

Gonioscopy-Assisted Transluminal Trabeculotomy as an Option in a Young Myopic Patient with Progressive Glaucoma

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Abstract

A 30-year-old man with a history of juvenile open angle glaucoma (JOAG) presented with a complaint of decreased visual acuity (VA) in his right eye in the setting of elevated intraocular pressure (IOP). An optical coherence tomography (OCT) scan and visual field test were performed, with each test showing extensive retinal fiber layer (RNFL) thinning and visual field deficits respectively. Upon ocular examination, both optic nerve heads were found to have significant cupping with significant peripapillary atrophy and high cup to disc ratios. Due to the man's young age and profound visual field defects, aggressive treatment was suggested and he underwent gonioscopy-assisted transluminal trabeculotomy (GATT) on his right eye. The procedure successfully lowered his IOP by greater than 30% from baseline, and his visual acuity returned to baseline in the right eye. This is significant considering IOP-lowering is the basis for glaucoma treatment and with the advent of this effective new conjunctival-sparing procedure, long-term adverse effects and the need for further glaucoma surgery is reduced.

Keywords: Gonioscopy-Assisted Transluminal Trabeculotomy (GATT); Primary Open Angle Glaucoma (POAG); Juvenile Open Angle Glaucoma (JOAG); Microincision Glaucoma Surgery (MIG); Trabeculectomy; Ab Interno Trabeculotomy

Abbreviations

GATT: Gonioscopy-Assisted Transluminal Trabeculotomy; SLT: Selective Laser Trabeculoplasty; MIGS: Microinvasive Glaucoma Surgery; IOP: Intraocular Pressure; VA: Visual Acuity; OCT: Optical Coherence Tomography; RNFL: Retinal Nerve Fiber Layer; HVF: Humphrey Visual Field; POAG: Primary Open Angle Glaucoma

Introduction

Glaucoma is the leading cause of irreversible blindness in the world today. The only proven treatment is reducing intraocular pressure (IOP) to prevent any continuous optic nerve damage [1]. There are many topical medications that can be used to control IOP quite effectively, however none provide a permanent solution. Although laser and incisional surgical options exist, such as selective laser trabeculoplasty (SLT), or trabeculectomy and aqueous shunts, such procedures can be impermanent or lead to post-operative complications such as infection and hypotony [2,3]. In order to avoid these potential negative consequences, a new group of procedures has been developed, deemed minimally invasive glaucoma surgeries (MIGS). MIGS allows for a more permanent reduction in IOP than SLT, while reducing the risk profile of traditional surgery, by requiring only microincision and avoiding conjunctival dissection [4]. A new MIGS procedure was developed called gonioscopy-assisted transluminal trabeculotomy (GATT) (also known as internal canaloplasty, and *ab interno* trabeculotomy), first described by Grover, *et al.* in 2014. GATT requires the use of an illuminated microcatheter or thermally blunted suture to be inserted into the anterior chamber following the creation of a clear corneal paracentesis. Under a gonioprism lens, microsurgical forceps are then used to guide the microcatheter or suture, 360 degrees, cannulating Schlemm's canal from an *ab interno* approach. Finally, the suture or microcatheter is pulled through Schlemm's canal in order to split the trabecular meshwork, allowing for better aqueous drainage through connector channels. We present a case of primary open angle glaucoma, which was treated successfully using this GATT procedure.

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Case Background

A 30-year-old, myopic Asian American male was first diagnosed with bilateral juvenile glaucoma at the age of 22. He initially presented in January 2016 with a chief complaint of decreased vision in his right eye. Per the patient’s report, his IOP had been well-controlled up to this point on once daily bimatoprost 0.01% (16 mmHg OU) by his local eye specialist. However, previous patient records showed he had experienced IOPs as high as 32 mmHg in the past.

From his initial visit in January through follow-up in June, his visual acuity (VA) declined in the right eye from 20/20 to 20/25, with a subsequent IOP elevation from 16 to 20 mmHg in the right eye. On fundusoscopic exam, the right optic nerve had a myopic tilted appearance with peripapillary atrophy, a cup to disc ratio of 0.85, and an inferior notch without heme. The left optic nerve also had a myopic tilted appearance with peripapillary atrophy, a cup to disc ratio of 0.85, and temporal thinning without heme or notching. The rest of the ocular examination was unremarkable. Due to the increase in IOP in his right eye, he was started on timolol 0.25% once daily in addition to the bimatoprost. An optical coherence tomography scan (OCT) and Humphrey visual field test (HVF) were administered to monitor for any glaucomatous changes. An OCT of the macula (Figure 1) showed inferior thinning greater in the left eye than the right eye. An OCT of the peripapillary retinal nerve fiber layer (RNFL) (Figure 2), showed extensive thinning of both optic nerves especially inferiorly in the right eye, and temporally in the left eye. A HVF (Figure 3) showed abnormalities in both eyes, with a dense superior arcuate scotoma in the right eye, and an early inferior nasal step in the left eye.

