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CHORIOCAPILLARIS PERFUSION IN MYOPIC PATIENTS WITH PERIPHERAL CHORIORETINAL DEGENERATION

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Keywords: *myopia; peripheral chorioretinal degeneration; choroid; optical coherence tomography angiography.*

Introduction. Peripheral chorioretinal degenerations (PCRDs) represent one of the most clinically significant complications of myopia and are associated with an increased risk of retinal tears and rhegmatogenous retinal detachment. Myopia As the prevalence of moderate and high myopia continues to rise worldwide, the incidence of peripheral retinal degenerative changes and related vitreoretinal complications is also increasing. Previous studies have demonstrated a close relationship between axial elongation of the eye, progressive retinal stretching, and the development of peripheral retinal abnormalities in myopic eyes [1,2,3].

In recent years, particular attention has been focused on the role of the choroid and choriocapillaris microcirculation in the pathogenesis of myopic fundus alterations. Choroidal thinning and vascular remodeling are considered important structural manifestations of myopic eye elongation and may contribute to impaired metabolic support of the outer retina. Although several studies have report-

ed reduced choroidal thickness in myopia, the characteristics of choriocapillaris perfusion in patients with PCRDs remain insufficiently investigated [1,4,5,6,7]. Optical coherence tomography angiography (OCTA) provides a noninvasive method for quantitative assessment of chorioretinal microcirculation and enables evaluation of biomarkers such as choriocapillaris flow deficit and choriocapillaris vessel density [2,8,9, 10,11]. Assessment of these parameters may improve understanding of the vascular mechanisms underlying peripheral degenerative retinal changes and expand the possibilities for early diagnosis and risk stratification of complicated myopia.

Purpose. To investigate the characteristics of choriocapillaris perfusion and their association with the presence of peripheral chorioretinal degeneration in patients with myopia using optical coherence tomography angiography.

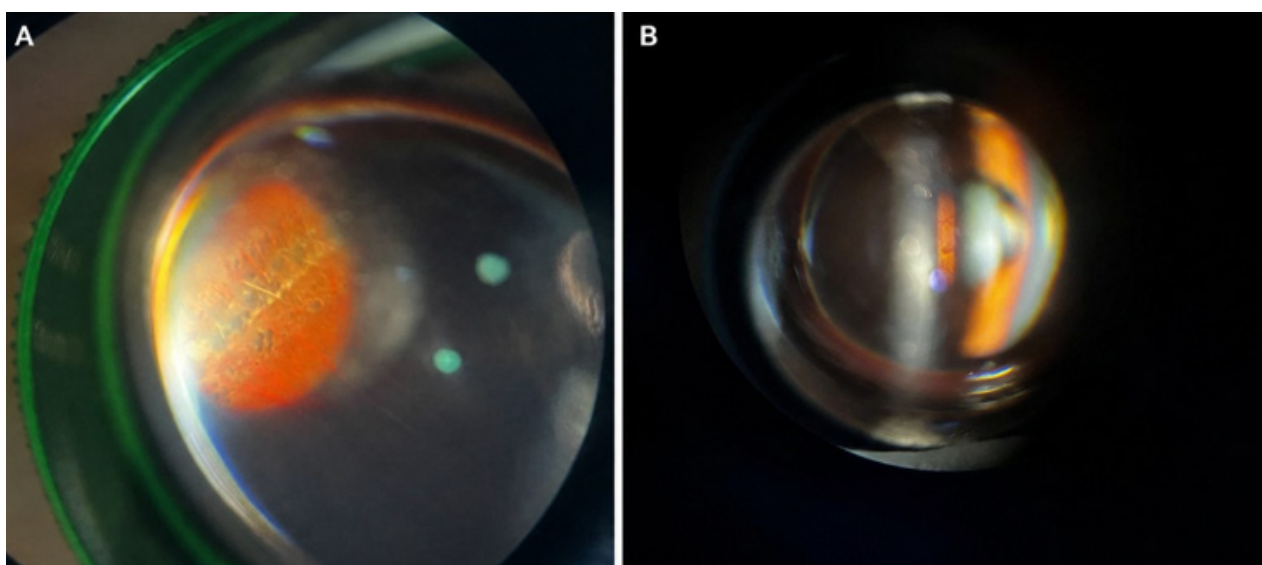
Materials and Methods. The study included 65 patients (130 eyes) with varying degrees of myopic refractive error who

were examined between 2024 and 2026 at the Ziyο Bakhsh Clinic. The main group consisted of 34 patients (68 eyes) with signs of PCRД, while the control group included 31 patients (62 eyes) without peripheral retinal degenerative changes. The

diagnosis of PCRД was established based on fundus ophthalmoscopy using a Volk SuperField aspheric lens. Representative clinical images of peripheral retinal degenerative lesions observed during fundus examination are presented in Figure 1.

