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# Changes in Choroidal Thickness Following Panretinal Photocoagulation: A Retrospective Study from Al Qassim, Saudi Arabia

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## Abstract

Panretinal photocoagulation (PRP) is a well-established treatment for diabetic retinopathy, yet its effects on the choroid remain incompletely understood. This retrospective study aimed to evaluate changes in choroidal thickness before and six months after PRP in patients from the Al Qassim region, Saudi Arabia. A total of 30 eyes with diabetic retinopathy who underwent PRP were included. Choroidal thickness was measured using enhanced depth imaging optical coherence tomography at baseline and at six months post-treatment. The mean choroidal thickness decreased from 309.53 ± 11.68 μm at baseline to 295.30 ± 12.05 μm at six months, representing a mean reduction of 14.23 μm. These findings indicate that PRP is associated with a significant reduction in choroidal thickness, suggesting structural and hemodynamic changes in the choroid following treatment. Further studies are warranted to explore the clinical implications of these changes.

## Keywords

Panretinal Photocoagulation, Choroidal Thickness, Diabetic Retinopathy

## 1. Introduction

Diabetic retinopathy (DR) remains one of the leading causes of visual impairment worldwide and is a major microvascular complication of diabetes mellitus [1]. Advanced stages of the disease are characterized by progressive retinal ischemia and neovascularization, often requiring timely treatment to prevent vision loss. Among available options, panretinal photocoagulation (PRP) is a well-established and widely used approach, especially for patients with proliferative diabetic retinopathy [1].

PRP exerts its therapeutic effect by lowering retinal oxygen demand and inhibiting vascular endothelial growth factor (VEGF) production, thereby encouraging regression of neovascularization [1]. However, the impact of PRP is not confined to the retinal layers alone, as it may also affect the underlying choroid, which is vital for ocular blood supply. Changes in choroidal thickness have been suggested as a possible indicator of alterations in choroidal circulation and overall ocular hemodynamics after laser treatment [2].

With the advent of enhanced depth imaging optical coherence tomography (EDI-OCT), *in vivo* assessment of choroidal thickness has become easier and more consistent [3]. Several studies have examined choroidal changes after PRP, but their results remain inconsistent, with some showing increased and others decreased thickness after treatment [4] [5]. These differences may stem from variations in study design, patient populations, and follow-up periods.

Understanding how PRP affects choroidal thickness is clinically important because it could reveal insights into disease progression and treatment response in patients with diabetic retinopathy. Furthermore, regional data are still limited, especially within the Saudi population.

Therefore, this study aimed to evaluate changes in choroidal thickness before and six months after panretinal photocoagulation in patients with diabetic retinopathy in the Al Qassim region, Saudi Arabia.

## 2. Methods

This retrospective study was conducted at Qassim University Medical City in Al Qassim, Saudi Arabia. Medical records of patients with diabetic retinopathy who underwent panretinal photocoagulation (PRP) for proliferative diabetic retinopathy were reviewed from June 2019 to April 2026.

Inclusion criteria comprised patients diagnosed with diabetic retinopathy who received PRP and had available enhanced depth imaging optical coherence tomography (EDI-OCT) measurements both before treatment and at six months. Patients with incomplete records, prior retinal surgery, a history of macular edema or anti-VEGF injections, or coexisting ocular conditions affecting choroidal thickness were excluded.

Data collected included demographic characteristics (age, sex), medical comorbidities, and choroidal thickness measurements obtained using enhanced depth OCT imaging. Both eyes were included for some patients when eligible.

Panretinal photocoagulation (PRP) was performed using a 577 nm yellow laser system. Treatment was delivered over 2 - 3 sessions, depending on patient tolerance and the severity of diabetic retinopathy. A total of approximately 1500 - 2000 laser spots were applied to the peripheral retina, sparing the macular area and optic disc. Laser parameters were adjusted according to retinal response, with a typical spot size of 200 - 500 μm and a duration of 100 - 200 ms to achieve a gray-white burn. All procedures were performed by experienced ophthalmologists in accordance with standard clinical practice.

OCT scans were obtained using Spectral Domain-OCT (SD-OCT) (Revo Nx, Optopol, CA, USA). Choroidal thickness was measured manually from a hyper-reflective line representing RPE-Bruch's membrane to the choroid-scleral junction at the subfoveal area. The primary outcome was the change in choroidal thickness from baseline to 6 months post-PRP.

Statistical analysis was performed using JASP (Version 0.96.0). Continuous variables were expressed as mean ± standard deviation. The normality of the data distribution was assessed using the Shapiro-Wilk test. As the data were not normally distributed, the Wilcoxon signed-rank test was used to compare choroidal thickness measurements before and six months after panretinal photocoagulation. 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. 607-47-008479).

## 3. Results

Out of 81 records screened, 30 eyes from 21 patients met the inclusion criteria and were included in this study. The mean age was 53.9 ± 14.2 years, with a median of 54.5 years (range: 28 - 78). The mean duration of diabetes was 15.8 ± 7.3 years, with a median of 15 years (range: 5 - 30).

Thirteen patients (61.9%) were male, and 8 (38.1%) were female. The most common comorbidity was hypertension, present in 12 patients (57.1%), followed by dyslipidemia in 8 patients (38.1%). Hypothyroidism and ischemic heart disease were each observed in 1 patient (4.8%).

