

ОЦЕНКА ОКТ-ПАРАМЕТРОВ У ПАЦИЕНТОВ С ПОСТТРОМБОТИЧЕСКОЙ РЕТИНОПАТИЕЙ НА ФОНЕ СУБПОРОГОВОГО МИКРОИМПУЛЬСНОГО ЛАЗЕРНОГО ВОЗДЕЙСТВИЯ

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Аннотация. Актуальность. Несмотря на разнообразие существующих методов лечения посттромботической ретинопатии (ПТР), их эффективность остается недостаточной, и они не обеспечивают необходимого уровня восстановления зрительных функций. Поэтому поиск более оптимальных методов лечения ПТР остается актуальной задачей, требующей решения. **Цель исследования.** Оценить изменения ОКТ-показателей у пациентов с посттромботической ретинопатией под воздействием субпорогового микроимпульсного лазерного лечения (СМИЛВ). **Материалы и методы.** Исследование включало две однородные по полу и возрасту группы пациентов: в первой группе (n=18, 18 глаз) применяли комбинированную терапию с использованием анти-VEGF и СМИЛВ с использованием жёлтого диодного лазера (577 нм); во второй группе (n=18, 18 глаз) пациенты получали только анти-VEGF терапию. **Результаты и заключение.** Комбинированная терапия анти-VEGF и СМИЛВ продемонстрировала большую эффективность по сравнению с монотерапией анти-VEGF. Это выражалось в более быстром и значительном уменьшении центральной толщины сетчатки, снижении числа гиперрефлективных очагов и сокращении зоны DRIL. Комбинированное лечение анти-VEGF и СМИЛВ может быть предпочтительным методом терапии для пациентов с посттромботической ретинопатией, обеспечивая более быстрое и стойкое улучшение состояния сетчатки.

Ключевые слова: посттромботическая ретинопатия; ОКТ-признаки; субпороговое микроимпульсное лазерное воздействие.

Для цитирования:

Юсупов А.Ф., Джамалова Ш.А., Махмудова З.А. Оценка ОКТ-параметров у пациентов с посттромботической ретинопатией на фоне субпорогового микроимпульсного лазерного воздействия. Передовая Офтальмология. 2024;11(5):106-109.

EVALUATION OF OCT PARAMETERS IN PATIENTS WITH POST-THROMBOTIC RETINOPATHY UNDER THE INFLUENCE OF SUBTHRESHOLD MICROPULSE LASER TREATMENT

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Abstract. Relevance. Despite the variety of existing treatment methods for post-thrombotic retinopathy (PTR), their effectiveness remains insufficient, and they do not provide the necessary level of visual function recovery. Therefore, the search for more optimal treatment methods for PTR remains a pressing issue that requires resolution. **Purpose of the study.** To assess changes in OCT parameters in patients with post-thrombotic retinopathy under subthreshold micropulse laser treatment (SMLT). **Materials and methods.** The study included two homogeneous groups of patients in terms of sex and age: in the first group (n=18, 18 eyes), a combination therapy with anti-VEGF and SMLT using a yellow diode laser (577 nm) was applied; in the second group (n=18, 18 eyes), patients received only anti-VEGF therapy. **Results and conclusion.** Combination therapy with anti-VEGF and SMLT showed greater efficacy compared to anti-VEGF monotherapy. This was reflected in a faster

and more significant reduction in central retinal thickness, a decrease in the number of hyperreflective foci, and a reduction in the DRIL zone. Combined anti-VEGF and SMLT treatment can be considered the preferred therapeutic method for patients with post-thrombotic retinopathy, providing faster and more sustained retinal improvement.

Key words: post-thrombotic retinopathy; OCT features; subthreshold micropulse laser treatment.

For citation:

A.F. Yusupov, Sh.A. Djmalova, Z.A. Makhmudova Evaluation of oct parameters in patients with post-thrombotic retinopathy under the influence of subthreshold micropulse laser treatment. Advanced Ophthalmology. 2024;11(5):106-109.

BO'SAG'AOSTI MIKROIMPULSLI LAZER TA'SIRI FONIDA POSTTROMBOTIK RETINOPATIYASI BO'LGAN BEMORLARDA OKT PARAMETRLARINI BAHOLASH