Figure 1.

Figure 1. Clinical appearance of peripheral chorioretinal degeneration (PCRД) during indirect ophthalmoscopy using a Volk SuperField lens.

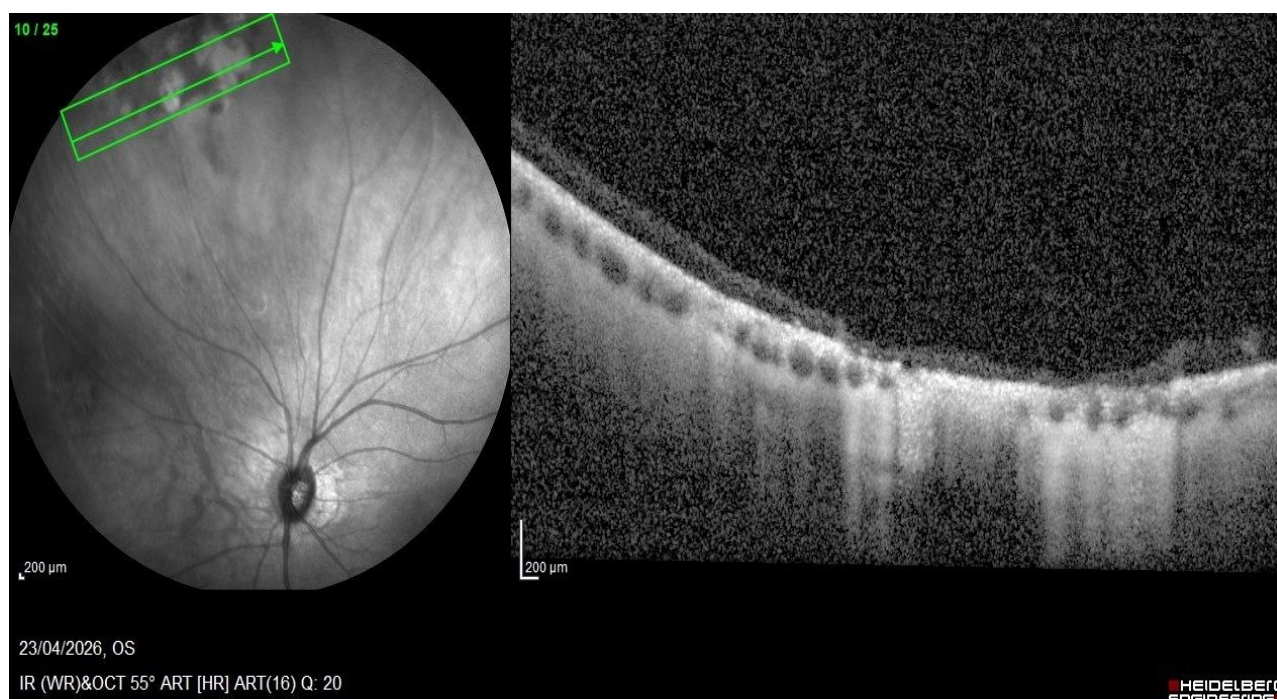


Note. (A) Lattice degeneration of the peripheral retina characterized by retinal thinning and pigmentary alterations. (B) Peripheral retinal tear identified during fundus examination.

