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SIGNIFICANCE OF PHYSIOTHERAPEUTIC MANIPULATIONS IN THE PREVENTION OF TRAUMATIC OPTIC NEUROPATHY

Agzamova S. S.[1], Khikmatov M. N.[2]

[1] Doctor of Sciences, Associate Professor of the Department of Ophthalmology, Tashkent State Dental Institute, e-mail: sara2408@yandex.ru, +998(90)9501315, https://orcid.org/0000–0003–3829–7762
[2] Assistant of the Department of Ophthalmology, Tashkent State Dental Institute, e-mail: mirkamol1218@mail.ru, +998(90)8053775, https://orcid.org/0000–0001–6500–1192

Summary. Relevance. Approximately 1.5% to 5% of patients with closed head injuries have damage to the optic pathways (4–6 per 100,000 population per year). TMS is a new, relatively safe, non-drug method for the treatment of various diseases and consequences of injuries of the nervous system. The introduction of the method into everyday clinical practice will optimize the treatment and rehabilitation programs for patients. **The purpose of the study.** To evaluate the effectiveness of simultaneous color and magnetic stimulation in the prevention of traumatic optic neuropathy. **Material and methods.** Color and magnetic stimulation were performed in addition to traditional treatment methods in 37 patients with hemodynamic changes detected in eye artery dopplerography. All patients underwent dopplerography of the eye arteries and a comprehensive ophthalmological examination, including: visiometry, tonometry, perimetry, study of visual evoked potentials (VEP). **Conclusions.** All ophthalmological examination results have increased significantly. In the prevention of traumatic optic neuropathy, the use of color and magnetic stimulation has increased the effectiveness of treatment.

Keywords: color and magnetic stimulation, eye artery dopplerography, visual evoked potentials, eye injury; traumatic optic neuropathy.

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ЗНАЧЕНИЕ ФИЗИОТЕРАПЕВТИЧЕСКИХ МАНИПУЛЯЦИЙ В ПРОФИЛАКТИКЕ ТРАВМАТИЧЕСКОЙ ОПТИЧЕСКОЙ НЕЙРОПАТИИ

Агзамова С. С.[1], Хикматов М. Н.[2]

[1] Доктор медицинских наук, доцент кафедры Офтальмологии, Ташкентский государственный стоматологический институт, e-mail: sara2408@yandex.ru, +998(90)9501315, https://orcid.org/0000–0003–3829–7762
[2] Ассистент кафедры Офтальмологии, Ташкентский государственный стоматологический институт, e-mail: mirkamol1218@mail.ru, +998908053775, https://orcid.org/0000–0001–6500–1192

Аннотация. Актуальность. Приблизительно от 1,5 до 5% пострадавших с закрытыми черепно-мозговыми травмами имеют поражение зрительных путей (4–6 на 100 000 населения в год). ТМС — новый, относительно безопасный, немедикаментозный метод лечения различных заболеваний и последствий травм нервной системы. Внедрение метода в повседневную клиническую практику позволит оптимизировать лечебно-реабилитационные программы пациентов. **Цель исследования.** Целью данного исследования было оценить эффективность цветовой и магнитной стимуляции в профилактике травматической нейропатии зрительного нерва. **Материал и методы.** Цветовая и магнитная стимуляция проводилась в дополнение к традиционным методам лечения у 37 пациентов с гемодинамическими изменениями, выявленными при допплерографии глазных артерий. Всем пациентам выполнялась допплерография артерий глаза и комплексное офтальмологическое обследование, включающее: визиометрию, тонометрию, периметрию, исследование зрительных вызванных потенциалов (ЗВП). **Результаты и заключение.** Результаты всех офтальмологических обследований значительно повысились. В профилактике травматической нейропатии зрительного нерва использование цветовой и магнитной стимуляции повысило эффективность лечения.

Ключевые слова: цветовая и магнитная стимуляция, допплерография артерий глаза, зрительные вызванные потенциалы, травма глаза; травматическая оптическая нейропатия.