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Annotatsiya. Dolzarbligi. Posttrombotik retinopatiyasini (PTR) davolashning mavjud usullari turli-tuman bo'lishiga qaramay, ularning samaradorligi yetarli darajada emas va ko'rish funksiyalarini tiklash uchun zarur darajani ta'minlay olmaydi. Shuning uchun, PTRni davolashning yanada samarali usullarini izlash dolzarb muammo bo'lib qolmoqda va uni hal qilishni talab etadi **Tadqiqot maqsadi.** Posttrombotik retinopatiyasi bo'lgan bemorlarda subporogli mikroimpulsli lazer bilan davolash (SMILV) ta'sirida OKT ko'rsatkichlaridagi o'zgarishlarni baholash. **Material va usullar.** Tadqiqot ikki birxil jins va yoshga ega guruhni o'z ichiga oldi: birinchi guruhda (n=18, 18 ko'z) anti-VEGF va jyoltoq diodli lazer (577 nm) bilan SMILV qo'llangan majmuaviy davo usuli qo'llandi; ikkinchi guruhda (n=18, 18 ko'z) bemorlar faqat anti-VEGF terapiyasini oldi. **Natijalar va xulosa.** Anti-VEGF va SMILV bilan majmuaviy terapiya anti-VEGF monoterapiyasiga nisbatan yuqori samaradorlikni ko'rsatdi. Bu markaziy retina qavatining tezroq va ahamiyatliroq kamayishi, giperreflektiv o'choqlar sonining kamayishi va DRIL zonasining qisqarishi bilan namoyon bo'ldi. Anti-VEGF va SMILV bilan majmuaviy davolash posttrombotik retinopatiyasi bo'lgan bemorlar uchun afzal usul bo'lishi mumkin, chunki bu retina holatining tezroq va barqarorroq yaxshilanishini ta'minlaydi.

Kalit so'zlar: posttrombotik retinopatiya; OKT ko'rsatkichlari; subporogli mikroimpulsli lazer ta'siri.

Iqtibos uchun:

Yusupov A.F., Djmalova Sh.A., Maxmudova Z.A. Bo'sag'aosti mikroimpulsli lazer ta'siri fonida posttrombotik retinopatiyasi bo'lgan bemorlarda OKT parametrlarini baholash. Ilg'or oftalmologiya. 2024;11(5):106-109.

Relevance. Retinal vein occlusion (RVO) is one of the most severe retinal diseases in terms of retinal damage and prognosis for visual function recovery. In the overall structure of vascular pathologies of the eye, RVO accounts for about 60% and leads to visual disability in 15% of cases. Recently, there has been a trend toward an increase in the number of patients with this condition, affecting both the elderly and young working-age individuals [1,2,6,9].

A complication of RVO is the development of post-thrombotic retinopathy (PTR), a complex of pathological changes in the retina caused by prolonged ischemia following an acute disturbance of venous blood flow in the retina. PTR includes the dilation of intraretinal capillaries, vascular shunts, microaneurysms, transudation, and neovascularization. PTR typically develops 1–3 months after a thrombotic episode. The primary factor contributing to vision loss in PTR is macular edema (ME) [3,5,7].

Currently, various treatment strategies are used for PTR, including conservative therapy, intravitreal administration of angiogenesis inhibitors and corticosteroids, as well as different laser therapy

methods [4,8]. Despite the variety of existing treatment methods for PTR, their effectiveness remains insufficient, and they do not provide the necessary level of visual function recovery. Therefore, the search for more optimal treatment methods for PTR remains a pressing issue that requires resolution.

This study analyzes the dynamics of optical coherence tomography (OCT) indicators in patients with post-thrombotic retinopathy in two groups: those receiving anti-VEGF monotherapy and those undergoing combined treatment (anti-VEGF + subthreshold micropulse laser therapy).

Purpose of the study. To assess changes in OCT parameters in patients with post-thrombotic retinopathy under subthreshold micropulse laser treatment (SMLT).

Materials and methods. The study was conducted at the laser department of the Republican Specialized Scientific and Practical Medical Center of Eye Microsurgery. A total of 36 patients (36 eyes) with post-thrombotic retinopathy (PTR) were observed, including 17 men and 19 women. The average age of the patients was 51±4.7 years.

The patients were divided into two homogeneous study groups, balanced by sex and age:

In Group 1 (n=18, 18 eyes), patients underwent combined treatment using anti-VEGF therapy and subthreshold micropulse laser therapy (SMLT) with a yellow diode laser (577 nm).

In Group 2 (n=18, 18 eyes), patients received only anti-VEGF therapy.

Before and after treatment, all patients underwent a complete ophthalmological examination, including visual acuity testing (visometry), fundus examination (ophthalmoscopy), and optical coherence tomography (OCT). Assessments were conducted at 1, 3, and 6 months after treatment.

Combined Treatment Protocol. Subthreshold micropulse laser therapy was performed using a Supra 577 nm laser system (Quantel Medical, France). The laser parameters were as follows: 577 nm wavelength in micropulse mode, power of 250–300–400 mW, exposure time of 0.03 ms, duty cycle of 10–12%, and spot diameter of 300–350 μ m. Individual pulse power testing was performed outside the vascular arcade, with power titration starting from 50 mW until achieving a first-degree burn according to the F. L'Esperance classification (1983).

For anti-VEGF therapy, the drug "Vizkue" (Novartis, Switzerland) was used, with the generic name brolocizumab. The drug was administered intravitreally at a dose of 0.2 ml (2.0 mg). In the combined treatment group, the subthreshold micropulse laser session was performed 3 days after a single loading dose of the anti-VEGF drug.

Statistical Analysis.

Statistical analysis was performed using the standard software package Microsoft Office 2018.