Inclusion criteria were age over 18 years, the presence of myopia, and clear ocular media. Exclusion criteria included previous vitreoretinal surgery, glaucoma, inflammatory eye diseases, diabetic retinopathy, macular pathology, and systemic diseases potentially affecting the choroidal vasculature. All patients underwent a standard ophthalmological examination including best-corrected visual acuity assessment, autorefractometry, slit-lamp biomicroscopy, tonometry, and fundus ophthalmoscopy. Choroidal parameters were assessed using enhanced depth imaging optical coherence tomography (EDI-OCT) with the Spectralis OCT system (Heidelberg Engineering, Germany). Subfoveal choroidal thickness and the choroidal vascularity index were analyzed. Representative infrared reflectance and corresponding OCT images demonstrating the structural characteristics of paving-stone degeneration in a myopic eye are presented in Figure 2.

Figure 2.

Figure 2. Structural OCT characteristics of peripheral paving-stone degeneration in a myopic eye



Note. On infra-red imaging, pavingstone degeneration appears as hyporeflective lesions

Peripheral OCT highlights thinning of the retina at lesions and subsequent increased choroidal visibility

In addition, all patients underwent OCT angiography of the macular area using a standard 6×6 mm scan protocol. Choriocapillaris perfusion parameters, including choriocapillaris flow deficit and choriocapillaris vessel density, were evaluated. Flow deficit was defined as the percentage area of non-perfused regions within the choriocapillaris layer, while vessel density was defined as the density of vascular signal within the choriocapillaris slab. All measurements were obtained automatically using the device's built-in software. Statistical analysis was performed using IBM SPSS Statistics version 26.0. Quantitative data are presented as mean ± standard deviation ($M \pm SD$). Student's t-test was

used for comparison of quantitative variables, and Pearson's chi-square test was applied for categorical variables. Differences were considered statistically significant at $p < 0.05$.

Results. The study results demonstrated no statistically significant differences between the groups in terms of age or sex distribution ($p > 0.05$). Patients with PCRD showed more severe myopic refractive error and greater axial length compared with patients without PCRD. High myopia (> -6.0 D) was significantly more frequent in the PCRD group, being detected in 72.1% of eyes versus 41.9% in the control group ($p = 0.001$) (Table 1).

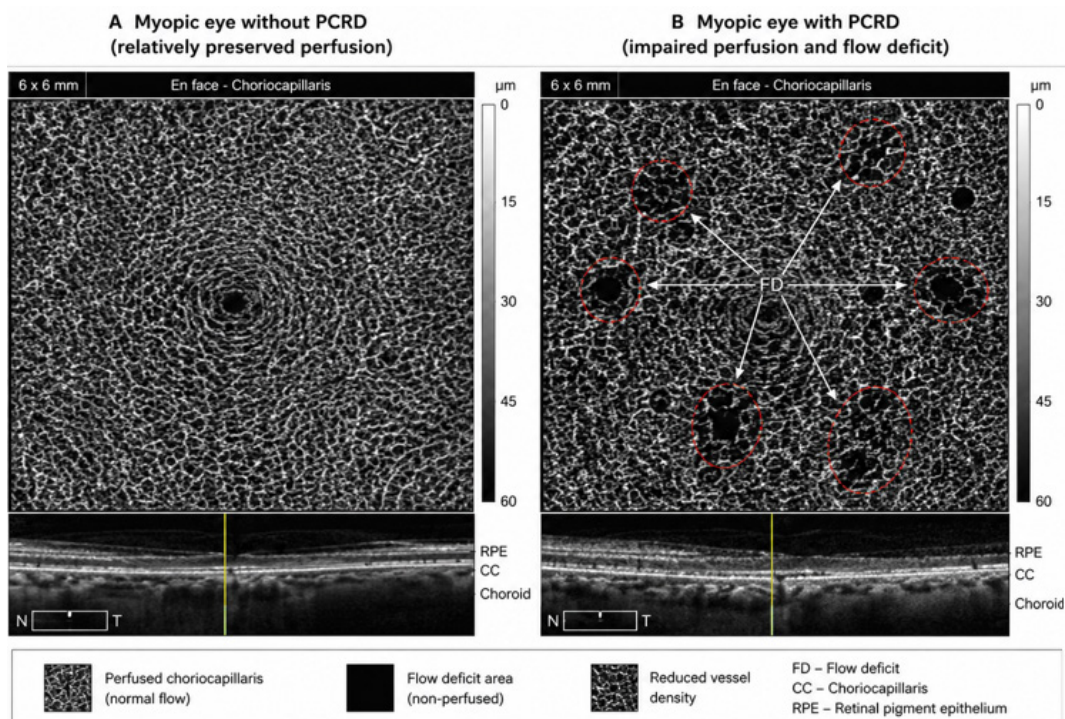
Table 1.

