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EVALUATION OF LOW-INTENSITY LASER THERAPY EFFECTIVENESS IN DRY AGE-RELATED MACULAR DEGENERATION

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ABSTRACT

Research Objective. To evaluate the clinical and functional effectiveness of combined treatment for dry AMD following cataract surgery, including low-intensity laser therapy using the "MAKDEL-08 SPEKL" device. Methods. The study was conducted as an observational prospective longitudinal research. Patients were divided into two groups depending on the type of IOL. Patients observed a moving speckle formed by the radiation of a helium-neon laser (wavelength 0.63 μm). The treatment course consisted of 10 daily sessions of 10 minutes each. Each year, patients received 2 sessions every 6 months. Morphometric analysis was performed using the Dri Oct Triton optical coherence tomograph (Topcon), and macular electroretinography was performed using the Neuro-ERG device (Neurosoft). Results. It has been proven that the application of low-intensity laser therapy in the comprehensive treatment of category 3 dry AMD is effective in reducing the regression of morphometric, functional, and electrophysiological macular indicators. The assessment of indicator dynamics showed that the use of LILT contributed to a more stable trend in indicators over 2 years. Therapy results were particularly pronounced in the groups with a yellow filter and in the group with immature cataracts. However, in the group with clear IOL, despite LILT application, a regression of indicators was observed.

Key words: Age-Related Macular Degeneration; Low-Intensity Laser Therapy; MAKDEL-08 SPEKL.

INTRODUCTION

Currently, age-related macular degeneration (AMD) is one of the leading causes of irreversible vision loss in many patients with posterior segment eye diseases. According to epidemiological data, it is expected that the number of AMD patients will globally increase from approximately 200 million in 2020 to nearly 300 million by 2040. The influence of various spectra of radiation on AMD pathogenesis is one of the least studied areas (1,2,5).

Photobiomodulation therapy (PBMT) has recently attracted attention worldwide as a novel scientific approach to therapeutic application in ophthalmology. PBMT refers to the beneficial effect of low-energy light radiation on target cells or tissues. Numerous studies have shown that PBMT also plays a therapeutic role in various retinal diseases (3,4,6). It significantly improved best-corrected visual acuity and contrast sensitivity in patients with dry age-related macular degeneration and reduced drusen volume, indicating that PBMT, obtained by exposure to low-energy red light, may alleviate the progression of dry AMD and improve patients' visual functions (7,8). Moreover, transcranial delivery of infrared light significantly enhances cytochrome oxidase activity, indicating its role in providing metabolic and antioxidant effects. Infrared light can penetrate these tissues and contribute to neuron restoration in yellow spot degeneration.

Research Objective. To evaluate the clinical and functional effectiveness of combined treatment for dry AMD following cataract surgery, including low-intensity laser therapy using the "MAKDEL-08 SPEKL" device.

Materials and Methods.

Clinical material collection was conducted from 2020 to 2023 at the Republican Specialized Scientific and Practical Medical Center for Eye Microsurgery in Tashkent. An internationally recognized classification according to AREDS was used to grade the stages of dry AMD, with patients in the study included in the 3rd category of AMD according to AREDS classification.

The study was conducted as an observational prospective longitudinal research. Patients were divided into two groups depending on the type of IOL. The study groups are outlined below:

Group 1 (32 eyes): Implanted with yellow-filter IOL Aurovue EV Gold (Aurolab).

Group 2 (30 eyes): Implanted with clear IOL Aurovue EV (Aurolab).

Group 3 (30 non-operated paired eyes of patients with early or immature cataracts). This group was formed as a control to assess the dynamics in eyes without IOL.

