT groups along the 12-month follow-up ($P = 0.330$). GATT indicates gonioscopy-assisted transluminal trabeculotomy; PHACO, phacoemulsification.

transparency in any of the cases. Furthermore, no significant difference in endothelial cell density was noted between GATT and PHACO-GATT groups. This finding adds significantly to our knowledge on GATT's safety profile and may guide the surgical approach in patients with poor preoperative endothelial conditions.

Regarding surgical complications, the most common postoperative finding in our study was hyphema, which is in accordance with the literature. Hyphema is caused by blood reflux from the episcleral veins to Schlemm canal following surgically induced hypotony and due to intraoperative compression of veins by the goniolens.[24] After GATT, as the trabecular meshwork is torn, blood can escape to the anterior chamber. We found postoperative hyphema in 39% of eyes, with a median duration of 5 days. Similarly, the pooled occurrence rate of hyphema was 36% in the meta-analysis conducted by Guo et al.[15] The rate of hyphema occurrence, however, may vary in the literature. Loayza-Gamboa et al,[25] studying outcomes of

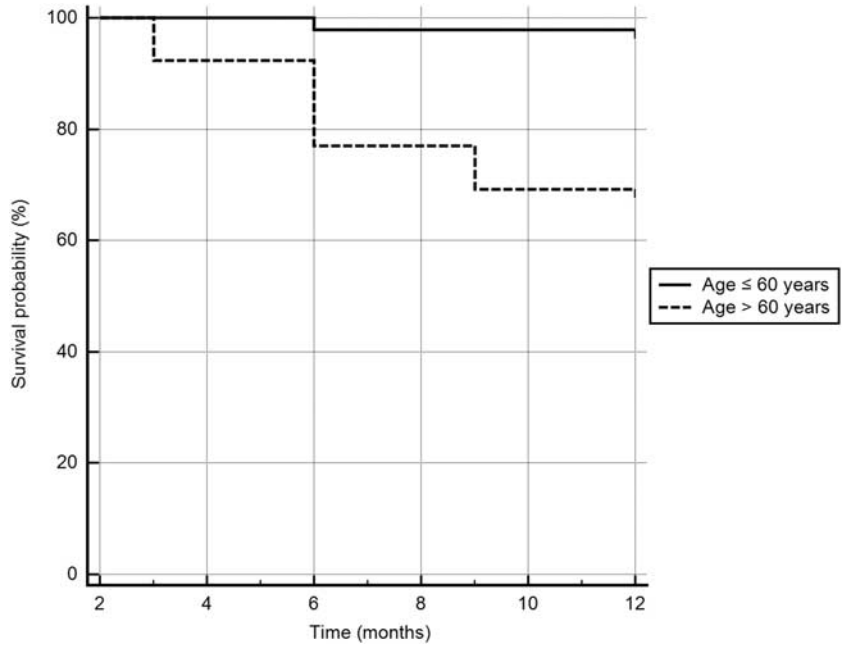

FIGURE 3. Kaplan-Meier survival curve showing significant larger probability of survival in the subgroup of patients aged younger than 60 years old along the 12-month follow-up ($P = 0.026$).

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TABLE 2. Twelve-month Postoperative Outcomes

Variables	Mean ± SD	Change From Baseline (%)	*P*
Intraocular pressure (mm Hg)	12.1 ± 2.0	−51.3	< 0.0001
VFMD index (dB)	−11.1 ± 8.2	2.7	0.320
No. medications	1.0 ± 1.0	−71.4	< 0.0001
Corneal ECD (cells/mm^2)	2041.6 ± 345.2	−3.4	0.021

ECD indicates endothelial cell density; VFMD, visual field mean deviation.

