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Short-Term Changes in Macular Thickness after Panretinal Photocoagulation in Patients with Proliferative Diabetic Retinopathy: A Retrospective Study from Al Qassim, Saudi Arabia

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Abstract

This retrospective study evaluated changes in central macular thickness (CMT) and visual acuity (VA) three months after panretinal photocoagulation (PRP) in patients with proliferative diabetic retinopathy in the Al Qassim region of Saudi Arabia. A total of 50 eyes with complete baseline and follow-up data were included. CMT was measured using optical coherence tomography, and VA was recorded using the decimal system. The mean CMT was 250.52 ± 31.07 μm at baseline and 250.84 ± 33.45 μm at three months, with no statistically significant change. Mean VA was 0.416 ± 0.214 at baseline and 0.409 ± 0.243 at three months, with no statistically significant change. These findings indicate that no measurable association was detected between PRP and changes in CMT or VA in this cohort. Further prospective studies with larger samples and longer follow-up are needed.

Keywords

Proliferative Diabetic Retinopathy, Panretinal Photocoagulation, Central Macular Thickness

1. Introduction

Diabetic retinopathy (DR) remains a leading cause of visual impairment worldwide and represents a major complication of diabetes mellitus [1]. Proliferative

diabetic retinopathy (PDR) is an advanced stage of the disease, characterized by retinal ischemia and the development of neovascularization, which can lead to severe vision loss if not treated in a timely manner. Panretinal photocoagulation (PRP) remains the standard therapeutic approach for PDR and has been shown to reduce the risk of vision loss by promoting regression of neovascularization [2].

Although PRP primarily targets the peripheral retina, its effects are not limited to this area. The macular region may also be influenced, raising concerns about potential structural changes following treatment. Central macular thickness (CMT), measured using optical coherence tomography (OCT), is widely used as an indicator of retinal integrity and is closely linked to visual function [3]. Previous studies have reported varying outcomes after PRP, with some describing a transient increase in CMT related to inflammatory changes, while others have found little or no sustained effect over time [4]-[6].

Given that macular edema is a major contributor to visual impairment in patients with diabetic retinopathy, understanding how PRP influences macular thickness is clinically important [1]. However, findings in the literature remain inconsistent, particularly over short follow-up periods.

In light of these uncertainties, the present study was conducted to evaluate changes in central macular thickness before and three months after panretinal photocoagulation in patients with proliferative diabetic retinopathy in the Al Qassim region of Saudi Arabia.

2. Method

This retrospective study included 50 eyes (from 32 patients) with proliferative diabetic retinopathy who underwent panretinal photocoagulation (PRP) at Qassim University Medical City and Dr. Sulaiman Al Habib Hospital in Al Qassim, Saudi Arabia, from June 2019 to December 2025. Medical records were reviewed for patients with available optical coherence tomography (OCT) measurements of central macular thickness before treatment and at 3 months after PRP.

Demographic and clinical data were collected from medical records, including age, gender, diabetes duration, and comorbidities such as hypertension. Best-corrected visual acuity (BCVA) was recorded in the decimal system at baseline and at the 3-month follow-up. Central macular thickness (CMT) was measured using optical coherence tomography (OCT) at the same time points. Both eyes were included for some patients when eligible.

Inclusion criteria comprised patients with proliferative diabetic retinopathy who underwent PRP and had complete OCT data at both time points. Patients with other retinal conditions affecting macular thickness, a history of intraocular surgery or anti-VEGF injections, or incomplete records were excluded. Records were carefully screened to exclude pre-existing macular edema (increased central macular thickness ≥ 300 μm and/or the presence of intraretinal or subretinal fluid on optical coherence tomography).

Central macular thickness (CMT) was measured using optical coherence tomography (OCT) (Cirrus HD-OCT 500, Carl Zeiss Meditec, Dublin, CA, USA). Measurements were obtained from the central 1-mm subfield of the Early Treatment Diabetic Retinopathy Study (ETDRS) grid.

Panretinal photocoagulation (PRP) was performed with a 577-nm yellow laser system. Treatment was delivered with a spot size of 200 - 300 μm and a pulse duration of 100 - 200 ms, and power was titrated individually to achieve a mild-to-moderate gray-white retinal burn as the treatment endpoint. Laser applications were distributed across the peripheral retina in a scatter pattern, avoiding the macular area and optic disc. Each eye received PRP in 2 to 3 sessions, with an interval of approximately 1 - 2 weeks between sessions. All procedures were performed by multiple experienced retinal specialists using a standardized protocol.

Statistical analysis was performed using JASP (Version 0.96.0). Paired comparisons between baseline and three-month measurements were performed using a paired t-test or a Wilcoxon signed-rank test, as appropriate. A p-value < 0.05 was considered statistically significant.