Clinical and demographic characteristics of the examined patients

Parameter	PCRD group (n=34 patients, 68 eyes)	Non-PCRD group (n=31 patients, 62 eyes)	<i>p</i>
Age, years	27,8±6,4	26,9±5,9	0,421
Male, n (%)	15 (44,1)	14 (45,2)	0,894
Female, n (%)	19 (55,9)	17 (54,8)	0,894
Number of eyes, n	68	62	–
Spherical equivalent, D	–7,12±2,34	–5,48±1,96	<0,001
High myopia (> –6,0 D), n (%)	49 (72,1)	26 (41,9)	0,001
Axial length, mm	26,84±1,12	25,71±0,94	<0,001
Intraocular pressure, mmHg	15,1±2,3	15,4±2,1	0,478
Best-corrected visual acuity	0,84±0,12	0,91±0,09	0,003

Note. Student's t-test was used for comparison of quantitative variables, and Pearson's chi-square test was applied for categorical variables. Differences were considered statistically significant at $p < 0,05$.

Figure 3.

Schematic representation of choriocapillaris perfusion in myopic eyes with and without PCRD based on OCTA-derived parameters

Note. A) Myopic eye without peripheral chorioretinal degeneration demonstrating relatively preserved choriocapillaris perfusion. B) Myopic eye with peripheral chorioretinal degeneration showing multiple flow deficit areas and reduced vessel density.

Analysis of OCT angiography parameters revealed statistically significant signs of impaired choriocapillaris perfusion in patients with PCRD compared with patients without peripheral retinal degenerative changes. Representative schematic visualization of the observed choriocapillaris perfusion differences between eyes with and without PCRD is presented in

Figure 3.

The PCRD group demonstrated increased choriocapillaris flow deficit and decreased choriocapillaris vessel density, accompanied by a reduction in the choroidal vascularity index. An elevated flow deficit ($>18\%$) was significantly more frequent in patients with PCRD ($p<0.001$) (Table 2).

Table 2.

OCTA parameters of choriocapillaris perfusion in patients with and without PCRD

Parameter	PCRD group (n=68 eyes)	Non-PCRD group (n=62 eyes)	<i>p</i>
Choriocapillaris flow deficit, %	18,7 $\pm$ 4,3	14,9 $\pm$ 3,6	$<0,001$
Choriocapillaris vessel density, %	46,8 $\pm$ 3,9	50,2 $\pm$ 4,1	$<0,001$
Choroidal vascularity index, %	61,8 $\pm$ 3,9	64,1 $\pm$ 4,1	$0,002$
Increased flow deficit ($>18\%$), n (%)	39 (57,4)	15 (24,2)	$<0,001$

Note. Student's t-test was used for comparison of quantitative variables, and Pearson's chi-square test was applied for categorical variables. Differences were considered statistically significant at $p<0,05$.

Discussion. The present study demonstrated that patients with PCRD had significantly impaired choriocapillaris perfusion compared with myopic patients without peripheral retinal degenerative changes. Eyes with PCRD were characterized by increased choriocapillaris flow deficit and decreased choriocapillaris vessel density, accompanied by a reduction in the choroidal vascularity index. These findings suggest that, in addition to structural choroidal alterations, microvascular impairment of the choriocapillaris may play an important role in the development of peripheral retinal degeneration in myopic eyes. The observed association between PCRD

and higher prevalence of high myopia and greater axial length is consistent with previous studies reporting progressive choroidal and retinal remodeling in elongated myopic eyes.

Particular attention should be paid to the combined reduction in choroidal vascularity and choriocapillaris perfusion observed in the PCRD group. Chronic hypoperfusion of the choriocapillaris may contribute to impaired metabolic support of the outer retina and retinal pigment epithelium, thereby promoting degenerative peripheral retinal changes. The significantly higher frequency of elevated flow deficit values in eyes with PCRD fur-

ther supports the potential role of choroidal microcirculatory insufficiency in the pathogenesis of peripheral retinal degeneration in myopia. These results indicate that OCT angiography biomarkers may have clinical value for early detection and risk stratification of peripheral retinal degenerative changes in myopic patients.