MAKDEL-08 "SPEKL". The principle of operation of this device involves projecting a laser speckle structure onto the retina of the eye, which has sufficient contrast and speckle size for perception by the visual system with reduced visual acuity up to 0.02. This stimulates the development of form vision in various forms of low vision. The MAKDEL-08 uses a helium-neon gas laser with a very narrow spectral emission band, which affects the contrast of the observed speckle pattern. Patients observed a moving speckle formed by the radiation of a helium-neon laser

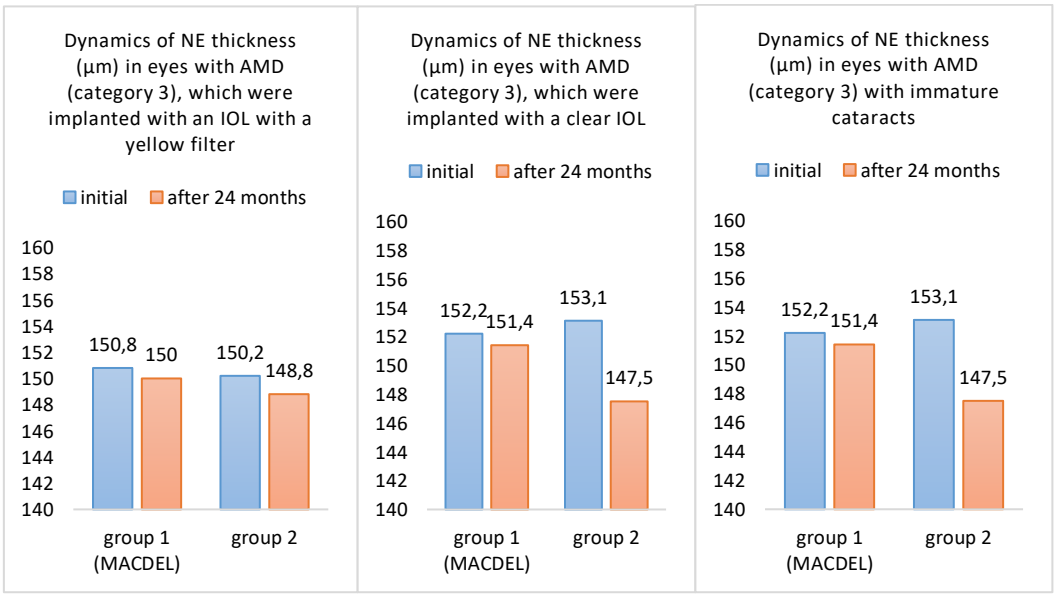
(wavelength 0.63 μm). The treatment course consisted of 10 daily sessions of 10 minutes each. Each year, patients received 2 sessions every 6 months.

Morphometric analysis was performed using the Dri Oct Triton optical coherence tomograph (Topcon), and macular electroretinography was performed using the Neuro-ERG device (Neurosoft).

Statistical analysis was carried out using the MC Office 2019 standard program package.

Results and Discussion.

During the evaluation of the effectiveness of low-intensity laser therapy (LILT), morphometric indicators of neuroepithelium and pigment epithelium thickness were investigated in patients with category 3 AMD. The assessment of indicator dynamics showed that the use of LILT contributed to a more stable trend in indicators over 2 years. Therapy results were particularly pronounced in the groups with a yellow filter and in the group with immature cataracts. However, in the group with clear IOL, despite LILT application, a regression of indicators was observed (Figure 1). Analysis of electrophysiological indicators revealed a similar trend over time. However, it should be noted that the impact of LILT on electrophysiological indicators was more significant, as statistically significant differences in the regression of a-wave amplitude and latency were observed between subgroups.