Results and discussion. The best corrected visual acuity (BCVA) in Group 2, after anti-VEGF therapy, averaged 0.74 ± 0.06 ($p < 0.05$) at 3 months, 0.71 ± 0.07 ($p < 0.05$) at 6 months, and 0.68 ± 0.06 ($p < 0.05$) at 9

months. In Group 1, following combined therapy, BCVA was 0.79 ± 0.05 ($p < 0.05$) at 3 months, 0.75 ± 0.05 ($p < 0.05$) at 6 months, and 0.73 ± 0.06 ($p < 0.05$) at 9 months.

Table 1 presents OCT parameters for both groups at various time points: baseline, 3 months, 6 months, and 9 months.

The parameters included: central retinal thickness (CRT), the total number of hyperreflective foci, and the size of the DRIL (disorganization of retinal inner layers) zone (μ m) within 1 mm of the central zone. Hyperreflective foci in the retina are often associated with inflammation, microhemorrhages, and edema. A reduction in their number may indicate a decrease in inflammation and improvement in retinal health. Both groups showed a decrease in hyperreflective foci, but this reduction was faster and more pronounced in Group 1, especially at 6 and 9 months.

The DRIL zone is an indicator of structural changes in the retina and is often associated with a decline in visual function. A decrease in the DRIL zone may suggest an improvement in the morphological structure of the retina and, potentially, the restoration of visual function. Both groups experienced a significant reduction in the DRIL zone over time; however, Group 1 showed a more pronounced reduction. This indicates more rapid and effective structural recovery of the retina with combined therapy.

The results of the analysis show that combined treatment with anti-VEGF therapy and SMLT is more effective compared to anti-VEGF monotherapy. This is demonstrated by the more rapid and significant reduction in central retinal thickness (CRT), the decrease in the number of hyperreflective foci, and the shrinking of the DRIL zone. The effectiveness of this combined approach may be due to the synergistic effect of the two treatment methods: anti-VEGF therapy reduces leakage, while SMLT promotes tissue remodeling and improves microcirculation.

Table 1. Dynamics of OCT Parameters in Patients with Post-Thrombotic Retinopathy.

Groups	Parameters	Baseline	After 3 months	After 6 months	After 9 months
		M $\pm$ m	M $\pm$ m	M $\pm$ m	M $\pm$ m
Group 1 (Combined treatment: anti-VEGF therapy + SMLT)	Central retinal thickness, μ m	298.5 $\pm$ 35.5	286.4 $\pm$ 34.6	265.1 $\pm$ 26.5	260.3 $\pm$ 14.3*
	Total number of hyperreflective foci	78.8 $\pm$ 11.6	71.1 $\pm$ 14.5	52.4 $\pm$ 10.2	40.5 $\pm$ 7.5*
	DRIL zone within 1 mm of the central zone	554.3 $\pm$ 190.2	465.2 $\pm$ 184.4	402.4 $\pm$ 110.3	368.6 $\pm$ 90.4*
Group 2 (anti- VEGF therapy only)	Central retinal thickness, μ m	301.4 $\pm$ 39.4	293.5 $\pm$ 30.5	275.4 $\pm$ 31.2	266.6 $\pm$ 23.4*
	Total number of hyperreflective foci	79.6 $\pm$ 11.1	74.5 $\pm$ 11.4	61.2 $\pm$ 12.2	51.5 $\pm$ 8.4*
	DRIL zone within 1 mm of the central zone	550.6 $\pm$ 186.3	488.6 $\pm$ 156.4	455.5 $\pm$ 134.3	415.6 $\pm$ 88.6*

*- Differences compared to baseline are statistically significant at $p < 0.05$.

^-. Differences compared to corresponding parameters in Group 2 are statistically significant at $p < 0.05$.

The observed changes in both groups indicate significant improvement in OCT parameters as early as 3 months after treatment initiation, with further improvement over 6 and 9 months. The most notable improvement was observed in the group receiving combined therapy, emphasizing the importance of a comprehensive approach in the treatment of post-thrombotic retinopathy.

Combined treatment with anti-VEGF therapy and SMLT can be considered a preferred method for patients with post-thrombotic retinopathy, providing faster and more sustained improvements in retinal condition.

Despite these positive results, the study has some limitations. Firstly, the relatively small number of patients in each group may limit the statistical significance of certain findings. Secondly, potential individual variations in treatment response and comorbidities, which could have influenced the results, were not accounted for.

The results demonstrated a significant decrease in CRT over time in both groups. However, in Group 1, which received combined treatment, the reduction in CRT occurred more quickly and was more pronounced,

especially at 6 and 9 months. This highlights the high effectiveness of combined treatment in reducing macular edema.

Conclusion. TAn analysis of the dynamics of OCT parameters in patients with post-thrombotic retinopathy demonstrated that combined treatment with anti-VEGF therapy and subthreshold micropulse laser therapy (SMLT) is more effective compared to anti-VEGF monotherapy. The key findings can be summarized as follows:

- combined treatment leads to a more significant and faster reduction in central retinal thickness, indicating a decrease in macular edema;

- the reduction in the number of hyperreflective foci is more pronounced in the group receiving combined treatment, suggesting a decrease in inflammatory processes and improvement in retinal health;

- the decrease in the DRIL zone is more substantial in the group receiving combined treatment, indicating better restoration of structural changes in the retina.

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