The study was conducted in accordance with the Law of Ethics of Research on Living Creatures in the Kingdom of Saudi Arabia and its implementing regulations. Approval was granted by the Ministry of Health regional ethics committee (Date: December 17, 2025/No. 607-47-008478).

3. Result

Of 147 records screened, the outcome analysis included 50 eyes from 32 patients who met the inclusion criteria and had complete data at both baseline and 3-month follow-up, with no missing values. The cohort comprised 17 females (53.1%) and 15 males (46.9%), with a mean age of 59 ± 11.57 years. The mean duration of diabetes was 16.69 ± 8.19 years. Hypertension was the most common comorbidity, present in 15 patients (46.9%), whereas 17 patients (53.1%) were normotensive.

The mean central macular thickness (CMT) at baseline was 250.52 ± 31.07 μm, compared with 250.84 ± 33.45 μm at 3 months. Mean visual acuity (VA) at baseline was 0.416 ± 0.214, and at 3 months was 0.409 ± 0.243.

Wilcoxon signed-rank tests were conducted to assess changes from baseline to 3 months for central macular thickness and visual acuity. For central macular thickness, the analysis showed no statistically significant difference over time ($W = 611.5$, $p = 0.805$), with a negligible rank-biserial correlation (−0.041, 95% CI [−0.345, 0.271]). Similarly, no significant difference was observed for visual acuity ($W = 229.5$, $p = 0.554$), with a small effect size (0.131, 95% CI [−0.285, 0.504]).

These findings indicate that both central macular thickness and visual acuity remained stable over the 3-month follow-up period following panretinal photocoagulation (See Table 1 and Table 2).

4. Discussion

In the present study, we did not observe a statistically significant change in central

Table 1. Baseline demographic and clinical characteristics of the study population (n = 32).

Variable	Value
Number of patients	32
Number of eyes	50
Age (years), mean ± SD	59.0 ± 11.57
Duration of diabetes (years), mean ± SD	16.69 ± 8.19
Gender, n (%)	
Male	15 (46.9%)
Female	17 (53.1%)
Comorbidities, n (%)	
Hypertension	15 (46.9%)
Dyslipidemia	8 (25.0%)
Hypothyroidism	1 (3.1%)
Ischemic heart disease	1 (3.1%)

Table 2. Changes in central macular thickness and visual acuity before and 3 months after panretinal photocoagulation (n = 50 eyes).

Variable	Baseline	3 Months	p-value
Central macular thickness (μm)	250.52 ± 31.07	250.84 ± 33.45	0.403
Median (IQR)	255.5 (–)	253.5 (–)	
Visual acuity (decimal)	0.416 ± 0.214	0.409 ± 0.243	0.731
Median (IQR)	0.360 (–)	0.320 (–)	

macular thickness (CMT) or visual acuity (VA) at three months following panretinal photocoagulation (PRP) in patients with proliferative diabetic retinopathy. These findings indicate that, in our cohort, PRP was not associated with measurable short-term alterations in macular structure or function, and that the macula remained stable during the early post-treatment period.

The effect of PRP on macular thickness has been widely explored, although results have not been consistent. Several studies have reported a temporary increase in CMT shortly after treatment, which is commonly attributed to inflammatory responses and increased vascular permeability following laser application [4] [6]. This early thickening is thought to reflect disruption of the blood–retina barrier and the release of inflammatory mediators. More recent work has also supported the presence of early post-treatment changes, with some studies documenting increased macular thickness during the initial follow-up period [7].

On the other hand, a number of studies have shown that these early changes tend to resolve over time, with macular thickness returning to baseline levels. This pattern has been described in both cross-sectional and longitudinal analyses, particularly in eyes without pre-existing diabetic macular edema [5] [7] [8]. Similarly,

longer follow-up studies have demonstrated that macular structure generally stabilizes after the initial post-treatment phase [9]. These observations are in line with our findings, where no significant change was detected at three months.

From a physiological standpoint, the absence of significant macular thickening may be explained by the therapeutic effects of PRP. By reducing retinal ischemia and suppressing vascular endothelial growth factor (VEGF) production, PRP improves retinal oxygenation and contributes to stabilization of the blood–retina barrier [2] [10]. While a transient increase in vascular permeability may occur shortly after treatment, this effect appears to diminish over time, leading to stabilization of macular thickness. Previous studies have also shown that PRP reduces retinal metabolic demand and alters retinal blood flow in a way that supports long-term vascular balance [10].

Visual acuity findings in this study further support the structural results. We did not detect any significant change in VA over the follow-up period, suggesting that central visual function was preserved. This is consistent with earlier reports in which visual acuity remained stable despite measurable structural or microvascular changes in the retina [6] [8] [9]. Taken together, these findings highlight that changes detected on imaging do not always translate into functional impairment.