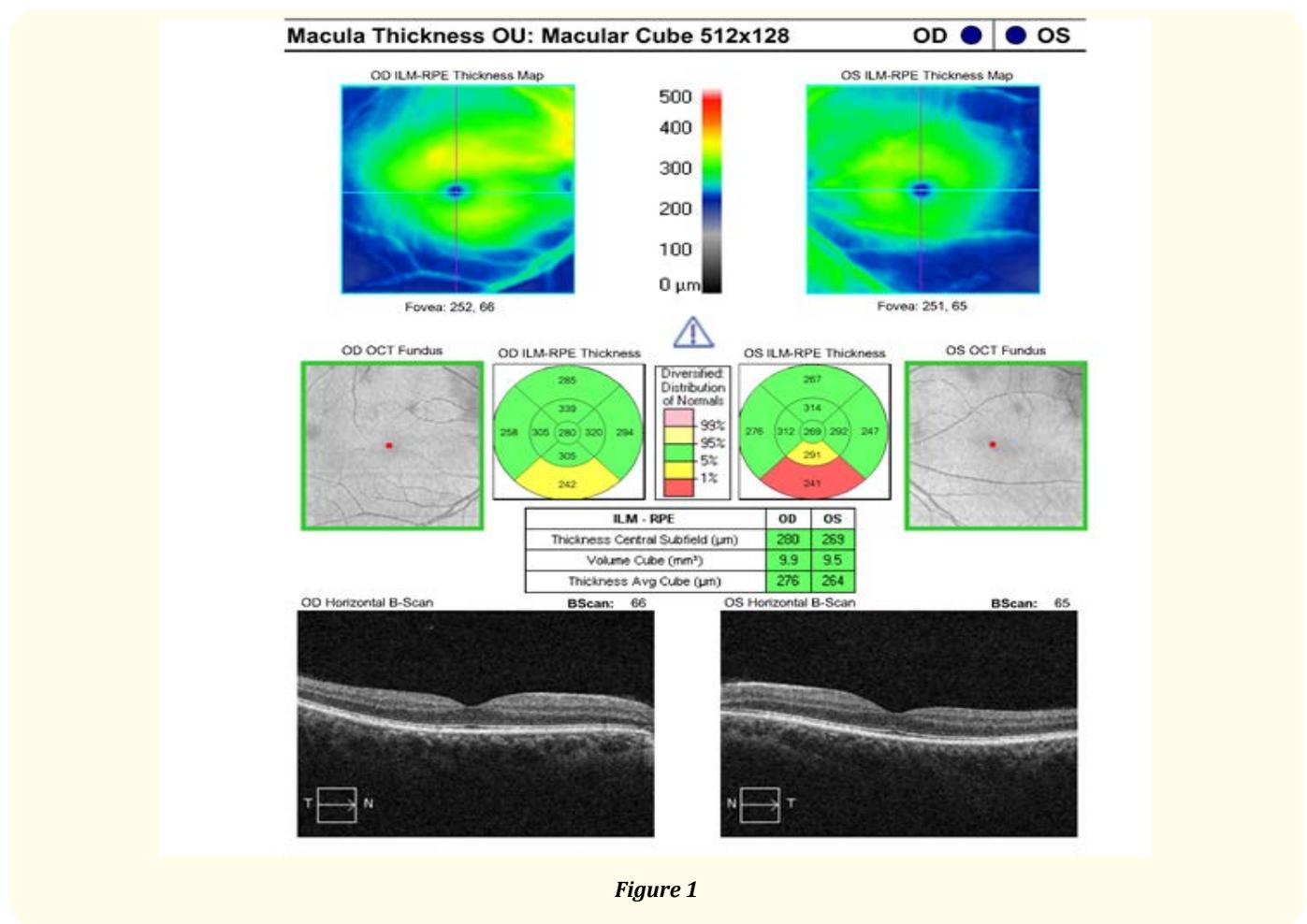


Figure 1