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ТРАВМАТИК ОПТИК НЕЙРОПАТИЯ ПРОФИЛАКТИКАСИДА ФИЗИОТЕРАПЕВТИК МУОЛАЖАЛАРНИНГ АҲАМИЯТИ

Агзамова С. С.[1], Ҳикматов М. Н.[2]

[1]Тиббиёт фанлари доктори, Офтальмология кафедраси доценти, Тошкент давлат стоматология институти, e-mail: sara2408@yandex.ru, +998(90)9501315, https://orcid.org/0000–0003–3829–7762
[2] Офтальмология кафедраси ассистенти, Тошкент давлат стоматология институти, e-mail: mirkamol1218@mail.ru, +998908053775, https://orcid.org/0000–0001–6500–1192

Аннотация. Долзарблиги. Бош мия ёпиқ шикастланиши бўлган одамларнинг тахминан 1,5 дан 5% гача кўриш йўллари зарарланиши билан кечади (йилига 100 000 аҳолига 4–6). ТМС — асаб тизимининг турли касалликлари ва шикастланишлари оқибатларини даволаш учун янги, нисбатан хавфсиз, номедикаментоз усулдир. Усулни кундалик клиник амалиётга жорий етиш беморларни даволаш ва реабилитация дастурларини оптималлаштиради. **Тадқиқот мақсади.** Травматик оптик нейропатияни олдини олишда рангли ва магнитли стимуляциянинг самарадорлигини баҳолаш. **Материал ва услублар.** Кўз артериялари доплерографиясида гемодинамик ўзгаришлари аниқланган 37 та беморда анъанавий даволаш усулларидан ташқари, рангли ва магнитли стимуляция амалга оширилди. Барча беморлар кўз артериялари доплерографияси ва кенг қамровли офтальмологик текширувдан ўтказилди, уларга қуйидагилар киради: визиометрия, тонометрия, периметрия, визуал чақирилган потенциалларни (ВЧП) ўрганиш. **Натижа ва хулоса.** Барча офталмологик текширув натижалари сезиларли даражада ошди. Травматик оптик нейропатияни олдини олишда рангли ва магнитли стимуляциядан фойдаланиш даволаш самарадорлигини оширди.

Калит сўзлар: ранг ва магнит стимуляция, кўз артерияси доплерографияси, визуал уйғотувчи потенциаллар, кўзнинг шикастланиши; травматик оптик нейропатия.

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Relevance. Approximately 1.5% to 5% of patients with closed head injuries have damage to the optic pathways (4–6 per 100,000 population per year). These injuries can be divided into anterior and posterior. Anterior lesions show ophthalmoscopic abnormalities (occlusion of the central retinal artery) and are usually associated with various easily recognizable lesions of the eyeball. Anterior lesions may include optic nerve avulsion, traumatic anterior ischemic optic neuropathy, anterior optic sheath hematoma, and compression of the optic nerve by anterior orbital hematoma. Posterior lesions, on the other hand, are often not detected by ophthalmoscopy, but disc edema (acutely) and optic nerve pallor (eventually) occur. Posterior traumatic optic neuropathy is characterized by loss of vision that occurs in the presence of an afferent pupillary defect (APD) but without evidence of damage to the eye or optic nerve.

Currently, only descriptions of individual clinical cases of the use of Transcranial magnetic stimulation (TMS) in the treatment of the consequences of traumatic brain injury (TBI) have been published in the literature; blind placebo-controlled studies with a large number of patients have not been conducted. Animal model studies have been published suggesting the effectiveness of this method in the rehabilitation of patients. They show the effect of using TMS in the form of a decrease in apoptosis, an increase in neuronal activity, and an increase in the expression of neuroplasticity markers [1–3]. The description of TMS-induced epileptic seizures in the treatment of TBI consequences causes some concern, however, it is indicated that these seizures occur when high-frequency stimulation (>5 Hz) is used, while the use of low-frequency stimulation is considered a safe technique [4]. Significant clinical improvement has been described with TMS in patients with mild TBI. In a study by L. Koski et al. showed a decrease in the severity of headache, sleep disorders and improvement of cognitive functions in the treatment of mild TMS TBI [5]. Separate publications on the use of TMS in the treatment of severe TBI show a clinical improvement, in particular, in cognitive functions, primarily visuospatial perception and executive functions [6, 7]. In the treatment of syndromes of impaired consciousness and vegetative state, no clinical improvement was found [8–10]. Thus, TMS is a new, relatively safe, non-drug method for the treatment of various diseases and consequences of injuries of the nervous system. The introduction of the method into everyday clinical practice will optimize the treatment and rehabilitation programs for patients.

The purpose of the study: to evaluate the effectiveness of simultaneous color and magnetic stimulation in the prevention of traumatic optic neuropathy.

