

Micropulse Trans-Scleral Cyclophotocoagulation: A New Innovative Technology in Glaucoma Management

Tanuja Kate, M.S.

Rajas Eye & Retina Research Centre, Indore, India



Abstract : Glaucoma is a progressive optic neuropathy and is the leading cause of irreversible blindness worldwide.¹ The treatment of glaucoma aims to lower the intraocular pressure (IOP) by using medications, lasers and incisional surgery. Laser treatment in Glaucoma till now was in the form of YAG laser peripheral iridotomy, Laser trabeculoplasty and highly destructive cyclo photo coagulation using G probe.

Diode laser micro pulsing has been shown in previous clinical and experimental studies to be useful in achieving targeted tissue damage and minimizing collateral thermal injury to adjacent tissues.^{2,3,4} Micropulse diode trans scleral cyclo photocoagulation (MP-TSCPC) has emerged as a new treatment option for glaucoma. The new **Cyclo G6, Glaucoma laser system** (Diode laser 810nm) is an innovative cyclo photocoagulation system **with unique patented Micro Pulse technology**. The Micro Pulse technology makes this laser safe and efficacious.⁶

This article would discuss mode of action, indications, procedural considerations and advantages of MP-TSCPC. At last, the results of our own prospective study would be mentioned. Our study included 40 eyes of 38 patients who underwent MP-TSCPC with the new Cyclo G6, Glaucoma laser system. We included varied types of glaucoma. At 6 months follow up, the mean IOP reduced by 43.4% which was statistically significant with a P value of 0.0001. The mean no. of medication reduced from 3.2 at baseline to 1.94 at 6 months follow up which again was statistically significant (P value 0.001)

Thus, this newer **Cyclo G6, Glaucoma laser system with Micro Pulse technology** is a gentle, low risk option to control IOP and reduce the number of medication needed. As compared older G probe, MP3 provides a kinder, gentler approach with identical efficacy yet improved safety profile.

Introduction :

Glaucoma is a progressive optic neuropathy and is the leading cause of irreversible blindness worldwide.¹ The treatment of glaucoma aims to lower the intraocular pressure (IOP) by using medications, lasers and incisional surgery. Laser treatment in Glaucoma till now was in the form of YAG laser peripheral iridotomy, Laser trabeculoplasty and highly destructive cyclo photocoagulation using G probe.

Diode laser micro pulsing has been shown in previous clinical and experimental studies to be useful in achieving targeted tissue damage and minimizing collateral thermal injury to adjacent tissues.^{2,3,4} In contrast to conventional laser delivery where a continuous train of high intensity energy is delivered, micropulse laser application delivers a series of repetitive short pulses of energy with rest periods in between pulses.⁵ Micropulse diode trans scleral cyclo photocoagulation (MP-TSCPC) has emerged as a new treatment option for glaucoma. The new **Cyclo G6, Glaucoma laser system** (Diode laser 810nm) is an innovative cyclo photocoagulation system **with unique patented Micro Pulse technology**. The Micro Pulse technology makes this laser safe and efficacious.⁶



Figure 1 : Cyclo G6 Glaucoma Laser System

Micropulse trans scleral cyclophotocoagulation (MP-TSCPC) was **approved by FDA in January 2015**.

Mode of action

In **MP-TSCPC**, a fractionated continuous wave diode laser is



Figure 2 : Micro Pulse P3 (Pars Plana Probe)

employed which targets melanin in a non destructive way in ciliary body tissues thus reducing aqueous production. Also, possibly, it increases uveo scleral out flow. In MicroPulse technology 31.3% duty cycle signifies that the laser is off 68.7% of the time, thereby avoiding focal heating and burning of the tissue. The technique of gliding the MP3 device back and forth over 1 hemisphere of the ciliary body results in a slow, steady application of laser energy. Micropulse delivery allows energy to build up to the coagulative threshold in targeted pigmented tissues during the “on” cycles. Adjacent non-pigmented tissue cools during the “off” cycle and does not reach the coagulative threshold. Collateral tissue damage is therefore minimized, thus resulting in fewer complications without sacrificing efficacy.

Where can it be used ?