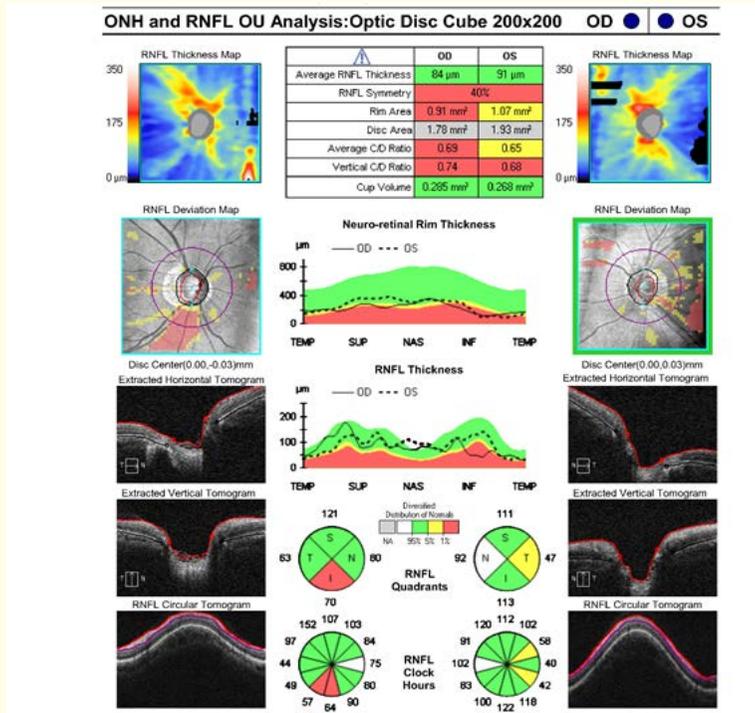
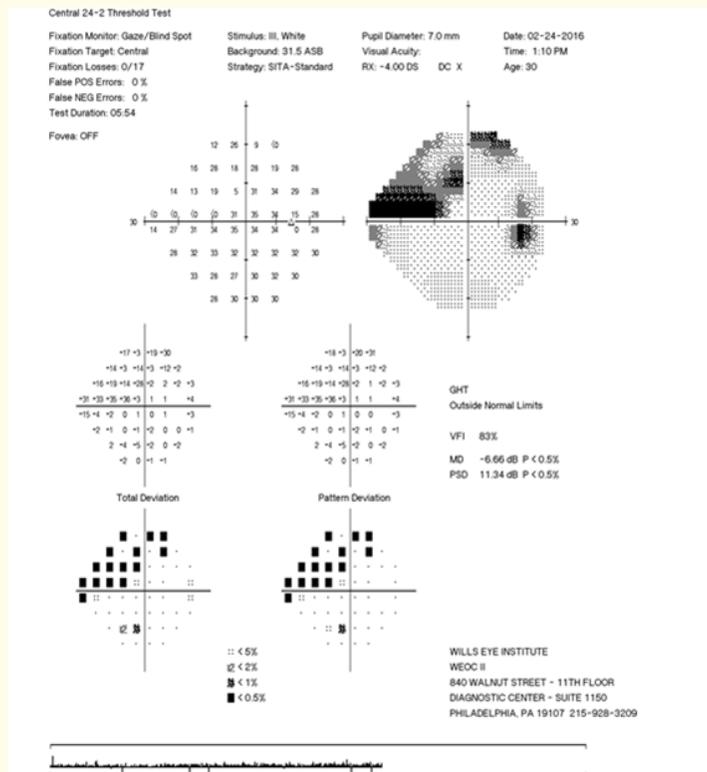