Material and methods. We used color and magnetic stimulation of the optic nerve in addition to the traditional methods of drug treatment (dehydration therapy, local neuroprotective therapy) in 37 patients with hemodynamic changes during dopplerography of the ophthalmic arteries. In the control group, 19 patients received only conservative treatment. Age of patients 18–55 years; 25 men, 12 women. All patients underwent dopplerography of the ophthalmic arteries and a comprehensive ophthalmological examination,

which included: visometry, tonometry, perimetry of the spherical perimeter and the study of visual evoked potentials (VEP) using the Neuro-MEP-NeuroSoft apparatus.

During the treatment, the apparatus TMS-12 developed by LMO OOO was used. The monocular light emitter installed on the glasses included in the TMS-12 kit makes it possible to carry out the procedure of color stimulation simultaneously with transcranial magnetic stimulation. To do this, a monocular light emitter is put on special glasses. During the procedure, the magnetic examiner is located in the zones along the projection of the optic nerve, which provides the regime of a moving magnetic field. The direction of movement changes every minute to reduce the adaptability of the body. The speed of its movement (modulation frequency) can be adjusted from 1 to 16 Hz, which provides a very wide choice of frequency to optimize the treatment parameters. The treatment was carried out for 20 minutes every day for 10 days. Patients in the control group received treatment according to the traditional scheme.

Results and discussion. To assess the effectiveness of the therapy, an analysis of the Doppler ultrasound parameters of 90 eyes in dynamics was carried out (15 eyes in each group, before and after treatment).

The parameters of artery ophthalmicus (AO) ultrasound before the start of treatment were 19.1±0.14 cm/s in the main group, and 20.6±0.12 cm/s in the control group. A decrease in the initial level of the maximum systolic blood flow velocity (Vs) and an increase in the resistance index RI in all the studied groups, as well as a decrease in the ischemia coefficient (IC) by 10–13% were revealed.

Indicators of blood flow velocity in the AO in patients in the main group after treatment (10 days) increased by 6 to 29.1 ± 0.21 cm/s, in the control group this indicator was 24.4 i.e., more by 4. At 1 month of observation, it was found that the blood flow velocity in the AO in the main and control groups was 29.3±0.17 and 23.5±0.11 cm/s, respectively (it was stable). After 3 months, in patients of the main group, it was revealed: a slight decrease in the blood flow velocity in the AO by 3, amounting to 26.5±0.15 cm/s ($p<0.05$).

Studies of blood flow in the vessels of the eye in patients of the control group in the period from 1 to 3 months, there was a decrease in the achieved functional indicators, namely, the intensity of chorioretinal microcirculation decreased in AO by more than 10. This was confirmed by an increase in RI in all vessels by 4.2% and a decrease in IC by 2.5% from the initial level, which indicates the progression of the chorioretinal ischemic process and the further development of TON.

As a result of the combined physiotherapy, visual acuity improved by 0.3–0.5 in 68% of patients; expansion of the field of view: on average by 85 ± 35 degrees; visual evoked potentials: in 80% — an increase in amplitude by 2–4 μV, a decrease in latency by 20–35 ms. Subjective assessment of the condition: according to the patients, "began to see better, including small letters", increased efficiency, discomfort in the eyes, headache disappeared, sleep and mood improved.

Side effects were not observed. As a result of the combined physiotherapy, there was an improvement in visual acuity in 70% of patients in the comparison group by 0.2–0.4; expansion of the field of view: on average by 85 ± 35 degrees; visual evoked potentials: in 80% — an increase in amplitude by 2–4 μV, a decrease in latency by 20–35 ms. In the control group, improvement in visual acuity occurred in 28% of patients by 0.1; expansion of the field of view: on average by 25 ± 5 degrees; visual evoked potentials did not change. Thus, according to the data of the study, the effectiveness of the new method of physiotherapeutic neuroprotection is significantly higher than the traditional method of magnetotherapy to the orbit area.

Conclusions. Thus, the analysis of the results of combined surgical and joint ophthalmic conservative treatment of patients in the main group showed a significant improvement in hemodynamic parameters, which indicate stabilization of the ischemic process in 95% of cases.

Conservative treatment used in the control group causes short-term (up to 1 month) dilatation of the arteries, a decrease in RI and an increase in CI. In the future, the indicators return to the original level.

The use of color and magnetic stimulation in combination with traditional conservative therapeutic measures in the prevention of traumatic optic neuropathy increased the effectiveness of therapeutic measures. This method allows you to more effectively improve and stabilize the important functions of the patient.

Simultaneous color and magnetic stimulation resulting in an increase in P100 VEP amplitude indicates activation of the visual cortex.

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