

Ranking Laser in Glaucoma Treatment

Minimally Invasive Laser Treatment (MILT): Why Subthreshold Laser Should Be the Treatment of Choice for Glaucoma Patients

BY MARK LATINA, MD, AND YVES LACHKAR, MD



Glaucoma management has traditionally taken a stepped approach based on the level of risk involved. The low-risk treatment option is medication.

Next are laser/selective laser trabeculoplasty (SLT), MIGS, and incisional surgery. It ends with the highest risk option of cyclodestructive procedures (Figure 1).

Today, subthreshold lasers are changing the paradigm of how we approach glaucoma management. SLT is being used as the primary therapy, and SubLiminal cyclophotocoagulation (SubCyclo) diode laser is a newer laser that is expanding our glaucoma armamentarium.



Figure 1. Glaucoma management via a traditional stepped approach.

For MIGS, there are various new microdevices and procedures available to glaucoma specialists that are substantially increasing management options. These include the new Schlemm's canal-based trabecular bypass procedures, subconjunctival filtration procedures, and suprachoroidal drainage procedures. These new procedures alter the paradigm and treatment concepts of glaucoma surgery and are accelerating the importance of earlier surgical intervention. The earlier we can successfully address glaucoma, we can reduce the morbidity of progression, reduce the need for more aggressive surgical options (while preserving that option), and reduce the burden of medication and patient-compliance issues, which is one of the most prevalent problems in glaucoma treatment today.¹

HOW DO WE DECIDE?

The fundamental treatment principles remain relatively the same as before. Our goal is to maintain the patient's visual function and related quality of life at a sustainable cost. To reach this goal, we want to employ the safest, easiest, and most effective methods to reduce IOP to a level that is adequate for the optic nerve to slow or prevent glaucoma progression. When planning the best course of treatment, factors for each patient must be taken into account. These include family history, IOP values, corneal thickness, visual field damage, progression rate, pigment dispersion, optic nerve disk size, and so forth.

SETTING TARGET IOP

Setting the target IOP is one of the most critical steps of glaucoma management. Target IOP is defined as the upper limit of a stable range of measured IOPs deemed likely to retard further optic nerve damage.² When setting target IOP, each eye is staged into one of four severity groups: suspect, early, moderate, or advanced glaucoma. Categorizing a patient's eye into one of these four groups requires assessing the optic nerve and visual field changes, patient factors, age, life expectancy, risk factors for progression, and patient input regarding their quality of life. There is a fine line between setting an appropriate goal

Suggested upper limit of initial target IOP for each eye		
Stage	Suggested upper limit of target IOP. Modify based on longevity, QOL and risk factors for progression	Evidence
Suspect in whom a clinical decision is made to treat	24 mm Hg with at least 20% reduction from baseline	OHTS EGPS
Early	20 mm Hg with at least 25% reduction from baseline	EMGTS CIGTS
Moderate	17 mm Hg with at least 30% reduction from baseline	CNTGS AGIS
Advanced	14 mm Hg with at least 30% reduction from baseline	AGIS Odberg

Adapted from Damji KF, et al. Can J Ophthalmol 2003;38:189-97.
Note: Target IOP may need to be adjusted during the course of follow-up. Extremes of COT may be helpful in the setting of target IOP. For example, if the cornea is very thin, this may encourage a more aggressive approach with more frequent follow-up.
Canadian Ophthalmological Society evidence-based clinical practice guidelines for the management of glaucoma in the adult eye. Can J Ophthalmol 2009;44(Suppl 1):S1-S93.

Figure 2. The suggested upper limit of initial target IOP for each eye.

to prevent optic nerve damage and being overly aggressive in IOP lowering. The suggested upper limit of initial target IOP for each eye can be seen in Figure 2.³

WHY SUBTHRESHOLD LASER SHOULD BE THE TREATMENT OF CHOICE FOR GLAUCOMA PATIENTS

The latest treatment option guidelines for primary open-angle glaucoma (POAG) suggest SubCyclo diode laser is safe and effective when used earlier in glaucoma treatment. This places SubCyclo diode after laser/SLT and just before the MIGS procedures on the current stepped approach outline.⁴ In the United States alone, approximately 80% of all glaucoma cases are classified as open-angle glaucoma (OAG) with POAG being the most common.⁵ Before the introduction of SLT, the standard of care was to treat medically with IOP-lowering eye drops. An aggressive regimen of eye drops led to inflammatory conjunctiva and significantly raised the risk factor for failure of future surgical treatments like SLT.⁶ Choosing laser as a first line of therapy is now the recommended standard of care and significantly reduces a treatment regimen of preservatives found in prostaglandin analogue eye drops (Figure 3).

