

## **OPHTHALMOLOGICAL DEVICE MILTA-01 OFT IN TREATMENT OF CHILDREN WITH INDEX AMBLYOPIA**

***T.S. Kheilo, O.A. Plyukhova, V.N. Khristoforov, A.Y. Grabovshchiner***

**Center of Therapeutic Ophthalmology; PKP GIT, Moscow**

Index amblyopia is a major cause of vision impairment in children. Amblyopia occurs as a unilateral or bilateral decline in vision acuity which can be related to the absence, restriction or distortion of visual afferentation or abnormality of binocular interaction in childhood (Nordon, 1978).

Available treatments are combined interventions (occlusion, penalization, reflex therapy and others) in the setting of specialized offices and centers. Therapy efficacy, which can be 50 percent (Parks, 1993), is largely dependent on its regularity, a requirement which may not be achievable for various reasons. The high price of necessary equipment also limits availability of therapy.

Furthermore, treatment of index amblyopia is most effective in the first decade of life, and therefore most should be done of it just in this span.

These considerations prompted the need for a new treatment for amblyopia in children, which would be effective and safe and would use a compact, easily operated and relatively cheap equipment allowing treatment at home.

This project offers a new multimodality method for index amblyopia.

A known intervention for amblyopia is mechanical treatment of the circular eye muscle (vibratory massage) which improves the posterior ocular blood supply through myofascial reflexes and activates metabolism.

We have proposed magnetic stimulation instead of the mechanical treatment to make effects on the circular muscle more focused. The static magnetic field more actively evokes vascular compensatory mechanisms, with emergence of arteriovenular and venulovenular anastomoses and capillary dilation. Combined use of low-intensity laser radiation and the static magnetic field potentiates the effects because of their additive action and induction of qualitatively new physical processes (1).

We used as a source of circular muscle irradiation the magnetic-infrared therapeutic laser device (MILTA) which has been permitted for clinical use by the Russian Health Ministry's Committee for New Equipment in 1993 and which has acquitted itself well.

The MILTA device combines three therapeutic factors:

- magnetic field similar to the magnetic field of Earth,
- continuous light diode infrared radiation similar to infrared thermal radiation of the sun,
- pulsed laser infrared radiation similar to that of cells.

Concurrent exposure to these factors consolidates their therapeutic effects. The effects of the MILTA device are underlied by stimulating action of radiation on the body. Importantly, this intervention is not associated with exposure to any foreign chemical agents.

Beneficial effects of MIL therapy are multiple (anti-inflammatory, analgesic, antioedematous, immunostimulating, desensitizing, regenerative and others), but of special interest to us was the vasodilating effect resulting in blood and lymph microcirculation improvement.

Another known therapy of index amblyopia is laser stimulation of eye vessels, effectiveness of which has been long since confirmed (Avetisov et al., 1977; Semyonova et al., 1986). Of special interest are methods of continuous macular stimulation using a monochromatic helium-neon laser beam, as this laser is readily available and relatively cheap. Clinical effects of laser stimulation are seen as enhancement of visual function and improvement of functional tests (color perception thresholds, dark adaptation, red light retinogram, the central visual field and the photostress test) (Baronetskaya et al., 1989). Visual functional stimulation is achieved because of light-induced intensification of DNA and RNA synthesis in retinal cells (Linnik et al., 1979) and improvement of the phagocytic activity in the retinal pigment epithelium (Krasnov et al., 1982).

Laser stimulation increases the number of cone reception fields and produces a stable inhibition-stimulation relationship in the central retina.

Our clinical trial explored effects of combined use of interventions for index amblyopia (helium-neon laser stimulation of the retina simultaneous with magnetic-infrared laser treatment of the circular muscle).

The study was based at the Moscow scientific-technological center Eye Microsurgery and involved 23 children (29 eyes) aged 6 to 14 years diagnosed with index amblyopia (severe in 7, moderate in 18 and mild in 4).

The course comprised six alternate-day treatments. The MILTA device was used to deliver magnetic-infrared laser radiation on the circular muscle. The irradiation mode was scanning.

Irradiation characteristics were magnetic field induction, 25-33 mTl; power of incoherent infrared radiation with a 860-930 nm wavelength, 60 mW; power of laser radiation with a 890 nm wavelength, 2 mW. Circular muscle exposure was 5 min.

Retinal laser stimulation was conducted immediately after MIL therapy. Irradiation parameters were wavelength, 639 nm; red-spectrum wave maximum output power, 50 mcW; spot diameter, 500 mcm; frequency, 1.5 Hz; exposure, 3-5 min.

In the presence of bilateral amblyopia, both eyes were treated on the same day at a 30 minute interval. Acuity improved in 27 of 29 eyes.

A significant increase in amplitudes of v and v1 waves was seen on electroretinograms, suggesting functional activation of retinal central cones. Amplitudes of evoked visual potentials also significantly grew after therapy. Only two patients (two eyes) with severe index amblyopia showed no improvement.

Encouraged by the good results of the clinical trial, we combined the possibilities of MIL therapy and retinal red-spectrum laser stimulation in one device, whose control and design were made simpler to allow its use at home apart from the clinical setting.

The new version for a clinical trial was the ophthalmological therapeutic device MILTA-01 OFT (MIL spectacles).

Indications for its use are

- index (anisometropic) amblyopia,
- dysbinocular amblyopia,
- obscure amblyopia (after reversal of a primary cause).

The mechanism of MIL therapy and laser stimulation of the retina allows to expand indications for their use on macular dystrophy of various origins (except for retinal abiotrophy).

Contraindications for use of MILTA-01 OFT are

- acute infections and septic conditions,
- blood diseases
- central nervous system diseases (epilepsy, schizophrenia and others).

## METHOD

Patients put on the MIL spectacles whose frame had in its upper and lower orbital edges embedded sources of magnetic-infrared laser radiation consistent with the location of the circular muscle. Muscle exposure was 5 min. Irradiation parameters were magnetic field induction, 25-45 mTl; incoherent radiation power, 60 W; wavelength, 860-930 nm; infrared laser radiation power, 2 mW; wavelength, 890 nm. Irradiation was by contact. Next, without taking the spectacles off, the patients turned on a semiconductor source of red coherent radiation (wavelength, 630 nm) and focused the eyes on the source which was located in the spectacles at a 5 cm distance. Radiation power was up to 5 mcW, the spot diameter 500 mcm and exposure 3-5 min.

A course of treatment was six exposures at alternate days. The course can be repeated in three months.

## CONCLUSION

The proposed method for pediatric amblyopia using the MILTA-01 OFT device appears to be promising and usable in combination with other interventions.

## REFERENCES

1. Illarionova V.Y. Techniques and methodologies of laser procedures. Moscow, Laser Market, 1994.