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EVALUATION OF THE EFFECTIVENESS OF THE USE OF SUBTHRESHOLD MICROPULSE LASER EXPOSURE IN THE TREATMENT OF DIABETIC MACULAR EDEMA


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ДИАБЕТИК МАКУЛА ШИШИНИ ДАВОЛАШДА БЎСАҒА ОСТИ МИКРОИМПУЛС ЛАЗЕР ТАЪСИРИДАН ФОЙДАЛАНИШ САМАРАДОРЛИГИНИ БАҲОЛАШ

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ОЦЕНКА ЭФФЕКТИВНОСТИ ПРИМЕНЕНИЯ СУБПОРОГОВОГО МИКРОИМПУЛЬСНОГО ЛАЗЕРНОГО ВОЗДЕЙСТВИЯ В ЛЕЧЕНИИ ДИАБЕТИЧЕСКОГО МАКУЛЯРНОГО ОТЕКА

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Резюме. *Диабетик макула шиши (ДМШ) қандли диабет (ҚД) билан оғриган беморларда кўриш бузилишининг энг кенг тарқалган сабабидир ва диабетик ретинопатиянинг ҳар қандай босқичида пайдо бўлиши мумкин. Қандли диабетнинг кўз ичи асоратларини ўз вақтида даволанмаса, кўриш органининг визуал функцияларининг қайтариб бўлмайдиган даражада бузилишлари кузатилади. Бўсаға ости микроимпулс лазер таъсири (БОМИЛТ) 577нм энг самарали, зарарсиз ва энг муҳими ДМШ ни даволашда қатъий параметрлар ва протоколлар ёрдамида клиник шароитда қўлланилиши мумкин бўлган даволаш усули. Ушбу тадқиқотда 12 ой ичида илгари даволанмаган ДМШ ли кўзларида 577 нм микроимпулс лазерли таъсирлашнинг визуал ва анатомик натижаларини ўрганиб чиқилди.*

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Abstract. *Diabetic macular edema (DME) is the most common cause of visual impairment in patients with diabetes mellitus (DM) and can occur at any stage of diabetic retinopathy. The prognosis of the visual functions of the organ of vision is unfavorable, in the absence of timely treatment of intraocular complications of DM. Subthreshold micropulse laser exposure (SMPLE) 577nm is a safe and reproducible method for the treatment of DME, which can be applied in real clinical conditions using fixed parameters and protocols. This study examined the visual and anatomical results of 577 nm micropulse laser photocoagulation in previously untreated DME eyes at 12 months.*

Keywords: *diabetic macular edema, subthreshold micropulse laser exposure, optical coherence tomography.*

Introduction. Diabetic retinopathy (DR) is the most common complication of diabetes mellitus (DM). The complications of progressive DR include macular edema, which largely leads to visual impairment. [3,8,11-13], while the patient needs outside help and possibly reaches disability [1,6]. The global incidence of this disease remains high and approximately 130 million people in the world suffer from diabetes. Data from the World Health Organization show that by 2025 the number of patients suffering from diabetes may reach 350 million people [7].

Macular edema occurs in 10-15% of patients with type 2 diabetes Diabetic macular edema (DME) is the most common cause of visual impairment in patients with diabetes and can occur at any stage of diabetic retinopathy and is observed in the proliferative stage in 70% of cases. The prognosis of the visual functions of the organ of vision is unfavorable, in the absence of timely treatment of intraocular complications of DM [5]. According to the results of Figueira J. and others, in patients with type 2 DM, the detection of DME increases depending on the duration of diabetes from 3% for the first time 5 years from the onset of the disease, to 28% with a history of diabetes for more than 20 years [4]. In patients with type 2 DM, the incidence of DME is higher (27.15%) than with type 1 DM (11.84%) [5].

In 1968, Meyer Schwickerath and Schott published an article describing the positive results of laser treatment for diabetic retinopathy. According to their method, coagulates were applied to the retina in the form of a "lattice" [10]

Different approaches to the treatment of diabetic retinopathy using lasers led to the start of the ETDRS (Early Treatment of Diabetic Retinopathy Study). The use of threshold laser coagulation has its limitations and disadvantages: with a slight edema in the central zone, laser coagulation will be rough, and with significant edema, laser coagulation will be less effective. The possibility of multiple laser coagulation of the foveal zone is also excluded, and repeated sessions are possible only after at least 4-6 months after the first procedure [9].

In 1990, Pankratov invented a new method of laser coagulation in which laser energy was delivered in short pulses or “micropulses” instead of a continuous wave [10]. Friberg and Karatza first reported the clinical use of the 810 nm diode micropulse laser for diabetic macular edema in 1997 [6]. In 2000, a clinical study was launched using a new approach to laser treatment of fundus diseases. Using a diode laser with a wavelength of 810 nm in the micropulse mode, DME was treated for the first time in order to avoid any damage to the retina [1].

Subthreshold micropulse laser exposure (SMPLE) allows to achieve resorption of macular edema, stabilizes and improves the functions of the organ of vision [2]. SMPLE is the most effective, harmless [1,7] and, most importantly, the SMPLE procedure can be performed multiple times in the treatment of DME. The selective effect of SMPLE improves the pumping function of retinal pigment epithelium cells, which in turn leads to the production of antivasoproliferative factors [9].

Thus, the standard continuous laser has been an effective option for decades despite its collateral damage to the retina. Despite the slow spread, the potential of the subthreshold micropulse laser is also gaining recognition.

Purpose. To describe the visual and anatomical results of micropulse laser photocoagulation at 577 nm in previously untreated DME eyes at 12 months.