PHACO-GATT, saw the transient presence of blood in the anterior chamber in only 9.3% of the eyes. Conversely, Cubuk and Unsal observed hyphema in 89.1% of the eyes undergoing GATT. This higher rate was attributed to the absence of anterior chamber filling with a viscoelastic substance at the end of the procedure.[12] This step may prevent postoperative hyphema.[7] We did not observe any sight-threatening complications in our study, which is consistent with other case series.[15]

It is important to discuss the main clinical impact of our findings. Although we set stricter success criteria than most of other GATT studies, only a small proportion of failure was observed after 1 year, which shows a good overall effectiveness of the procedure. Also, as sight-threatening complications were absent and no clinically significant impact on endothelial cell density was noted, GATT may be considered a safe option for the surgical management of OAG cases. Since cataract extraction seems to exert no impact on IOP reduction after GATT, it may be performed either isolated or combined with phacoemulsification. The awareness that better outcomes were obtained in younger patients may influence physicians when choosing the best surgical alternative for their glaucoma patients. From a practical perspective, considering that a younger glaucoma patient has a longer life expectancy and that many glaucomatous eyes may require additional surgery throughout life, choosing GATT as a first procedure (before a conventional filtering surgery) may be beneficial especially in younger (younger than 60 y old) glaucoma patients.

The present study has some limitations, many of which are related to its retrospective, nonrandomized design. The selection of patients may have been influenced by the surgeon's decision to perform GATT instead of other surgical techniques. Also, medical charts' data were added at all time points by the surgeon, who inevitably was not masked to the surgical intervention. The definition of success based on IOP values and the number of medications may not be ideal in the assessment of glaucoma control since insufficient information for the adequate analysis of anatomic and functional progression was obtained. However, the detection of unequivocal disease progression is unlikely after 1-year follow-up, especially in cases in which cataract extraction imposes functional baseline evaluation reset. Although important inferences could be made on the basis of our outcomes, 1-year is considered a modest follow-up duration, and future analysis of this cohort shall be elucidative. Lastly, due to the small sample size, caution must be taken in generalizing these results to the population at large.

In summary, these 1-year outcomes suggest GATT as an effective alternative procedure for OAG management with minor postoperative complications. The fact that older patients had an increased risk of failure, independent of baseline IOP and number of preoperative medications, should be considered while managing these cases.

