

Gonioprism-Assisted Laser Cyclophotocoagulation in Treatment of Primary Open Angle Glaucoma after Failed GATT Procedure: A Case Report

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How to cite this paper: Sakarya, Y. and Sakarya, R. (2025) Gonioprism-Assisted Laser Cyclophotocoagulation in Treatment of Primary Open Angle Glaucoma after Failed GATT Procedure: A Case Report. *Open Journal of Ophthalmology*, 15, 246-251. <https://doi.org/10.4236/ojoph.2025.154028>

Received: September 6, 2025

Accepted: November 11, 2025

Published: November 14, 2025

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Abstract

Aim: To present a case of gonioprism-assisted laser cyclophotocoagulation (GALC) following a failed gonioscopy-assisted transluminal trabeculotomy (GATT), utilizing a standard vitrectomy laser probe and a direct surgical gonioscope in a patient with primary open-angle glaucoma (POAG). **Materials and Methods:** Case report. **Results:** A 76-year-old male patient with POAG underwent a 360-degree GATT without complications. However, during the postoperative 3-month period, despite receiving maximum topical anti-glaucoma treatment, intraocular pressure (IOP) failed to decrease to the target intraocular pressure (IOP) range of 12 - 15 mmHg. Subsequently, a 240-degree GALC was successfully performed, and the IOP has since been maintained at safe levels with the use of three medications. (measured between 12 and 16 mmHg at 1 and 6 months with three medications). **Conclusions:** GALC presents itself as a viable option for the treatment of POAG. This procedure provides surgeons with an additional alternative treatment option in situations where an endocyclophotocoagulation (ECP) device is unavailable.

Keywords

Cyclophotocoagulation, Frequency Doubled Nd:YAG, GATT, Glaucoma

1. Introduction

The effectiveness of gonioscopy-assisted transluminal trabeculotomy (GATT) in managing open-angle glaucoma was initially reported by Grover *et al.* [1]. This procedure involves tearing the trabecular meshwork 360 degrees using a prolene

suture [2]. Although the success rate of the GATT procedure is generally high, there are instances of failure. Reduced patency of collector canals is primarily blamed. When GATT surgery fails, alternative surgeries include trabeculectomy, seton implantation, and cyclodestructive laser procedures.

Cyclophotocoagulation entails the destruction of the ciliary body's secretory epithelium to reduce aqueous humor production [3]-[6]. This treatment can be administered transsclerally or internally, known as ECP which is one of the widely-used cyclodestructive laser procedures, involves a microprobe housing a fiber for both diode laser and aiming beam, another for endoscopy viewing, and a third for the light source. ECP requires a microprobe that integrates a diode laser, an endoscopic viewing system, and a light source, allowing direct visualization of ciliary processes during photocoagulation.

While the integrated 810 nm diode laser endoscope system (Endo Optiks, Little Silver, NJ) has been a mainstay in glaucoma treatment for years, its adoption in clinics has been limited due to cost constraints in developing countries.

Recently, Vila-Arteaga *et al.* introduced a device-free technique using a standard vitrectomy laser probe assisted by a direct surgical gonioscope [7]. This innovation demonstrated that cyclophotocoagulation can be performed without specialized endoscopic equipment. Building on this, GALC adapts commonly available vitrectomy laser probes and a gonioscope to achieve a similar effect, making it a practical and cost-effective alternative in resource-limited settings. To our knowledge, there are very few reports of GALC performed after failed GATT, making this case a valuable addition to the literature. This case report illustrates a patient who underwent GALC for primary open-angle glaucoma treatment after a failed GATT procedure.

2. Case Description

A 76-year-old male patient with primary open-angle glaucoma (POAG) presented to our clinic with a complaint of progressive vision loss in his right eye over the past 2 years. He had been undergoing regular eye examinations and treatment for glaucoma at various clinics. His medical history was notable for surgery for colon cancer and ongoing chemotherapy. Upon examination, the best-corrected visual acuity was 20/50 in the right eye (OD) and 20/20 in the left eye (OS). The patient had bilateral pseudophakia and exhibited dry eye and allergies secondary to antiglaucoma eyedrops. Despite receiving maximum topical antiglaucoma treatment, which included a fixed combination of brinzolamide 1%/brimonidine tartrate 0.2% (twice daily) and a fixed combination of 0.005% latanoprost and 0.5% timolol (once daily), IOPs measured with Goldman applanation tonometry were 34 mmHg OD and 19 mmHg OS. Central corneal thicknesses were 550 μ m in the right eye and 555 μ m in the left eye. Gonioscopy revealed wide angles with moderate pigmentation bilaterally. Fundus examination indicated advanced glaucomatous damage in both eyes, particularly severe in the right eye. Optic coherence tomography (OCT) revealed a retinal nerve fiber layer (RNFL) thickness of 42.3

μm OD and 75.1 μm OS. Computerized visual field analysis confirmed visual field defects.