A wider range of patients can be treated with the MP-TSCPC procedure. This is used for **patients who are often on maximum medical therapy** or for whom other treatments have failed.⁷ It can be used in place of traditional surgery and even together with cataract surgery. Those who are not good surgical candidates for one reason or another may do well with this procedure. Patients who may have bleeding problems or who would have a difficult time with care after traditional glaucoma surgery are also good candidates.

So, the **indications are :**

1. Complicated glaucomas (Silicone oil induced, Uveitic, Post keratoplasty and neo vascular glaucoma). However, in neo vascular glaucoma, it doesn't seem to have promising results.
2. Patients who are not fit for surgical intervention/who refuse surgical intervention
3. Refractory glaucomas⁸
4. Patients with conjunctival scarring
5. Failed trabeculectomy
6. May be a promising treatment for early glaucomas once

more and more studies are available,¹⁰

What are the advantages of this technology ?

1. Non-incisional
2. Non invasive laser procedure
3. Less of follow up
4. Repeatable
5. FDA approved

How to perform the procedure ?

Anaesthesia : Retrobulbar anaesthesia / Peribulbar anaesthesia

I prefer to perform the procedure in operating room. The laser settings used are 2000mw energy, 31.3% duty cycle which translates to 0.5 ms of on-time and 1.1 ms of off-time. The laser probe's fiber-optic tip is applied with steady pressure in a continuous sliding arc (painting) motion. The probe (Micropulse pars plana probe) is put perpendicular to the globe in such a way that probe notch is towards the limbus. The tip is designed in a way to fit and adhere to the ocular globe at 3mm posterior to the limbus. MP3 probe is applied in superior and inferior hemispheres for a total of 160 seconds that is 80 seconds in each hemisphere. The MP3 probe is applied directly posterior to the limbus and moved every 10 seconds. The voice countdown timer feature on the laser makes this process very easy and efficient. We have to be careful in **avoiding the laser treatment at 3 and 9 clock hours** as it could affect ciliary nerves and therefore leading to pain. During treatment areas of scleral thinning are avoided. At the conclusion of surgery, 1% atropine is administered. Post laser treatment regimen includes topical steroid in tapering dose for a month. Also, antiglaucoma treatment is to be continued and gradually withdrawn depending on IOP level.

Our experience :

We evaluated 6 month results in a prospective, non comparative interventional case study of 40 eyes of 39 patients of various types of moderate to advanced glaucoma who underwent **MP-TSCPC** at Rajas Eye & Retina Research Centre, INDORE (M.P.) between March 2018 and October 2018. The patients had either the uncontrolled IOP with maximum medical therapy or they were non compliant for multiple medication. We included Primary Open Angle Glaucoma (POAG), Developmental Glaucoma, Neovascular Glaucoma (NVG), Post Traumatic Glaucoma, Refractory Paediatric Glaucoma, Silicone Oil Induced Glaucoma, Post Keratoplasty Glaucoma, Co-existing Cataract and POAG, Failed Trabeculectomy and Chronic Angle Closure Glaucoma (CACG). The cases with thin sclera were excluded from the study.

The mean baseline IOP was 33.8 mmHg which reduced by 46%, 52.4%, 47.2%, 42.5%, 44.2% and 43.4% on follow up days

