

SubLiminal Cyclophotocoagulation: A New Perspective

BY LYLE NEWBALL, MD



Glaucoma is a leading cause of irreversible blindness affecting approximately 60 million people globally 40 years of age and older.¹ Glaucoma is a disease that cannot be ignored, and the need for significant changes in how we diagnose,

manage, and treat must be examined and applied whenever possible. With currently available advancements, it is simply unacceptable to wait for a patient's vision to deteriorate to operate because traditional glaucoma surgical methods have not met acceptable risk-to-benefit assessments.

Fortunately, advancements in how we approach surgical protocols, such as the SubLiminal cyclophotocoagulation (SubCyclo) procedure (Quantel Medical), have changed the treatment landscape. I have been using the SubCyclo procedure for nearly 1 year, and my experience has been very positive. It is important to outline how we utilized SubCyclo and compare it to other options, including traditional cyclophotocoagulation and cyclodestructive procedures (and its varying modalities) used in the treatment of glaucoma.

SubCyclo is one of the latest technologies that uses a non-destructive 810-nm laser to treat open-angle, angle-closure, and even neovascular glaucoma. The technology is specifically designed to reduce the production of aqueous humour, selectively destroying the pigmented ciliary body, resulting in minimal coagulative necrosis. Another benefit of the technology is that it undertakes uveoscleral remodeling, which increases outflow through the unconventional pathway.

SubCyclo is based on pulse technology that delivers a continuous wave of repetitive short pulses with cooling breaks, which controls levels of thermal elevation and preserves the structures of the ciliary body.² The "cool-off" period between pulses, called the *Duty Cycle*, eliminates the risk of overheating, which causes coagulative necrosis in the eye and minimalizes the likelihood of patients developing phthisis bulbi or hypotension (Figure 1).

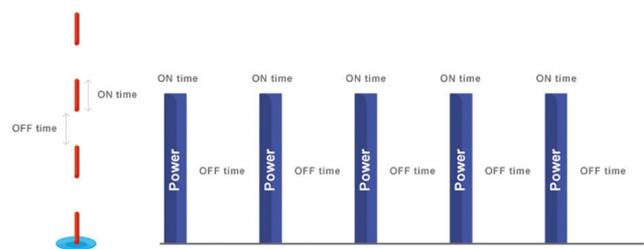


Figure 1. SubCyclo pulse technology graph.

THE DUTY CYCLE

The duty cycle is the relationship between the time we deliver the laser and the time of the breaks in between. As this can be adjusted, it is best used at 31.3 and 25%.³ This is evident in a study of patients with evolving moderate-to-severe glaucoma who were resistant to previous surgical treatments. In this particular study, laser settings were programmed as follows: power 2000mW, "on" time 0.63 ms, "off" time 1.9ms, and 25% duty cycle per 100 seconds to each eye.³ The results proved that SubCyclo at 25% duty cycle was safe and effective for reducing IOP. SubCyclo was also reported to be safer than conventional transscleral cyclophotocoagulation.³

Setting the duty cycle between 31.3 and 25% allows the use of the laser in cases of advanced or terminal glaucoma. We have seen many multifaceted patient cases where SubCyclo is determined to be the safest and most efficient surgical treatment plan. These cases include patients with ocular surface disease, patients who are intolerant to drugs, or patients where previous medical or surgical interventions have failed and there is a need to quickly reduce IOP.

In our own practice, when presented with cases where there is no associated disease or inflammation, we set the duty cycle to 31.3%. For patients who may have already been treated, and

who we want to treat again, or for patients who have a history of ocular inflammation but good VA, we recommend using the 25% duty cycle. The SubCyclo's wavelength is 810 nm with a power of 2000 mW. Depending on the case and the outcome you target, adjustments should be made to the duty cycle rather than power.

Treatment duration lasts 80 seconds for each half of the eye: 80 below and 80 above, giving us a total of 160 seconds. This is very important and what I personally recommend. Additionally, I prefer to use transillumination to mark the limbus, giving me the exact position of the ciliary body. This process is also effective in cases where there is disorganization of the anterior segment (i.e. corneal transplant, etc.), and we cannot identify the location of the limbus. With a phaco transilluminator, you can put it on the eye surface and look for the shadow. This means we have found the ciliary body, and it gives us a target for the laser treatment.

