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A STUDY ON SINGLE-SITTING PAN-RETINAL PHOTOCOAGULATION USING MULTISPOT LASER FOR NEWLY DIAGNOSED PROLIFERATIVE DIABETIC RETINOPATHY

Ophthalomology

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ABSTRACT

Pan-retinal photocoagulation (PRP) is a cornerstone treatment for proliferative diabetic retinopathy (PDR), traditionally performed in multiple sessions. Recent advancements, such as the multispot laser, allow for single-sitting PRP, which may improve patient compliance and streamline care. This study evaluates the safety and efficacy of single-sitting PRP in newly diagnosed PDR patients. A prospective, interventional study was conducted at Father Muller Medical College, Mangalore, involving 35 eyes of patients aged ≥40 years with newly diagnosed PDR. Patients underwent comprehensive ophthalmic evaluation and single-sitting PRP using a multispot laser. Outcomes included changes in best-corrected visual acuity (BCVA), macular thickness (OCT), neovascularization regression, and patient-reported satisfaction. Follow-ups were conducted at 2 weeks, 1 month, and 3 months. BCVA improved significantly, with 60% of eyes achieving ≥6/18 vision at 1 month ($p = 0.020$). Neovascularization regressed in 67.6% of cases within 1 month, with stabilization achieved in 91.4%. No significant macular edema or adverse events were observed, and pain scores were minimal (mean: 0.89 ± 0.53). Higher HbA1c levels correlated with slower neovascular regression ($p = 0.035$). Patient satisfaction was high (94%), citing reduced anxiety and convenience. Single-sitting PRP with a multispot laser is safe and effective for managing PDR, offering significant improvements in BCVA, high neovascular regression rates, and minimal discomfort. This approach enhances patient adherence and reduces the treatment burden, especially in resource-limited settings. Future research should explore long-term outcomes and potential combination therapies.

KEYWORDS

Diabetic Retinopathy, Proliferative Diabetic Retinopathy, Pan-Retinal Photocoagulation, Multispot Laser, Single-Sitting PRP, Visual Acuity, Neovascularization.

INTRODUCTION

Diabetic retinopathy (DR) is a microvascular complication of diabetes and a leading cause of preventable blindness worldwide. Its most severe form, proliferative diabetic retinopathy (PDR), is characterized by abnormal neovascularization, which increases the risk of vitreous hemorrhage and tractional retinal detachment, leading to irreversible vision loss (1). The global burden of DR is expected to rise with the increasing prevalence of diabetes, necessitating effective and accessible treatment options (2).

Pan-retinal photocoagulation (PRP) has been the cornerstone of PDR treatment for decades. Traditional PRP, administered in multiple sessions, reduces retinal ischemia by ablating peripheral retinal tissue, thereby decreasing the drive for neovascularization (3). However, the multi-session approach presents challenges, including poor patient adherence, increased treatment burden, and logistical issues (4).

Recent advancements in laser technology, such as the multispot laser, have facilitated single-sitting PRP, which promises to streamline treatment and improve patient compliance (5). Despite these advantages, concerns remain regarding safety, particularly the potential for macular edema, retinal damage, and increased discomfort during prolonged sessions (6). Additionally, the effectiveness of single-sitting PRP in controlling disease progression in patients with varying severity of PDR remains a topic of interest. This study evaluates the safety and efficacy of single-sitting PRP using a multispot laser in patients with newly diagnosed PDR, aiming to provide evidence-based guidance for clinical practice and address gaps in existing literature.

METHODS

Study Design

This was a prospective, interventional, single-center study conducted at the Department of Ophthalmology, Father Muller Medical College, Mangalore, India. The study adhered to the tenets of the Declaration of Helsinki and was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants. The study aimed to comprehensively evaluate both short-term and intermediate outcomes of single-sitting PRP using a standardized protocol for laser settings and follow-up care.

Study Population

The study included 35 eyes from 35 patients diagnosed with newly detected PDR.

