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Outcomes of MicroPulse Cyclophotocoagulation in Adult Glaucoma Patients

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Posterboard#: B0180

Abstract Number: 702 - B0180

AuthorBlock: *Eric Grisham[1], Sara Hooshmand[1], Jella Angela An[1,2]*
[1]University of Missouri, Columbia, Missouri, United States; [2]Ophthalmology, Mason Eye Institute, Columbia, Missouri, United States;

DisclosureBlock: Eric Grisham, None; Sara Hooshmand, None; Jella Angela An, None;

Purpose
MicroPulse Transscleral Cyclophotocoagulation (mTSCPC) is used to reduce intraocular pressure (IOP) and medication burdens in glaucoma patients. However, there is no meta-analysis comparing various laser settings and the resulting potential outcomes of mTSCPC in peer-reviewed journals to date. We performed a systematic review of all published peer-reviewed literature to evaluate efficacy and safety of mTSCPC. Secondary goal was to identify the optimal setting for the IRIDEX MicroPulse P3™ device resulting in the greatest decreases in IOP and in number of ocular hypotensive medications with the least number and severity of postoperative complications.

Methods
Two PubMed searches were performed using combinations of keywords and Medical Subject Headings evaluating safety and efficacy related to mTSCPC. Results from randomized controlled trials and review articles discussing treatment outcomes of mTSCPC procedures were included in this analysis. Reported laser settings were compared against weighted averages of preoperative and postoperative IOP and in the number of ocular hypotensive medications. Definite success was defined as an IOP reduction of 20% or more without additional medication or IOP lowering procedures, or a reduction of medication while remaining at target IOP of 18mmHg or lower.

Results
The mean number of eyes from studies analyzed at 3, 6 and 12 months was 49.3. The mean total duration of laser application was 194.44 s (SD±87.83) and the mean total weighted laser power was 1992mW. Standard weighted mean differences in IOP were -1.94 (SD±0.61), -2.04 (SD±0.53), and -2.24 (SD±0.58) for 3, 6 and 12-month follow-ups, respectively ($p<0.0002$). After 1 month of follow up, a significant effect was observed in changes in IOP-lowering medications. However, there was no statistically significant decrease in the number of medications 6 and 12 months post-operatively ($p=0.11$). Reported laser power settings did not vary statistically between studies and the effect of laser energy settings could not be measured.

Conclusions
Overall, our meta-analysis of mTSCPC literature showed that it is a safe and effective IOP-lowering procedure for many types of glaucoma patients. We identified that a number of laser settings which may be relevant to treatment outcomes are not consistently reported and studies may have excluded relevant outcomes and settings relevant to this study that were not the focus of their investigation.

Layman Abstract (optional): Provide a 50-200 word description of your work that non-scientists can understand. Describe the big picture and the implications of your findings, not the study itself and the associated details.

Micropulse® Cyclophotocoagulation (mTSCPC) is a safe and effective laser procedure used to lower the pressure in the eyes of patients with glaucoma. Given the novelty of this technology, there is a paucity of peer-reviewed journals reporting on this procedure. We performed a systematic review of all the peer-reviewed journals reporting on safety and effectiveness of mTSCPC to better understand the outcome of mTSCPC. We determined that a number of laser settings which may be relevant to treatment outcomes were not consistently reported and studies may have excluded relevant outcomes and settings that were not the focus of their investigation. We believe that a randomized controlled trial with longer follow-up periods and more thorough evaluation and reporting of mTSCPC laser settings and outcomes is required to further evaluate the safety and prognostic factors associated with mTSCPC.

Table 1. Patient Characteristics and Outcome Measures

Continuous Variable	Weighted Average	SD		
Mean Age* (years)	64.48	0.49		
Age Range* (years)				
Mean follow-up‡ (months)	14.20	2.41		
Mean pre-IOP (7 studies)	26.16	0.90		
Categorical Variable	**Weighted Frequency**	**SD**	**Weighted Average**	**% of total**
Sex (512 eyes)				
Male	0.5475	0.32	35.04	53.21
Female	0.4387	0.35	28.07	47.79
Ethnicity§ (300 eyes)				
African American	0.2045	0.23	20.45	20.46
Asian	0.0008	0.23	0.08	1.89
Hispanic	0.1168	0.29	11.58	23.86
White	0.5243	0.20	52.43	53.41
Multiracial/Unspecified	0.0007	0.08	0.07	0.38
Glaucoma type§‖ (622 eyes)				
POAG	0.0344	0.83	2.14	46.95
CACG	0.0020	0.21	0.12	4.50
NVG	0.0109	0.68	0.68	8.20
Uveitic	0.0019	0.12	0.12	1.45
Pseudoexfoliation	0.0014	0.08	0.08	3.05
Aphakic	0.0011	0.12	0.07	0.80
Congenital/Juvenile	0.0011	0.12	0.07	0.80

* Bolded items represent characteristics or outcomes that had sufficient variability or sample size for comparison or consideration of success.
† Not reported
‡ Mean follow-up was calculated from 251 eligible eyes; eyes not reported with associated standard deviations were excluded.
§ Only categories shared among three or more studies were represented in Table 1
‖ Aside from POAG, no more than two studies at a time reported the same glaucoma type. Results from this study represent estimated outcomes based on cumulative reporting for glaucoma types

POAG = Primary Open Angle Glaucoma; CACG = Chronic Angle Closure Glaucoma; NVG = Neovascular Glaucoma

TABLE 2. SUMMARY OF mTSCPC DOSING IN THE LITERATURE

Clinical Studies	mTSCPC Power	mTSCPC Mean Total Duration	mTSCPC Duty cycle
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2000 mW	[illegible]	[illegible]
[illegible]	2000 mW	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2000 mW	[illegible]	[illegible]
[illegible]	2000 mW	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

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