I have found that using sub-Tenon block in place of topical anesthesia reduces patient discomfort and pain. Peribulbar or retrobulbar are also acceptable anesthesia for this procedure. The bottom line is that we always perform SubCyclo under sedation.

A CASE STUDY

A patient in our clinic presented with neovascular glaucoma and significant inflammation. We determined that SubCyclo was the best course of treatment. To start, we marked the location of the ciliary body and mapped out the lower 160°, which should provide an accurate field. One of the most important tips I have learned is to respect the 3-to-9 meridians. This is where you will find the neurovascular bundle. If this area is lasered, not only will you cause more inflammation, but it may cause mydriasis in the postoperative period. Be careful not to confuse the 3-to-9 meridian due to cyclotorsion that occurs when the patient is in surgical position. I recommend using a pendulum marker to ensure the line is at 180°.

Place the sub-Tenon block in the sub-Tenon space otherwise chemosis will occur, and you will lose the gap in which you marked the ciliary body. Slide the probe over the upper 160° while keeping the probe completely perpendicular to the eyeball, so that you can find the ciliary body. I have found that approaching this step by quadrant (80°) is much more effective, and there is less of a concern to keep your hands at an angle. Simply repeat for each quadrant. For this particular case, due to the neovascular glaucoma and inflammation, we set the SubCyclo at 25% duty cycle.

Postoperatively, we use steroids, which I typically taper down, reducing the dose each week. I start with a steroid four times per day for week 1, three times per day for week 2, and so forth. It is important to assess the inflammatory reaction in the anterior chamber to adjust the steroid treatment schedule accordingly.

Real-Life Experience

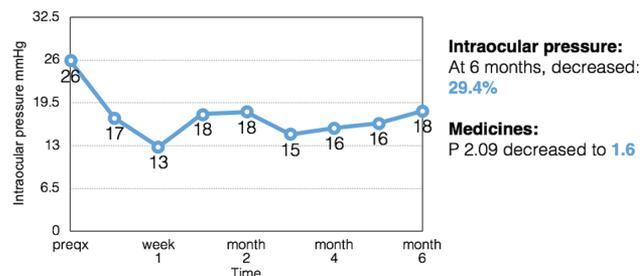


Figure 2. Six-month results using the 31.3 to 25% duty cycle.

The other important postoperative protocol is to discontinue all previous glaucoma drugs, so that you can assess the real effect of the SubCyclo treatment procedure. Other physicians I know prefer to use ocular hypotensive drugs for 1 month before discontinuing. If I need to start hypotensive drugs because the pressure is high, I will start based on the IOP value. I also always check for mydriasis and uveitis in the postoperative period.

CONCLUSION

My overall experience with SubCyclo has been positive, and it has proven to be a safe and efficient surgical treatment. We have seen results, on average, of IOP reduction by 29%, and we have reduced the number of drugs from 2.09 to 1.6 (Figure 2). These results include patients with neovascular glaucoma, including painful blind eyes that we have treated using both the 31.3 and 25% duty cycle. In my opinion, SubCyclo is just as efficient as treatment based on cyclophotocoagulation without the side effects and complications. This is primarily due to the rest periods and tissue cooling period that do not risk destruction of the ciliary body itself. This treatment option can also be repeated to ensure the target result is met for each patient. ■

1. Probability of blindness from glaucoma has nearly halved [news release]. American Academy of Ophthalmology. Available at: <https://www.aaopt.org/newsroom/news-releases/detail/probability-of-blindness-from-glaucoma-has-nearly-> Accessed September 20, 2019.
 2. New laser therapy for advanced and end-stage glaucoma. Quantel Medical website. Available at: <https://www.quantel-medical.com/products/ophthalmology/laser/vitra-810>. Accessed September 20, 2019.
 3. Benhatchi N, Bensmail D, Lachkar Y. Benefits of subcyclo laser therapy guided by high-frequency ultrasound biomicroscopy in patients with refractory glaucoma. *J Glaucoma*. 2019;28(6):535-539.

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