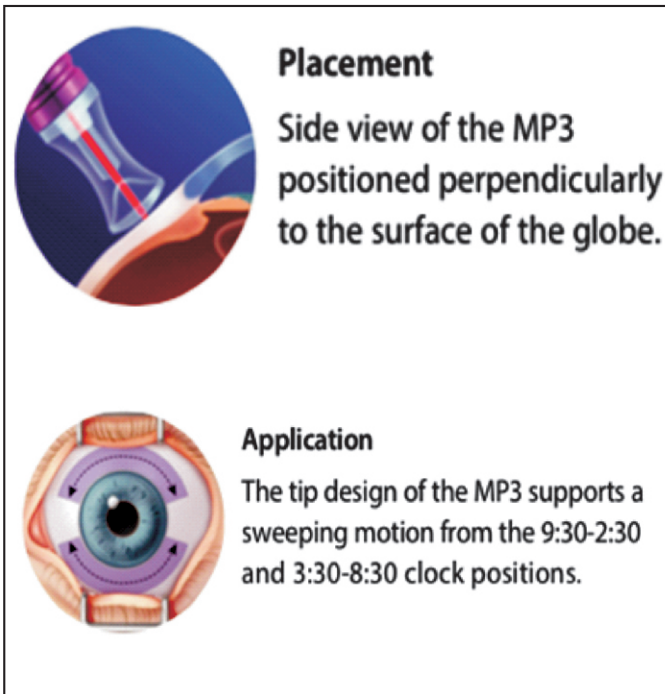


Figure 3 : Placement and Application of MicroPulse Pars Plana Probe

1,7,15,1month,3 months and 6 months respectively. The statistical analysis of observed IOP from baseline to follow up visits was done by computed Wilcoxon Signed rank test and the P value at all time points was less than 0.0001 meaning thereby that there was a significant reduction in IOP following **MP-TSCPC**.

The mean no. of medication reduced from 3.2 at baseline to 1.94 at 6 months follow up.(P value 0.001)

Thus in our study there was significant decrease in IOP and number of medication at variable follow-up periods. No major side effects were noted.

Conclusion :

Similar to continuous wave TSCPC, MP-TSCPC eliminates the need for a sterile operating room, provides less post-operative activity restriction, virtually no risk of infection and is a portable technology. **MP-TSCPC** is a non-invasive option for range of glaucoma patients and also it is a good alternative for managing co-existing cataract and glaucoma. **MP-TSCPC** using the MP3 probe and the new Cyclo G6 glaucoma laser system has been shown to have excellent safety and efficacy

rates. **MP-TSCPC** is an effective modality of managing glaucoma cases(Especially refractory glaucoma) without significant side effects as used to be seen with age old continuous pattern trans scleral cyclophotocoagulation." Thus, this newer **Cyclo G6, Glaucoma laser system with Micro Pulse technology** is a gentle, low risk option to control IOP and reduce the number of medication needed. As compared older G probe,MP3 provides a kinder, gentler approach with identical efficacy yet improved safety profile.

References:

1. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020.BrJ Ophthalmol 2006; 90:262–267.
2. Nguyen AT, et al. Early Results of Micro Pulse Trans scleral Cyclo photocoagulation for the Treatment of Glaucoma Eur J Ophthalmol 2019; 11206 72119839303 Published online ahead of print
3. Sarrafpour SS, et al. Micro Pulse Trans sclera Cyclo photocoagulation: A Look at Long Term Effectiveness and Outcomes Ophthalmology Glaucoma 2019 Published online ahead of print
4. Yelenskiy A, et al. Patient Outcomes Following Micro Pulse Trans scleral Cyclo photocoagulation Intermediate-term Results J Glaucoma 2018; 27 (10):920925
5. Pastor SA, Singh K, Lee DA, et al. Cyclo photocoagulation: a report by the American Academy of ophthalmology. Ophthalmology. 2001; 108:2130–2138.
6. Grippo T, et al. Efficacies and Safety of Micro Pulse Trans sclera Cyclo photocoagulation in Glaucoma Arch Soc Esp Ophthalmol 2018; 93 (12):573579
7. Zaarour K, et al. Outcomes of Micro Pulse Trans scleral Cyclo photocoagulation in Uncontrolled Glaucoma Patients J Glaucoma 2019;28(3): 270-275
8. Tan AM, Chockalingam M, Aquino MC, Lim ZI, See JL, Chew PT. Micropulse trans scleral diode laser cyclo photocoagulation in the treatment of refractory glaucoma. Clin Exp Ophthalmol. 2010; 38(3):266-272.
9. Venkata N.V. Varikuti, Parth Shah, Oshin Rai BS, Ariel C. Chaves, Alex Miranda, Boon-Ang Lim, Syril K. Dorairaj, Sandra F. Outcomes of Micro pulse Trans scleral Cyclo photocoagulation in Eyes with Good Central Vision Sieminski Journal of Glaucoma Publish Ahead of Print DOI:10.1097/IJG.0000000000001339
10. Shah P, Bhakta A, Vanner E, et al. Safety and Efficacy of Diode Laser Trans scleral Cyclophotocoagulation in Eyes With Good Visual Acuity. J Glaucoma.2018; 27(10):874-879.
11. AquinoMCD.Micropulse versus continuous wave trans-scleral diode cyclophotocoagulation in refractory glaucoma: a randomized exploratory study. Clin Experiment Ophthalmol. 2015;43(1):40-46.