From a clinical perspective, the stability of both CMT and VA is reassuring. Concerns about PRP-induced macular edema can sometimes influence treatment decisions, particularly in patients at risk of central vision loss. In our cohort, PRP did not appear to adversely affect macular integrity in the short term, especially in the absence of significant baseline macular edema.

It is also important to consider the characteristics of the study population. The relatively long duration of diabetes and the presence of comorbid conditions such as hypertension are factors known to influence retinal vascular status and disease progression [1]. Despite these factors, macular thickness remained stable, suggesting that PRP did not exacerbate short-term structural changes in this group of patients.

Several limitations should be acknowledged. The retrospective design may introduce selection bias and limits control over data completeness. The relatively small sample size may also affect the generalizability of the findings. In addition, the short follow-up period does not allow for assessment of long-term outcomes. The inclusion of both eyes from some patients may have introduced inter-eye correlation, potentially affecting statistical independence. Finally, the lack of detailed systemic data, such as glycemic control (HbA1c) and diabetes type, limits the ability to fully account for potential confounding factors.

5. Conclusion

This study found no statistically significant change in central macular thickness or visual acuity three months after panretinal photocoagulation in this cohort of patients with proliferative diabetic retinopathy. These findings suggest that no measurable short-term association between PRP and macular structural or func-

tional change was detected in this sample. Further prospective studies with larger cohorts, longer follow-up, and adjustment for systemic and ocular confounders are needed to better clarify the short- and long-term effects of PRP on macular outcomes.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Cheung, N., Mitchell, P. and Wong, T.Y. (2010) Diabetic Retinopathy. *The Lancet*, **376**, 124-136. https://doi.org/10.1016/s0140-6736(09)62124-3

[2] The Diabetic Retinopathy Study Research Group (1981) Photocoagulation Treatment of Proliferative Diabetic Retinopathy. *Ophthalmology*, **88**, 583-600. https://doi.org/10.1016/S0161-6420(81)34978-1

[3] Diabetic Retinopathy Clinical Research Network (2007) Relationship between Optical Coherence Tomography-Measured Central Retinal Thickness and Visual Acuity in Diabetic Macular Edema. *Ophthalmology*, **114**, 525-536. https://doi.org/10.1016/j.ophtha.2006.06.052

[4] Diabetic Retinopathy Clinical Research Network (2009) Observational Study of the Development of Diabetic Macular Edema Following Panretinal (Scatter) Photocoagulation Given in 1 or 4 Sittings. *Archives of Ophthalmology*, **127**, 132-140. https://doi.org/10.1001/archophthalmol.2008.565

[5] Lee, S.B., Yun, Y.J., Kim, S.H. and Kim, J.Y. (2010) Changes in Macular Thickness after Panretinal Photocoagulation in Patients with Severe Diabetic Retinopathy and No Macular Edema. *Retina*, **30**, 756-760. https://doi.org/10.1097/iae.0b013e3181c701e0

[6] Ganekal, S., Soman, M., Nair, U.K. and Nair, K. (2012) Effect of Panretinal Photocoagulation on Macular Morphology and Thickness in Eyes with Proliferative Diabetic Retinopathy without Clinically Significant Macular Edema. *Clinical Ophthalmology*, **6**, 2013-2017. https://doi.org/10.2147/opth.s37340

[7] Watanachai, N., Choovuthayakorn, J., Patikulsila, D. and Ittipunkul, N. (2015) Changes in Central Macular Thickness Following Single Session Multispot Panretinal Photocoagulation. *Journal of Ophthalmology*, **2015**, Article ID: 529529. https://doi.org/10.1155/2015/529529

[8] Mukhtar, A., Khan, S., Junejo, M., Ishaq, M. and Akbar, B. (2016) Effect of Pan Retinal Photocoagulation on Central Macular Thickness and Visual Acuity in Proliferative Diabetic Retinopathy. *Pakistan Journal of Medical Sciences*, **32**, 221-224. https://doi.org/10.12669/pjms.321.8758

[9] Hamed, N., Vander Woude, L., Roohipourmoallai, R., Ohning, C., Regan, K.A. and Iyer, S.S.R. (2021) Effect of Pattern Scanning Laser on Macular Thickness in Diabetic Retinopathy. *Therapeutic Advances in Ophthalmology*, **13**. https://doi.org/10.1177/25158414211035860

[10] Stefánsson, E. (2006) Ocular Oxygenation and the Treatment of Diabetic Retinopathy. *Survey of Ophthalmology*, **51**, 364-380. https://doi.org/10.1016/j.survophthal.2006.04.005