Safety and Efficacy of Micropulse Transscleral Cyclophotocoagulation In Eyes With Good Central Vision

Parth Shah[1] DO, Kyle Batton[2] BS, Alex Miranda[1] MD, Boon-Ang Lim[2] MD, Syril K. Dorairaj[2] MD, Sandra F. Sieminski[1] MD

1. *Ross Eye Institute, University at Buffalo, Buffalo, NY.* ***2.*** *Department of Ophthalmology, Mayo Clinic, Jacksonville, FL.*

Introduction

Transscleral Cyclophotocoagulation (TS-CPC) is an effective treatment in the management of glaucoma. It causes ablation of the ciliary body epithelium, leading to lower aqueous humor production and a reduced IOP. However, the risk of vision threatening complications from the traditional diode laser has limited the use of TS-CPC to those patients with poor visual potential or patients who are poor candidates for incisional surgery.[1]

MicroPulse Trans Scleral Cyclophotocoagulation (MP-TSCPC) is an innovative approach where the laser is delivered through a series of repetitive short pulses of laser energy (on cycle) followed by rest periods (off cycle). It has been shown to be both safe and effective in the treatment of refractory glaucoma,[2,3,4] while causing less intraocular inflammation and less vision loss than diode TSCPC.[4] However, the outcomes of MP-TSCPC among those patients with good central vision has not been previously reported.

Purpose

To evaluate the outcomes of MP-TSCPC (MicroPulse-P3, Iridex Corporation, Mountain View, CA, USA) in eyes with a baseline visual acuity of 20/60 or better.

Methods

Patients with a baseline best corrected visual acuity (BCVA) of ≥ 20/60 who underwent treatment with MP-TSCPC at the Ross Eye Institute (Buffalo, NY) and the Mayo Clinic (Jacksonville, FL) from Nov 2016 to Jan 2018 with a minimum of 3 months follow up were retrospectively reviewed. The research was conducted in accordance to Declaration of Helsinki.

The Cyclo G6 trans scleral diode laser with a P3 probe was used for laser delivery. All patients were treated with a power of 2000mW with a mean laser duration of 78.94±5.21 sec in superior hemifield and 79.17±5.39 sec in the inferior hemifield.

The data recorded during pre and post operative patient visits were visual acuity (VA), IOP, number of medications and post operative complications.

Results

60 eyes of 46 patients (mean age 69.6 ± 15.8 years) underwent MP-TSCPC performed at 2000 mW with a laser duration of 80 seconds per hemifield. Mean follow-up duration was 10.2 months ± 3.1 months).

Table 1. Intraocular Pressure, Glaucoma Medications and Visual Acuity at baseline and after Micropulse Transscleral Cyclophotocoagulation

	Baseline (n=60)	Month 1 (n=60)	Month 3 (n=60)	Month 6 (n=56)	Month 12 (n=44)	Last f/u (n=60)
Intraocular Pressure						
Mean ± SD	25.5 ± 5.8	16.3 ± 4.4	15.1± 4.1	15.3 ± 3.4	15.2 ± 3.7	14.8 ±4.0
Mean Decrease[b] (%)		34.2 ± 21.1	38.2 ± 18.6	37.9 ± 16.9	41.3 ± 17.7	39.8 ± 19.2
P Value[c]		<0.0001*	<0.0001*	<0.0001*	<0.0001*	<0.0001*
IOP Reduction ≥20% (%)		42 (70%)	52 (86.7%)	49 (87.5%)	38 (86%)	49 (81.2)
Glaucoma Medications						
Mean +/- SD	3.6 ± 0.6	2.6 ±.8	2.7 ± 0.7	2.7± 0.7	2.68± 0.7	2.8 ± .8
Mean Decrease[b]		0.95 ± 0.5	0.87 ± 0.5	0.8 ± 0.6	.84± 5	0.78 ±.6
P Value[c]		<0.0001*	<0.0001*	<0.001*	<0.001*	<0.001*
Reduction of ≥ 1 medications (%)		49 (81.7%)	50(83.3%)	45 (80%)	36(82%)	46 (77%)
LogMAR Visual Acuity[a]						
Mean +/- SD	0.16 ± 0.14	0.18 ± 0.14	0.16 ± 0.13	0.19 ± 0.2	0.2 ± 0.18	0.19 ± 0.17
Mean Decrease[b]		0.02 ± 0.1	0.005 ± 0.1	0.02 ±0.14	0.03 ±0.2	0.02 ± 0.1
P value[c]		0.16	0.65	0.19	0.19	0.12
Loss to HM[d]			1	0	0	0
Loss to CF[e]			0	1	0	2
Loss ≥ 2 lines		4 (6.6%)	4 (6.6%)	6 (10.7%)	8 (18.1%)	8 (13.3%)

[a]LogMAR, logarithm of minimum angle of resolution. [b] Represents mean decrease of value from baseline. [c]P-Value was calculated using Wilcoxon Signed-Rank test for whether the difference from baseline is equal to zero (0). * indicates statistically significant value. ± indicates one standard deviation. [d]HM, hand motion; [e]CF, count fingers.