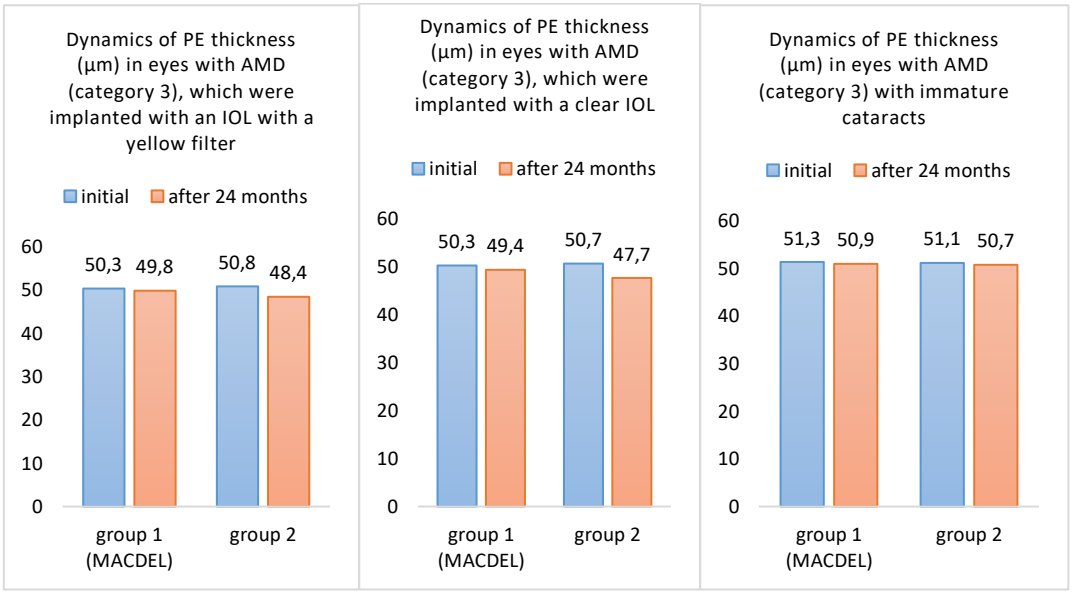


Figure 1. Dynamics of morphometric parameters of the retina in the studied groups.

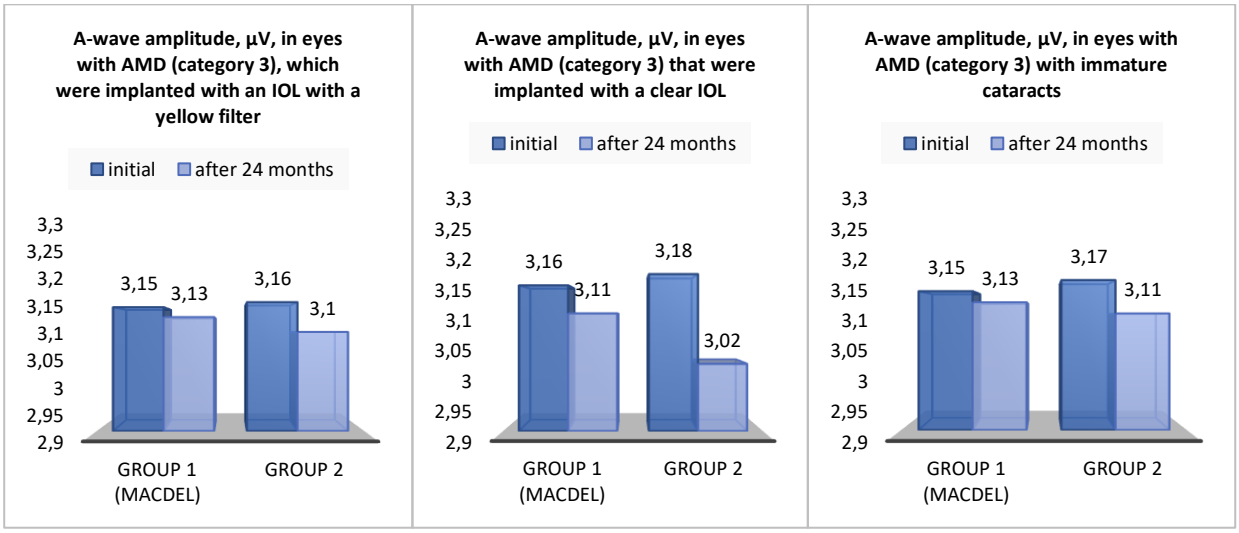


Figure 2. Dynamics of electrophysiological parameters of the retina in the studied groups.

It has been proven that the application of low-intensity laser therapy in the comprehensive treatment of category 3 dry AMD is effective in reducing the regression of morphometric, functional, and electrophysiological macular indicators.

Conclusion. Treatment of category 3 dry AMD after cataract surgery with low-intensity laser therapy using the MAKDEL-08 SPEKL device allows for the stabilization of morphometric, functional, and electrophysiological macular indicators. The most pronounced effect in reducing disease progression is observed when implanting IOL with a yellow filter.

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