Methods. The clinical study was conducted at the eye clinic "SIHAT KO`Z" and was a 12-month prospective follow-up. Comparison of morphofunctional parameters of the central retina was based on the analysis of 36 patients (42 eyes) with DME against the background of non-proliferative diabetic retinopathy. The age of the patients ranged from 48 to 66 years. There were 21 women, 15 men. The values of intraocular pressure according to pneumotonometry varied from 11.0 to 20.0 mm Hg. Art.

Before and after treatment, a comprehensive ophthalmological examination was performed, including the maximum correctable visual acuity (BCVA) and retinal thickness in the central fovea, which was determined using optical coherence tomography (OCT). Parameters were assessed before treatment and 1, 3, 6 and 12 months after treatment. The criterion for exclusion from this study was the presence of cataracts that reduce vision.

The mean value of BCVA before treatment in the examined patients was 0.53±0.09. According to OCT data, the thickness of the retina in the center of the fovea was 398.4 ± 18.1 μm on average.

SMPLE was performed on an Easyret diode laser device (Quantel medical, France) with a wavelength of 577 nm in a micropulse mode with a power of 200–400 mW, a spot size of 100 μm, and a pulse burst duration of 200 ms with a duty cycle of 5%. Individual testing of pulse power was performed outside the vascular arcade, with power titrated from 50 mW to a 1st degree burn according to the classification of F. L'Esperance (1983). SMPLE was then performed continuously on the macular region using the same spot size, reducing the laser power to half the power of the test burn. The number of spots varied depending on the length of the DMA.

Results and discussion. An analysis of the clinical and functional results of the treatment of patients showed that the average maximally corrected visual acuity gradually increased during the observation period, a statistically significant change was observed 6 and 12 months after the operation.

In particular, there was a positive trend in the increase in the average BCVA with a simultaneous decrease in the thickness of the retina by the follow-up period of 3 months. However, by the 6th month there was a deterioration in both indicators. The mean retinal thickness slightly increased 1 month after the start of treatment, after which it gradually (statistically significant, $p< 0.01$) decreased during the entire follow-up period.

BCVA indicators one month after SMPLE was 0.72±0.05 ($p<0.01$), after 3 months 0.68±0.03 ($p<0.01$), after 6 months 0.65±0.02 ($p<0.05$), after 12 months 0.64±0.03 ($p<0.05$).

The average retinal thickness steadily decreased during the entire observation period ($p < 0.05$) and. Resorption of the intraretinal fluid was expressed in a decrease or complete disappearance of edema in the outer layers of the retina and a decrease in the thickness of the neuroepithelium. Accordingly, OCT data also changed for all groups. Thus, the OCT values one month after the SMPLE session were 296.4±14.6 μm ($p<0.01$), after 3 months 290.8±18.8

μm (p<0.05), after 6 months 285.3±20.7 μm (p<0.05), after 12 months 286.5±17.9 μm (p<0.05). We did not find any pigmentary changes in fundus photographs or radial OCT scans.

Micropulse radiation with a wavelength of 577 nm in the treatment of "flat" DME showed its effectiveness, as well as safety during repeated treatment sessions, which was expressed in an increase in visual acuity and light sensitivity of the retina, as well as a decrease in the height of macular edema. Threshold laser coagulation reduces the leakage of fluid from the retinal vessels and provides long-term stabilization of the pathological process, but at the same time reduces the functional result due to irreversible damage to the neurosensory layer of the retina. So, in the framework of the study, this indicator turned out to be lower than in the main one, which can be explained both by the stimulating neuroprotective effect of SMPLE and the absence of laser-induced damage to the structure. Unlike suprathreshold, subthreshold laser mode is a non-damaging procedure. According to the selected duty cycle, the laser remains on only 5% of the time, thus generating less heat with consequent less retinal damage than continuous photocoagulation.

Thus, the use of the developed SMPLE protocol, in our opinion, is more preferable in the treatment of patients with "flat" DME from the standpoint of both safety and efficacy, since it allows not only to achieve a positive anatomical result, but also a more stable increase in the functional state of the retina.

Conclusions. Subthreshold micropulse laser therapy with a wavelength of 577 nm in the treatment of DME is an effective and safe treatment option, as it improves visual acuity and thickness of the macula at a follow-up period of 12 months in patients who did not receive treatment for DME.

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ОЦЕНКА ЭФФЕКТИВНОСТИ ПРИМЕНЕНИЯ СУБПОРОГОВОГО МИКРОИМПУЛЬСНОГО ЛАЗЕРНОГО ВОЗДЕЙСТВИЯ В ЛЕЧЕНИИ ДИАБЕТИЧЕСКОГО МАКУЛЯРНОГО ОТЕКА

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Резюме. *Диабетический макулярный отек (ДМО) является самой частой причиной понижения зрения у пациентов с сахарным диабетом (СД) и может возникнуть на любой стадии диабетической ретинопатии. Прогноз зрительных функций органа зрения неблагоприятен, при отсутствии своевременного лечения внутриглазных осложнений СД. Субпороговое микроимпульсное лазерное воздействие (СМИЛВ) 577нм является безопасным и воспроизводимым методом лечения ДМО, который можно применять в реальных клинических условиях с использованием фиксированных параметров и протоколов. В данной исследовании изучали визуальные и анатомические результаты микроимпульсной лазерной фотокоагуляции с длиной волны 577 нм в глазах, ранее не получавших лечения при ДМО через 12 месяцев.*

Ключевые слова: *диабетический макулярный отек, субпороговое микроимпульсное лазерное воздействие, оптическая когерентная томография.*