Conclusion. In patients with myopia, the presence of PCRD is associated not only with structural choroidal thinning but also with impaired choriocapillaris perfusion as assessed by OCT angiography. Eyes with PCRD demonstrated higher choriocapillaris flow deficit values and lower choriocapillaris vessel density, which may indicate the involvement of choroidal microcirculatory disturbances in the pathogenesis of peripheral retinal degenerative changes.

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РЕЗУМЕ

**МИОПИЯСИ БО'ЛГАН БЕМОРЛАРДА
ПЕРИФЕРИК ХОРИОРЕТИНАЛ
DEGENERATSIYALARNING
ХОРИОКАПИЛЛЯР PERFUZIYASI**

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Kalit so'zlar: miopiya, periferik xorioretinal degeneratsiya, xorioideya, optik kogerent tomografiya angiografiyasi.

Tadqiqotga turli darajadagi miopiya bo'lgan 65 nafar bemor (130 ta ko'z) kiritildi. Asosiy guruhni periferik xorioretinal degeneratsiyasi (PXRД) bo'lgan 34 nafar bemor (68 ta ko'z), nazorat guruhini esa periferik to'r parda degenerativ o'zgarishlari bo'lmagan 31 nafar bemor (62 ta ko'z) tashkil etdi. Barcha bemorlar standart oftalmologik tekshiruvdan, chuqurlashtirilgan tasvirlash rejimiga ega optik kogerent tomografiyadan (EDI-OCT) hamda makula sohasining OKT-angiografiyasidan (OCT-A) o'tkazildi. Subfoveal xorioidal qalinlik, xorioideya tomirlanish indeksi, xoriokapillyar oqim defitsiti va xoriokapillyar tomirlar zichligi tahlil qilindi. PXRД bo'lgan bemorlarda PXRД bo'lmagan bemorlarga qaraganda xoriokapillyar oqim defitsitining statistik jihatdan sezilarli darajada oshishi ($p<0.001$) va xoriokapillyar tomirlar zichligining kamayishi ($p<0.001$) aniqlandi.

Shuningdek, xorioideya tomirlanish indeksi ham PXRД guruhida sezilarli darajada past bo'ldi ($p=0.002$). Miopiyasi bor bemorlarda PXRДning mavjudligi xoriokapillyar perfuziyaning buzilishi va xorioid-eyaning tomirli ko'rsatkichlari pasayishi bilan bog'liqdir.

РЕЗЮМЕ

**ХОРИОКАПИЛЛЯРНАЯ
ПЕРФУЗИЯ ПЕРИФЕРИЧЕСКИХ
ХОРИОРЕТИНАЛЬНЫХ ДЕГЕНЕРАЦИЙ У
ПАЦИЕНТОВ С МИОПИЕЙ**

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Ключевые слова: миопия; периферическая хориоретинальная дегенерация; сосудистая оболочка глаза (хориоидея); оптическая когерентная томография ангиография.

В исследование было включено 65 пациентов (130 глаз) с миопией различной степени. Основную группу составили 34 пациента (68 глаз) с ПХРД (периферической хориоретинальной дегенерацией), а контрольную группу – 31 пациент (62 глаза) без дегенеративных изменений периферии сетчатки. Всем пациентам было проведено стандартное офтальмологическое обследование, оптическая когерентная томография в режиме улучшенного глубокого изображения (EDI-OCT), а также ОКТ-ангиография (ОСТА) макулярной зоны. Анализировались субфовеальная толщина хориоидеи, индекс сосудистой сети хориоидеи, дефицит хориокапиллярного кровотока и плотность хориокапиллярных сосудов. У пациентов с ПХРД было выявлено статистически значимое увеличение дефицита хориокапиллярного кровотока ($p<0.001$) и снижение плотности хориокапиллярных сосудов ($p<0.001$) по сравнению с пациентами без ПХРД. Индекс сосудистой сети хориоидеи также был достоверно ниже в группе с ПХРД ($p=0.002$). Наличие ПХРД у пациентов с миопией связано с нарушением хориокапиллярной перфузии и снижением сосудистых параметров хориоидеи.