The patient underwent gonioscopy-assisted transluminal trabeculotomy (GATT) surgery involving a 360-degree procedure with a 5/0 prolene suture, without complications. Intraoperatively, no episcleral venous fluid wave (a sign of collector channel patency during GATT) was observed. However, postoperatively, the IOP failed to decrease to the target intraocular pressure (IOP) range of 12 - 15 mmHg despite maximal anti-glaucoma medication, including oral dorzolamide pills. Consequently, at the third postoperative month, a decision was made to proceed with a gonioprism-assisted laser cyclophotocoagulation (GALC) procedure. The GALC procedure was performed according to the technique described by Vila-Arteaga *et al.*, with some modifications. The pupil was dilated with cyclopentolate and phenylephrine eye drops. Under retrobulbar anesthesia using a lidocaine-bupivacaine combination, the anterior chamber was filled with 1% sodium hyaluronate. Six iris hooks were placed in the nasal quadrant, approximately 35 degrees apart, after creating side ports with a 20-gauge MVR blade (**Figure 1**).

Rationale after GATT failure: The intraoperative absence of an episcleral venous fluid wave (EVFW)—a surrogate for collector-channel patency—suggested that distal outflow resistance likely persisted despite trabeculotomy. In this context, a procedure targeting aqueous production (cyclophotocoagulation) was a logical next step when further angle-based outflow enhancement was unlikely to succeed.

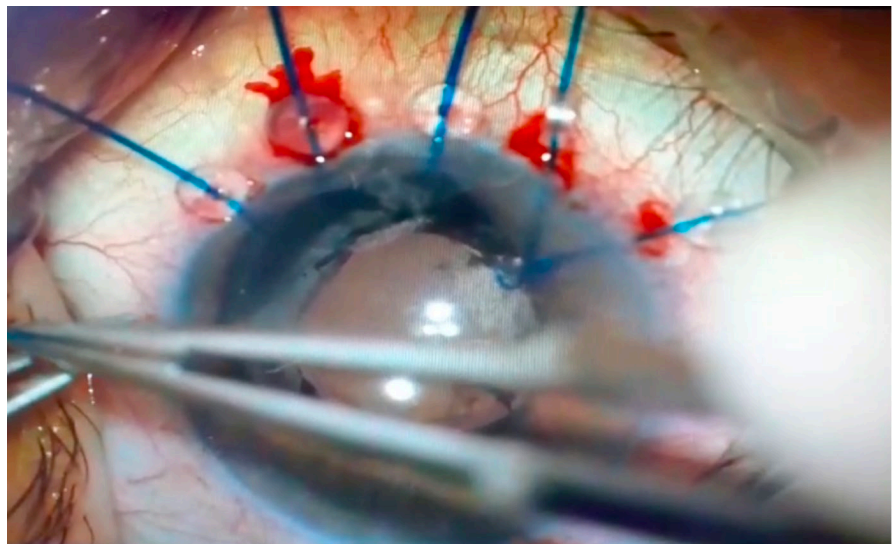


Figure 1. Six iris hooks were placed to retract the pupil.

These side ports were intended to be narrow, achieved by inserting only two-thirds of the MVR blade tip. Additionally, a temporal side port was created with a 20-gauge MVR blade. Following this, 3% sodium hyaluronate viscoelastic was injected behind the iris to lift it towards the cornea after most of the viscoelastic given at the beginning of the surgery had been removed. This step aimed to create

a concavity on the back surface of the iris to visualize the ciliary process. The microscope was inclined 35 degrees toward the surgeon, and the patient's head was turned approximately 35 degrees away from the surgeon. After applying 1% sodium hyaluronate to the corneal surface, a Swan-Jacob gonioprism was placed on the cornea. Both the patient's head and the microscope were adjusted to obtain a clear view of the ciliary process. A 23-gauge vitrectomy laser probe was inserted through the temporal side port, and laser settings were adjusted to 250 mW and 500 ms. The laser device used was the Vitra 2, a frequency-doubled Nd:YAG, emitting at 532 nm green laser (Quantel Medical, France). Laser application continued until whitening and shrinkage occurred, with caution taken to avoid exploding the ciliary process (**Figure 2**).