Inclusion Criteria Were:

- Age ≥40 years.
- Willingness to participate and provide informed consent.
- Clear media and adequate pupil dilation to allow laser treatment.

Exclusion Criteria Were:

- Presence of significant tractional retinal detachment or vitreous hemorrhage.
- History of prior laser treatment or intravitreal injections.
- Comorbidities significantly affecting visual function (e.g., advanced cataract or glaucoma).
- Poor systemic control of diabetes, defined as HbA1c levels >10%.

The baseline demographic and clinical characteristics of the patients were meticulously recorded, including systemic history, duration of diabetes, and prior ophthalmic diagnoses. Additionally, fasting blood glucose and HbA1c levels were collected to analyze correlations between systemic metabolic control and treatment outcomes.

Procedure

All participants underwent a comprehensive ophthalmic examination, including best-corrected visual acuity (BCVA), intraocular pressure (IOP), fundus photography, and optical coherence tomography (OCT). PRP was performed using a ZEISS VISULAS green laser system with a multispot mode. Laser parameters included:

- **Spot Size:** 200 µm.
- **Duration:** 10–20 ms.
- **Power:** Adjusted to produce mild laser burns.

The treatment was delivered in a single session under topical anesthesia, with the patient's comfort and positioning monitored throughout. Pain was assessed immediately post-procedure using the Wong-Baker Faces Pain Rating Scale, a widely used subjective assessment tool. The total duration of the procedure and the number of laser spots applied were recorded for each patient.

Outcome Measures

Primary outcomes:

1. **Safety, assessed by:**

- Pain scores.
- Changes in macular thickness (OCT).
- Incidence of adverse events (e.g., macular edema, retinal hemorrhage).

2. Efficacy, evaluated by:
- Improvement in BCVA.
- Regression of neovascularization (NVE/NVD).
- Stabilization of PDR status.

Secondary Outcomes:
- Correlation between baseline metabolic control (HbA1c) and treatment outcomes.
- Patient-reported satisfaction with single-sitting PRP.

Follow-up Protocol: Participants were evaluated at 2 weeks, 1 month, and 3 months post-treatment for BCVA, OCT macular thickness, and fundus findings. Each follow-up included an assessment of visual function, patient-reported outcomes, and any adverse events.

RESULTS

Demographics And Baseline Characteristics

The mean age of the participants was 56.2 ± 8.3 years, with 74.3% being male. The majority (85.7%) had uncontrolled diabetes, with a mean duration of 14.2 ± 4.9 years. All eyes had clinically diagnosed PDR, with baseline fundus findings including neovascularization of the disc (NVD) in 34.3% and vitreous hemorrhage in 20%. The mean baseline HbA1c level was 8.9 ± 1.7%, highlighting the suboptimal systemic control prevalent in the study population. Table 1 shows the general charactestics of the study population.

Visual Acuity Outcomes

BCVA showed significant improvement post-treatment. At baseline, 22.9% of eyes had a BCVA of 6/18, and 11.4% were at counting fingers (CF). At 1 month post-treatment:
- 20% achieved 6/6 vision.
- 60% had BCVA ≥6/18.
- At 3 months, stabilization of vision was observed in 80% of eyes. This improvement was statistically significant (p = 0.020).

Table 2: Distribution of the study participants according to their visual acuity at baseline and following pan-retinal photocoagulation using multispot laser

VISUAL ACUITY	Baseline		Follow-up after Pan-retinal photocoagulation using multispot laser			
			At 2 weeks		At 1 month	
	N	%	N	%	N	%
6/6	-	-	-	-	7	20.0
6/9	5	14.3	8	22.9	5	14.3
6/12	6	17.2	5	14.3	7	20.0
6/18	8	22.9	8	22.9	7	20.0
6/24	4	11.4	4	11.4	3	8.6
6/36	4	11.4	5	14.3	3	8.6
6/60	4	11.4	3	8.6	2	5.7
CF	4	11.4	2	5.7	1	2.9
Fisher's Exact Test			54.679			
p- value			0.020*			