The mean choroidal thickness at baseline was 309.53 ± 11.68 μm, which decreased to 295.30 ± 12.05 μm at six months following panretinal photocoagulation. This represents a mean reduction of 14.23 μm. The decrease in choroidal thickness was statistically significant, as demonstrated by the Wilcoxon signed-rank test ($z = 4.751$, $p < 0.001$). The median change was 13.00 (95% CI: 9.00 to 17.50). Furthermore, the effect size was large (correlation = 0.994), indicating a strong treatment-related change in choroidal thickness (See Table 1).

Table 1. Baseline demographic and clinical characteristics of the study population.

| Variable | Value |
|---|---|
| **Number of patients** | 21 |
| **Number of eyes** | 30 |
| **Age (years)** | 53.9 ± 14.2 |
| Median (range) | 54.5 (28 - 78) |
| **Duration of diabetes (years)** | 15.8 ± 7.3 |
| Median (range) | 15 (5 - 30) |

Continued

| | |
|---|---|
| **Gender, n (%)** | |
| Male | 13 (61.9) |
| Female | 8 (38.1) |
| **Comorbidities, n (%)** | |
| Hypertension | 12 (57.1) |
| Dyslipidemia | 8 (38.1) |
| Hypothyroidism | 1 (4.8) |
| Ischemic heart disease | 1 (4.8) |

Data on certain clinical variables, including diabetes type, glycated hemoglobin (HbA1c), blood pressure, and baseline visual acuity, were inconsistently available in the medical records and were therefore not included in the analysis.

## 4. Discussion

In this study, a significant reduction in choroidal thickness was observed six months after panretinal photocoagulation (PRP) in patients with diabetic retinopathy. The mean choroidal thickness decreased by approximately 14 μm, with a highly significant statistical difference ($p < 0.001$), indicating a consistent and measurable structural change following treatment. This finding suggests that PRP has a substantial impact not only on the retinal layers but also on the underlying choroidal vasculature.

The observed decrease in choroidal thickness may be explained by the physiological effects of PRP on ocular hemodynamics. PRP reduces metabolic demand by ablating photoreceptors, thereby improving oxygen diffusion from the choroid to the inner retina. This leads to a reduction in hypoxia-driven mediators such as vascular endothelial growth factor (VEGF), ultimately decreasing vascular permeability and choroidal blood flow [1]. Additionally, laser-induced damage to the outer retinal layers may lead to secondary alterations in the choriocapillaris, contributing to choroidal thinning.

The findings of the present study are consistent with several previous reports. Earlier longitudinal studies demonstrated a significant reduction in subfoveal choroidal thickness following PRP, particularly at later follow-up periods, supporting the concept of long-term choroidal remodeling after treatment [4]. More recent studies using optical coherence tomography and OCT angiography have also demonstrated significant changes in choroidal thickness and microvascular parameters following PRP, further supporting the role of PRP in altering choroidal structure and perfusion [6]-[8]. These findings align closely with our results and reinforce the concept that PRP induces sustained choroidal remodeling.

However, the literature also shows variability in reported outcomes. Some studies have observed an initial increase in choroidal thickness shortly after PRP, followed by a gradual decrease over time [5]. This transient thickening has been at-

tributed to inflammatory responses and increased vascular permeability immediately after laser treatment. In contrast, longer-term studies have reported either stabilization or no significant change in choroidal thickness [2]. These discrepancies may be related to differences in follow-up duration, disease severity, imaging techniques, and patient characteristics.

In this context, the six-month follow-up period in the present study is particularly relevant, as it reflects a more stable phase following the acute inflammatory response to PRP. The consistent reduction observed suggests that choroidal thinning represents a longer-term structural adaptation rather than a transient effect. Moreover, the large effect size identified in this study indicates that the change is not only statistically significant but also represents a consistent structural alteration in the choroid.

From a clinical perspective, these findings highlight the importance of considering choroidal changes when evaluating patients undergoing PRP. A reduction in thickness may reflect decreased choroidal congestion and improved retinal metabolic balance. However, excessive thinning might suggest compromised choroidal perfusion, with potential implications for long-term retinal health. It is important to note that this study assessed structural changes only, so no direct conclusions can be drawn about functional outcomes such as visual acuity.

The present study has certain limitations that should be acknowledged. The retrospective design introduces the possibility of selection bias, and the relatively small sample size may limit generalizability. Additionally, the absence of functional outcomes, such as visual acuity or choroidal blood flow parameters, limits the ability to fully correlate structural changes with clinical outcomes. Another limitation is the lack of data on important clinical covariates, such as diabetes type, glycemic control (HbA1c), and blood pressure. These factors may influence choroidal thickness and treatment response, and their absence limits the ability to adjust for potential confounding effects.

## 5. Conclusion

This study demonstrates a significant reduction in choroidal thickness six months after panretinal photocoagulation in patients with diabetic retinopathy. These findings support the hypothesis that PRP induces long-term alterations in choroidal structure, likely mediated by changes in ocular perfusion and VEGF activity. Further prospective studies with larger sample sizes and multimodal imaging are warranted to better understand the clinical implications of these changes.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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