Table 2. Baseline Demographics of Eyes Undergoing Micropulse Transscleral Cyclophotocoagulation (n=60)

Variables		Incidence
Race	Caucasian	85%
	African-American	12%
	Other	3%
Glaucoma Type	POAG	85%
	CACG	8%
	XFG	0%
	Other	7%
Lens Status	Phakic	42%
	Psuedophakia	57%
	Aphakic	2%
Prior SLT/ALT laser	none	42%
	SLT	55%
	ALT	3%
	CPC	0%
Prior Glaucoma Surgery	none	77%
	Trabeculectomy	17%
	Tube Shunt	7%
	Both	2%

Table 3. Complications after MP-TSCPC[a] (n=60 patients)

Variable	Incidence
Cataract Progression[b]	16.0%
Iritis	6.6%
Cystoid Macular Edema	3.3%
Corneal Edema	1.6%
Hypotony	1.6%
Hypotony Maculopathy	1.6%
Sympathetic Ophthalmia	0.0%
Vitreous hemorrhage	0.0%
Hyphema	0.0%
Pthisis Bulbi	0.0%
Necrotizing Scleritis	0.0%
Neovascularization of iris	0.0%

[a] All complications, except sustained iritis and vision loss ≥2 lines, were complications that occurred at any point during the follow-up period. [b] Cataract progression was defined as an increase in the cataract grade over follow-up duration as based on slit-lamp examination. Percentage is based on incidence of cataract progression among only phakic patients at baseline (n=25).

Results: *Highlights*

- 81.2% of patients had an IOP reduction of ≥ 20% from baseline at last follow-up.
- 77% of patients had a reduction of ≥ 1 glaucoma medications used from baseline at last follow-up.
- No statistically significant vision loss from baseline at follow-up interval.
- 77% of patients had no prior incisional glaucoma surgery.

Conclusions

MP- TSCPC has been increasingly reported in the literature to cause a significant reduction in both IOP and glaucoma medications. However, a majority of prior studies to date have involved patients with refractory glaucoma.[2,3,4]

Although clinicians are concerned about the vision loss based on prior results of traditional diode CPC, the majority of patients in our study lost less than or equal to 1 line of vision. Among the 8 patients that lost ≥ 2 lines, 4 had cataract progression, 1 had history of CME prior to MP-TSCPC, and 3 had unexplained vision loss. These results are more favorable than reports of diode CPC in patients with good central vision,[5] and comparable to incisional glaucoma surgery.[6]

MP-TSCPC also provides logistical advantages compared to incisional glaucoma surgery including technical ease, shorter surgical time, portability, and generally improved patient comfort post-operatively.[7]

MP-TSCPC is safe and effective, and should be considered in patients with good central vision as an alternative to incisional glaucoma surgery.

Bibliography

1. Mistlberger A, Liebmann JM, Tschiderer H, Ritch R, Ruckhofer J, Grabner G. Diode laser transscleral cyclophotocoagulation for refractory glaucoma. J Glaucoma. 2001. 10(4):288–293
2. Emanuel ME, Grover DS, Fellman RL, et al. Micropulse Cyclophotocoagulation: Initial Results in Refractory Glaucoma. J Glaucoma. 2017. 26 (8): 726-729.
3. Williams AL, Moster MR, Rahmatnejad K, et al. Clinical efficacy and safety profile of micropulse transscleral cyclophotocoagulation in refractory glaucoma. J Glaucoma. 2018. 27 (5): 445-449
4. Aquino MC, Barton K, Tan AM, et al. Micropulse versus continuous wave transscleral diode cyclophotocoagulation in refractory glaucoma: a randomized exploratory study. Clin Exp Ophthalmol. 2015. 43 (1): 40-46.
5. Rotchford AP, Jayasawal R, Madhusudhan S, Ho S, King AJ, Vernon SA. Transscleral diode laser cycloablation in patients with good vision. *Br J Ophthalmol.* 2010;94(9):1180-1183.
6. Gedde SJ, Herndon LW, Brandt JD, Budenz DL, Feuer WJ, Schiffman JC. Surgical complications in the Tube Versus Trabeculectomy Study during the first year of follow-up. *Am J Ophthalmol.* 2007;143(1):23-31.
7. Egbert PR, Fiadoyor S, Budenz DL, Dadzie P, Byrd S. Diode laser transscleral cyclophotocoagulation as a primary surgical treatment for primary open-angle glaucoma. *Arch Ophthalmol.* 2001;119(3):345-350.