REFERENCES

1. Heijl A, Leske MC, Bengtsson B, et al. Reduction of intraocular pressure and glaucoma progression: results from the Early Manifest Glaucoma Trial. *Arch Ophthalmol*. 2002; 120:1268–1279.
2. The Advanced Glaucoma Intervention Study (AGIS): 7. The relationship between control of intraocular pressure and visual field deterioration. The AGIS Investigators. *Am J Ophthalmol*. 2000;130:429–440.
3. Chihara E, Nishida A, Kodo M, et al. Trabeculotomy ab externo: an alternative treatment in adult patients with primary open-angle glaucoma. *Ophthalmic Surg*. 1993;24:735–739.
4. Tanihara H, Negi A, Akimoto M, et al. Surgical effects of trabeculotomy ab externo on adult eyes with primary open angle glaucoma and pseudoexfoliation syndrome. *Arch Ophthalmol*. 1993;111:1653–1661.
5. Prum BE, Rosenberg LF, Gedde SJ, et al. Primary open-angle glaucoma preferred practice Pattern(®) guidelines. *Ophthalmology*. 2016;123:P41–P111.
6. Saheb H, Ahmed II. Micro-invasive glaucoma surgery: current perspectives and future directions. *Curr Opin Ophthalmol*. 2012; 23:96–104.
7. Grover DS, Godfrey DG, Smith O, et al. Gonioscopy-assisted transluminal trabeculotomy, ab interno trabeculotomy: technique report and preliminary results. *Ophthalmology*. 2014;121: 855–861.
8. Grover DS, Smith O, Fellman RL, et al. Gonioscopy assisted transluminal trabeculotomy: an ab interno circumferential trabeculotomy for the treatment of primary congenital glaucoma and juvenile open angle glaucoma. *Br J Ophthalmol*. 2015;99: 1092–1096.
9. Grover DS, Smith O, Fellman RL, et al. Gonioscopy-assisted transluminal trabeculotomy: an ab interno circumferential trabeculotomy: 24 months follow-up. *J Glaucoma*. 2018;27:393–401.
10. European Glaucoma Society. Terminology and Guidelines for Glaucoma, 4th ed—Chapter 3: treatment principles and options supported by the EGS Foundation: Part 1: Foreword; introduction; glossary; Chapter 3 Treatment principles and options. *Br J Ophthalmol*. 2017;101:130–195.
11. Heuer DK, Barton K, Grehn F, et al. Consensus on definitions of Success. In: Shaarawy TM, Sherwood MB, Grehn F, eds. *Guidelines on Design and Reporting of Glaucoma Surgical Trials*. Amsterdam: Kugler; 2009:15–24.
12. Cubuk MO, Unsal E. One-year results of gonioscopy-assisted transluminal trabeculotomy: evaluation of prognostic factors. *Eur J Ophthalmol*. 2021;31:460–468.
13. Aktas Z, Ucgul AY, Bektas C, et al. Surgical outcomes of prolene gonioscopy-assisted transluminal trabeculotomy in patients with moderate to advanced open-angle glaucoma. *J Glaucoma*. 2019;28:884–888.
14. Sharkawi E, Lindegger DJ, Artes PH, et al. Outcomes of gonioscopy-assisted transluminal trabeculotomy in pseudoexfoliative glaucoma: 24-month follow-up. *Br J Ophthalmol*. 2021;105:977–982.
15. Guo CY, Qi XH, Qi JM. Systematic review and meta-analysis of treating open angle glaucoma with gonioscopy-assisted transluminal trabeculotomy. *Int J Ophthalmol*. 2020;13:317–324.
16. Rahmatnejad K, Pruzan NL, Amanullah S, et al. Surgical outcomes of gonioscopy-assisted transluminal trabeculotomy (GATT) in patients with open-angle glaucoma. *J Glaucoma*. 2017;26:1137–1143.
17. Salimi A, Nithianandan H, Al Farsi H, et al. Gonioscopy-assisted transluminal trabeculotomy in younger to middle-aged adults: one-year outcomes. *Ophthalmol Glaucoma*. 2021;4:162–172.
18. Carreon T, van der Merwe E, Fellman RL, et al. Aqueous outflow—a continuum from trabecular meshwork to episcleral veins. *Prog Retin Eye Res*. 2017;57:108–133.
19. Andrew NH, Akkach S, Casson RJ. A review of aqueous outflow resistance and its relevance to microinvasive glaucoma surgery. *Surv Ophthalmol*. 2020;65:18–31.
20. Hann CR, Vercnocke AJ, Bentley MD, et al. Anatomic changes in Schlemm's canal and collector channels in normal and

primary open-angle glaucoma eyes using low and high perfusion pressures. *Invest Ophthalmol Vis Sci*. 2014;55:5834–5841.
21. Chen PP, Lin SC, Junk AK, et al. The effect of phacoemulsification on intraocular pressure in glaucoma patients: a report by the American Academy of Ophthalmology. *Ophthalmology*. 2015;122:1294–1307.
22. Slabaugh MA, Bojikian KD, Moore DB, et al. The effect of phacoemulsification on intraocular pressure in medically controlled open-angle glaucoma patients. *Am J Ophthalmol*. 2014; 157:26–31.
23. Bozkurt E, Yenihayat F, Olgun A, et al. The efficacy of gonioscopy-assisted transluminal trabeculectomy combined with phacoemulsification. *Int Ophthalmol*. 2021;41:35–43.
24. Moses RA, Hoover GS, Oostwouder PH. Blood reflux in Schlemm's canal. I. Normal findings. *Arch Ophthalmol*. 1979;97: 1307–1310.
25. Loayza-Gamboa W, Martel-Ramirez V, Inga-Condezo V, et al. Outcomes of combined prolene gonioscopy assisted transluminal trabeculotomy with phacoemulsification in open-angle glaucoma. *Clin Ophthalmol*. 2020;14:3009–3016.