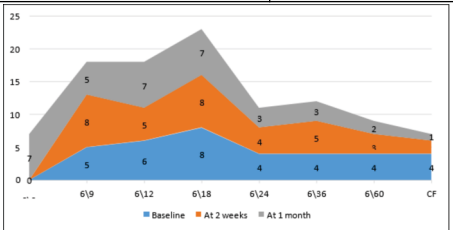

Figure 1: Distribution of the study participants according to their visual acuity at baseline and following pan-retinal photocoagulation using multispot laser

Macular Thickness (OCT)

The mean central macular thickness (CMT) decreased from 302.4 ± 59.6 µm at baseline to 298.8 ± 73.5 µm at 1 month. Although the reduction was not statistically significant, no cases of clinically significant macular edema were observed. By the 3-month follow-up, further stabilization of macular thickness was noted.

Pain Assessment

Pain scores ranged from 0 to 2, with a mean of 0.89 ± 0.53, indicating minimal discomfort during the procedure. Patients reported high levels of satisfaction with the single-session approach, citing reduced anxiety and the convenience of fewer clinic visits.

Regression Of Neovascularization

Neovascularization regressed in 67.6% of cases within 1 month which was statistically significant (p<0.001). Stabilization of PDR was achieved in 91.4% of eyes, with only 8.6% showing progression. At the 3-month follow-up, complete regression of neovascularization was observed in 75% of eyes.

Secondary Outcomes

Correlation with HbA1c: A significant association was noted between higher baseline HbA1c levels and delayed regression of neovascularization. Patients with HbA1c >9% were more likely to exhibit slower disease stabilization (p = 0.035).

Patient Satisfaction: 94% of participants reported satisfaction with the single-sitting approach, citing reduced time commitment and improved convenience as key factors. Only 6% preferred a multi-session alternative due to initial apprehensions about prolonged treatment sessions.

DISCUSSION;

This study demonstrates that single-sitting PRP using a multispot laser is both safe and effective for managing newly diagnosed PDR. The significant improvement in BCVA, along with high rates of neovascular regression and minimal adverse effects, highlights its potential as an alternative to traditional multi-session PRP (7).

Our findings align with prior studies that reported comparable efficacy of single-sitting PRP. For example, Evans et al. (2014) observed similar visual outcomes and safety profiles with multispot lasers (8). However, our study uniquely highlights the minimal pain and high patient tolerance associated with single-sitting PRP (9). Additionally, the observed correlation between baseline HbA1c levels and treatment outcomes underscores the importance of systemic metabolic control in optimizing visual outcomes (10).

The ability to achieve comparable outcomes with a single session of PRP can significantly improve patient compliance and reduce healthcare burden. This approach is particularly beneficial in resource-limited settings, where access to multiple sessions may be logistically or economically unfeasible (11). Furthermore, the role of integrated diabetes care is reinforced, as better systemic control is shown to enhance ocular treatment outcomes (12).

Concerns regarding macular edema, retinal damage, and patient discomfort with single-sitting PRP were not substantiated in this study. Minimal pain scores and a lack of significant adverse events support the safety of this approach, even for prolonged procedures. These findings provide reassurance to clinicians hesitant about adopting single-sitting protocols.

Future studies should explore the long-term durability of single-sitting PRP outcomes and compare them with emerging therapies, such as anti-VEGF injections. Additionally, identifying patient subgroups most likely to benefit from single-sitting PRP can further refine treatment strategies. Exploring combinations of laser and pharmacologic interventions may offer synergistic benefits in managing PDR (13).

CONCLUSION

Single-sitting PRP using a multispot laser is a promising alternative to traditional multi-session treatments for PDR. It offers significant advantages in terms of patient adherence, convenience, and clinical outcomes, with minimal discomfort and low complication rates. Furthermore, the correlation between improved systemic control and enhanced treatment outcomes highlights the need for integrated care approaches. However, further research is required to establish long-term efficacy and optimize treatment parameters. This approach has the potential to enhance the management of diabetic retinopathy and improve patient quality of life.

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