Figure 2. The ciliary processes underwent photocoagulation using laser.

This approach allowed for the photocoagulation of the nasal portion of the ciliary process about 120 degrees. Subsequently, the iris hooks were removed, and treatment of the temporal ciliary processes was performed from the nasal side after repeating the same steps.

Treatment extent: We selected a 240° treatment to balance efficacy with safety—aiming for robust IOP reduction while mitigating risks such as postoperative inflammation and hypotony. A staged or partial approach is prudent in eyes with advanced disease and useful vision, reserving further treatment for nonresponders.

Viscoelastic was removed using irrigation/aspiration, and the side ports were hydrated. Moxifloxacin 0.5% (0.05 ml) and triamcinolone acetonide 4% (0.01 ml) were injected into the anterior chamber. Postoperatively, the patient received moxifloxacin 0.5% eye drops four times daily for 14 days and prednisolone acetate 1% eye drops four times daily for 4 weeks. A fixed combination of brinzolamide 1%/timolol 0.5% (twice daily) and brimonidine tartrate 0.2% (twice daily) was initiated on postoperative day 1. IOP readings ranged between 12 mmHg and 16

mmHg at both 1 month and 6 months postoperatively, with minor pupillary distortion observed. At the 6-month follow-up, the patient reported marked improvement in visual comfort and a significant reduction in ocular pain and photophobia. His daily activities and vision-related quality of life improved notably, and he expressed high satisfaction with the surgical outcome.

3. Discussion

The effectiveness of ECP in glaucoma management has been evaluated in numerous studies [3]–[6]. This technique serves as an alternative procedure in glaucoma treatment. However, its impracticality in developing countries is underscored by the high cost of the device and supplies. Consequently, GALC may serve as an alternative for end-stage glaucoma patients in developing countries.

In this case report, we employed a frequency-doubled Nd:YAG 532 nm green laser. It's widely recognized that 532 nm green lasers penetrate the retina less deeply than diode lasers emitting at 810 nm. This feature may also be applicable to ciliary process coagulation. Such a characteristic may render the GALC technique less tissue-destructive in cyclophotocoagulation, due to its inclination towards more superficial photocoagulation compared to the 810 nm diode laser.

While ECP provides the advantage of direct endoscopic visualization with less intraocular manipulation, its use is limited by equipment cost and availability. GALC, by contrast, relies on instruments already present in most vitreoretinal surgical units, making it a practical and cost-effective alternative in settings where ECP devices are not accessible. Furthermore, this report highlights the feasibility of performing GALC after a failed GATT procedure. This sequence of surgeries has rarely been documented in the literature, and our findings suggest that GALC may provide an additional surgical option for patients with uncontrolled IOP following minimally invasive glaucoma surgery.

Potential risks and comparison: GALC shares complications with other cyclodestructive procedures, including transient inflammation, IOP spikes, cystoid macular edema, hypotony, and, rarely, phthisis. Compared with transscleral CPC, techniques that enable direct visualization (e.g., ECP) may reduce collateral damage, whereas micropulse transscleral CPC has been associated with lower rates of hypotony and inflammation compared to continuous-wave CPC in several reports.

Limitations: This is a single-case report with a 6-month follow-up, without standardized titration algorithms for power and duration specific to GALC using a 532-nm probe. Larger, comparative, and longer-term studies are needed.

4. Conclusion

GALC may represent a practical alternative when ECP devices are not available, especially in resource-limited settings. Beyond this single case, the promising outcome highlights the potential for broader clinical evaluation of GALC through comparative studies or multicenter experiences. Further research may help estab-

lish standardized protocols and encourage adoption in centers lacking ECP technology. In a pragmatic surgical algorithm after failed angle-based surgery, GALC may be considered when ECP is unavailable and when a transscleral approach is deemed higher risk; it can serve as a vision-preserving, titratable option prior to filtering or tube surgery in selected patients.

Consent

Written informed consent for this case report was obtained from the patient.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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