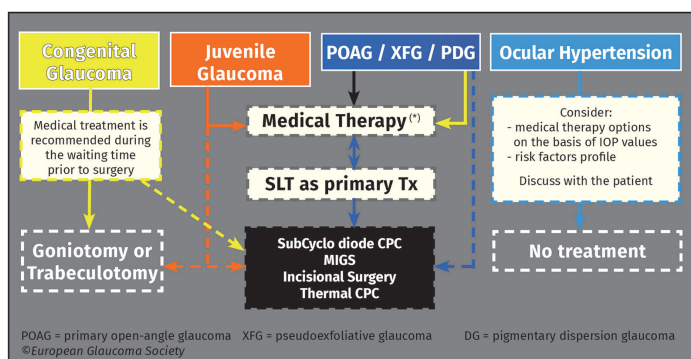


Figure 3. Treatment options under European Glaucoma Society guidelines (modified).

WHAT WE CAN EXPECT FROM SLT AS THE FIRST LINE OF TREATMENT THERAPY

The LiGHT multicenter randomized controlled trial (SLT vs eye drops for first-line treatment of ocular hypertension and glaucoma)⁷ validated SLT as a first-line treatment for OAG and ocular hypertension. Published results from more than 10 studies measuring the percentage of IOP reduction after SLT has set an average expectation between 20 to 25% (Figure 4).

MIGS STUDIES AND IOP REDUCTION RANGES

A review of a large number of MIGS studies^{8,9} has revealed a wide range of IOP reduction from 10 to 45%. These studies are wide-ranging in scope but primarily reserved for mild-to-moderate glaucoma management.

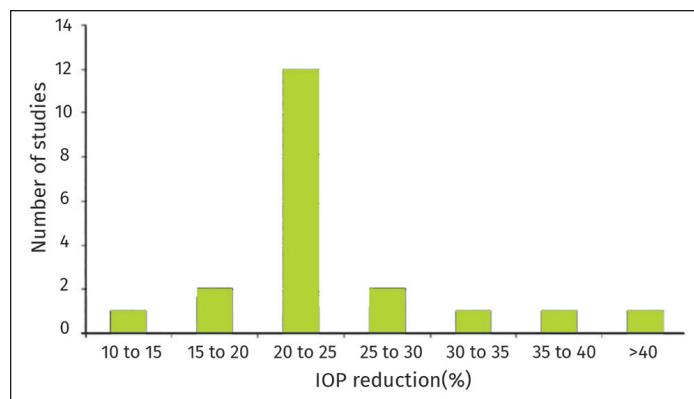


Figure 4. IOP reduction after SLT in different studies.

NEW LASER RANKINGS

Overall, our goal is to lower IOP through procedures that pose the least amount of risk to the patient. Trabeculectomy and glaucoma surgical/drainage devices are excellent at lowering IOP but come with the most significant risks.¹⁰ Thermal diode cyclophotocoagulation (CPC) is also very good at lowering IOP and is non-invasive but still poses a substantial risk.¹¹ The introduction of MIGS has expanded our treatment options for patients with mild-to-moderate OAG, being relatively lower risk compared to trabeculectomy but still being an invasive surgical procedure. Our experience with SubCyclo diode CPC supports that there are fewer adverse events, and it is very effective at reducing IOP,¹² which can be categorized as a non-invasive procedure along the same group setting as MIGS procedures. SLT provides low risk and successful IOP-lowering rates,¹³ which is why it is recommended as the preferred first-line treatment option (Figure 5).

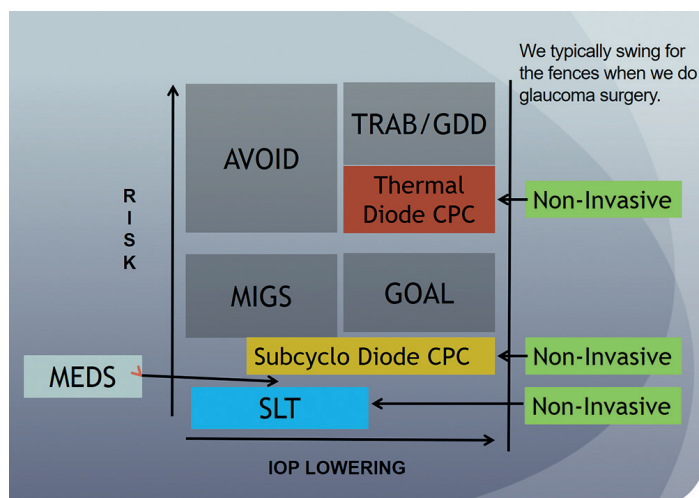


Figure 5. Paradigm shift in ranking laser treatments.