Figure 2



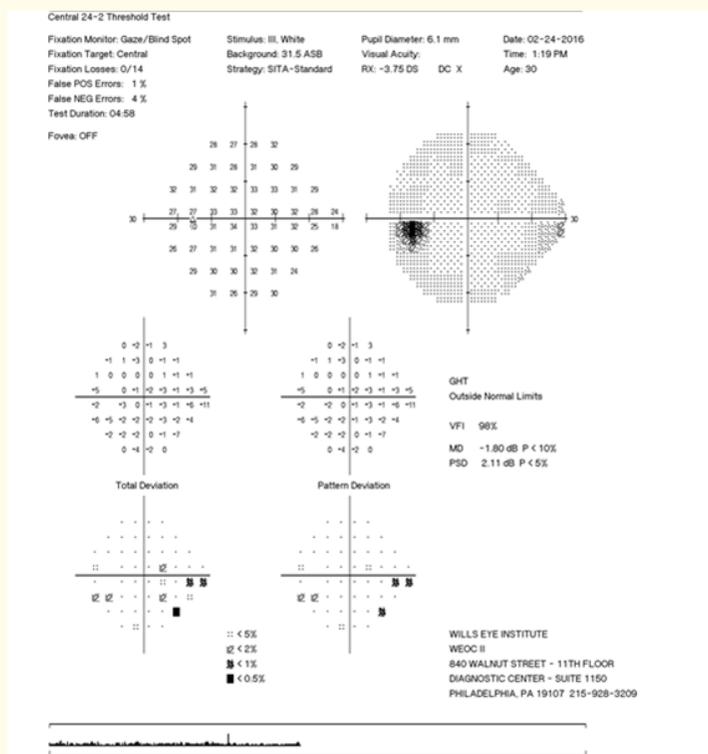


Figure 3

These findings, coupled with the patient’s prior history of elevated IOP (32 mmHg OU) and his young age, and high myopia (-9.0 diopters) led us to pursue aggressive treatment to ease the lifetime burden of progressive glaucoma. The risks, benefits, and associated factors of GATT were discussed with the patient, and in August 2016 the patient underwent GATT surgery in the right eye.

The surgery was successfully performed 360 degrees to open Schlemm’s canal. On post-op day 1 exam, the patient’s VA in the right eye was count fingers at 3 feet, he had an IOP of 28 mmHg, and a 1 mm layered hyphema was present in the anterior chamber. The patient was started on prednisolone acetate 1% four times a day, dorzolamide-timolol once a day, and Ocuflax 0.3% four times a day. At one month follow up, the patient’s hyphema had completely resolved, his VA improved to 20/20, and there was a significant decrease in IOP to 11mmHg, which is a 64% decrease from his max recorded IOP of 32 mmHg in the right eye. The patient is currently on bimatoprost once daily, no further adverse effects have been found and the patient has no ocular complaints at this time.

Discussion

Trabeculectomy is often considered the gold standard for glaucoma surgery, when medication and laser treatment fail to effectively lower IOP [5]. This invasive conjunctival-based procedure is associated with numerous post-operative complications including choroidal effusions, blebitis, bleb-related endophthalmitis, and hypotony maculopathy [6]. The formation of a partial-thickness scleral flap may scar with time, which then must be corrected by bleb needling or other surgical revisions, effectively negating any reduction in IOP and exposing the patient to more potential complications. Certain studies have shown that patients who have undergone trabeculectomy, 33% have lost both substantial visual field and visual acuity over the course of time, while 33% experience progressive glaucomatous optic nerve damage [7,8].

Trabeculotomy has gained popularity among glaucoma specialists, especially in the pediatric population, as an alternative surgical option that does not require bleb formation [9]. Currently, the most common approach to this surgical technique is circumferential tra-

beculotomy *ab externo*, which has been shown to effectively lower IOP with good long-term results [9]. Centripetal rupture through the trabecular meshwork into the anterior chamber allows for improved aqueous outflow due to greater access to more collector channels. Nevertheless, this procedure still requires extensive conjunctival and scleral flap incisions, increasing the risk of scarring and reducing the success of any necessary subsequent procedures. Alternatively, GATT allows for the same increased access to collector channels, while avoiding any major external incisions. In a recent study, the GATT procedure was shown to be at least as effective, if not better than traditional *ab externo* circumferential trabeculotomy [10]. According to the initial 2014 study by Grover, *et al.* patients who had never been surgically treated for primary open angle glaucoma (POAG), experienced a 30.0% and 39.8% reduction in IOP from baseline, with a mean reduction of 7.7 mmHg and 11.1 mmHg at 6 and 12 months, respectively. This mean reduction and 70% success rate was found to be comparable, regardless of prior glaucoma surgery status, prior cataract surgery status, or type of glaucoma [9-11]. The post-surgery complications were minimal, except for hyphema in approximately 30% of patients, which resolved in nearly all patients within one month after surgery [9-11].

Conclusion

Our patient was a 30-year old, myopic Asian American male with a history of juvenile glaucoma and elevated IOP who presented with decreased vision and extensive visual field defects. In young myopes, the risk of trabeculotomy complications are higher and the success rate is lower. Following the GATT procedure, he experienced a greater than 30% reduction in IOP, and an increase in visual acuity in his right eye. In a young patient with a longer life expectancy, it is important to treat glaucoma aggressively. With the exciting development and improvement of different MIGS, the GATT procedure is an excellent first-line therapy for young phakic patients with open angle glaucoma, preserving the conjunctiva if needed for later incisional glaucoma surgeries. Visual acuity often returns to baseline within days and the procedure does not need to be combined with cataract extraction.

Financial Disclosure

There are no financial disclosures or conflict of interest to be declared by any author.

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