A NOVEL, NON-DESTRUCTIVE CPC PROCEDURE

Similar to POAG and SLT, we see a comparable shift toward SubCyclo laser therapy as the first line of treatment in refractive glaucoma. Before SubCyclo, cyclodestructive procedures were restricted to refractory glaucoma and caused a litany of side effects, including initial high IOP, uveitis, chronic hypotony, phthisis bulbi, and vision loss.

The VITRA 810 for SubCyclo (Quantel Medical) is the latest technology for non-destructive cyclophotocoagulation. It features a non-destructive laser procedure and can be utilized to treat open-angle, angle-closure, and even neovascular glaucoma. The technology is specifically designed to reduce aqueous humor production, selectively destroying the pigmented ciliary body, resulting in minimal coagulative necrosis. SubCyclo undertakes uveoscleral remodeling, which increases outflow through the unconventional pathway. Although SubCyclo is based on transscleral CPC (TSCPC) principles, the variances are substantial. The most crucial difference is the tissue effect that the laser produces. Unlike traditional TSCPC, SubCyclo is based on pulse technology that delivers a continuous wave of repetitive short pulses with cooling breaks, which controls thermal elevation levels and preserves structures of the ciliary body. The “cool-off” periods between treating pulses (duty cycle) eliminate the risk of overheating (leading to tissue thermal destruction) and minimize the likelihood of inflammation and other serious adverse effects (Figure 6). The preservation of the ciliary body allows future glaucoma procedures to be repeated.

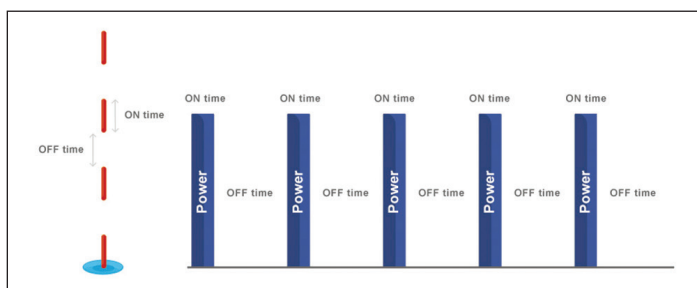


Figure 6. SubCyclo laser therapy: train pulse.

REAL-LIFE EXPERIENCES WITH SUBCYCLO

A 6-month study conducted by Lyle Newball, MD, from the Lynd Newball Clinic in San Andres Islas, Colombia¹⁴ started with an IOP of pre-treatment eyes at approximately 26 mm Hg. At the 6-month mark, results demonstrated a 29% decrease in IOP and a decrease in IOP-lowering medications from 2 to 1.6. Another study¹² out of Romania with 52 eyes resulted in a 37% IOP reduction with an 18% average reduction of medications. The significant result of this study was there was no reduction of BCVA. In a study⁴ utilizing SubCyclo with a 25% duty cycle, it was proved to be a safe and effective approach for reducing IOP in cases of refractory glaucoma and seems to be safer

than conventional TSCPC. Treatment with SubCyclo resulted in fewer complications, no tissue damage, and a low rate of vision loss over time. Furthermore, SubCyclo's showed efficacy and efficiency and offered repeatability (if necessary) without complications. These examples demonstrate that laser therapy changes the paradigm and treatment concepts, providing strong evidence that laser treatment therapy should be considered the first line of glaucoma treatment.¹⁵

These studies mentioned above raise an interesting question. Can SubCyclo diode CPC replace thermal diode laser therapy? The evidence suggests this may be the case. In a study¹⁶ comparing the effectiveness and tolerance of SubLiminal subthreshold TSCPC with a duty factor of 25% versus 31.3% with the Supra 810 SubLiminal laser (Quantel Medical), the results demonstrated a surgical success of the TSCPC 12 months after the first procedure. It also performed better in the 31.3% duty cycle group (83.5%) than in the 25% duty cycle group (65%). It is recommended to consider these options on a case-by-case basis.

SUBCYCLO DIODE LASER PATIENT SELECTION

The patient selection for SubCyclo diode laser treatment is expanding. Previously reserved for refractive glaucoma patients, we are now treating patients with the maximum tolerated medical therapy (usually prior SLT patients) and those who have had prior glaucoma surgical procedures. We are also able to consider patients who have been unwilling to have a glaucoma surgical procedure.

In a comparative report of seven recent studies¹⁷ with mid- and long-term follow-up of eyes treated with diode CPC, patients with refractory glaucoma on maximum tolerated medical therapy experienced excellent results. IOP was reduced by an average of 20 to 50%.

WHEN TO USE THERMAL DIODE CPC

As indicated, this treatment therapy is primarily reserved in refractory glaucoma when other glaucoma treatments have failed. Additionally, patients who are poor candidates for other incisional glaucoma procedures and patients with post-glaucoma shunt procedures with poor IOP control are considered candidates. It is important to note that thermal diode CPC should be limited as a last resort treatment and may be replaced by SubCyclo diode laser therapy, especially in patients with good vision, to reduce the risk of further vision loss.

THE BENEFITS OF SUBCYCLO

SubCyclo is a gentler procedure reducing thermal damage to the surrounding tissue, and it could replace thermal diode as the preferred treatment (Figure 7). It is as efficient as thermal

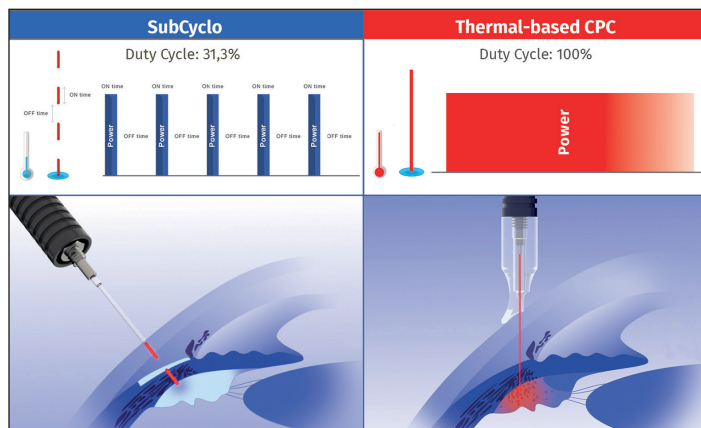


Figure 7. Duty cycle comparison: SubCyclo versus cyclodestruction.

CPC and preserves ciliary body structures. Furthermore, SubCyclo may improve uveoscleral outflow and is safe and repeatable.⁴ One of the most important benefits is the option of earlier intervention for patients with moderate-to-advanced glaucoma with good vision and visual potential. SubCyclo can be used like a MIGS procedure or in patients with MIGS failures.

CONCLUSION

How do we rank laser in glaucoma management? It is becoming increasingly clear that we should change the paradigm to use SLT as primary therapy and consider laser procedures that preserve the ocular tissues such as SubCyclo diode earlier in glaucoma management (Figure 8). Future studies may support the replacement of thermal diode with SubCyclo diode as we improve our treatment parameters. Subliminal laser procedures are safe and effective as an early treatment strategy for glaucoma. What we are learning today about the benefits of early intervention with laser therapy has the potential to usher in a new category of minimally invasive laser treatments which combines SLT with SubCyclo to replace medical and surgical treatment options, including MIGS. ■

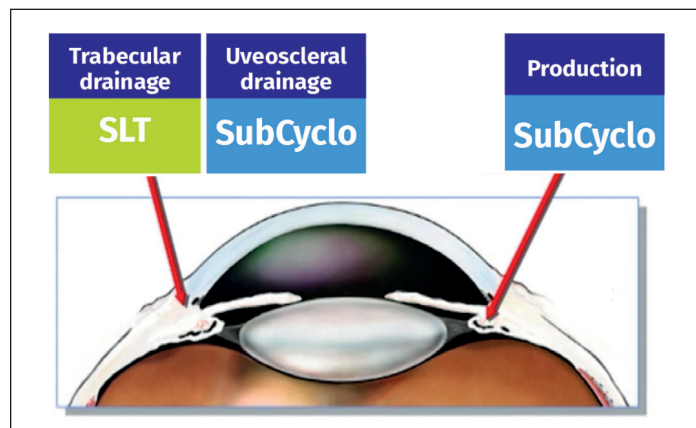


Figure 8. Glaucoma management: toward a paradigm shift.

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