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Application of photodynamic and neuroaccustic stimulation in the program of psychophysiological state correction of footballers

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Summary. The article outlines the new technologies of the multilevel approach in the application of neuro-acoustic and photodynamic stimulation in the protocols of correction of the psychophysiological state of the footballers at the stage of rehabilitation and in the process of preparation for the game. This protocol is based on the application of general and zonal stimulation of the neuromuscular system at individually selected frequencies in combination with the psychological state correction by physiotherapy methods.

Keywords. Psychological and medical rehabilitation of football players, photodynamic stimulation, neuro-acoustic stimulation, physiotherapy.

Relevance. Playing professional football makes specific requirements for the training of football players. The study of the psychophysiological state of football players, which affects the results of sports activities, has an important theoretical and applied significance [1,2]. Therefore, the problem of researching the psychophysiological features of football players is an urgent task and requires clarification of the patterns of influence of external physiotherapeutic influence and football training on the psychophysiological state of football players. It is known that athletes with high psychophysiological status have a fairly high level of neuropsychological endurance, high tone of the neuromuscular system, high decision-making speed, good motor reaction, moderate mental stress. The optimized level of the psychophysiological state of the player allows to participate effectively in competitions and at the same time feel quite comfortable [2]. The functional state of the neuromuscular system determines the basic parameters of the motor activity of the players. In team sports, which are subject to high levels of emotional stress and concentration, the psychophysiological status of an athlete plays a great role in achieving maximum performance in a short period [AV Shahanova, IS Belenko, 2014].

With a personalized approach to assessing and correcting the psychophysiological profile of a player, it is possible to effectively use the reserves of his body, which, in turn, can ensure the high efficiency of his sports activities, even in stressful situations, especially in responsible games. When playing soccer, the importance of namely this state of the neuromuscular system and the psychological preparation of athletes is absolutely obvious. If we take into account the high intensity and motor density of the training sessions in football, the optimization of the player's psycho-functional state in the process of preparing for the game and in the process of rehabilitating athletes after the game can significantly improve player’s life quality and, accordingly, his professional capabilities. The structure of training, competitive and rehabilitation activities in football requires the optimization of the psychophysiological state of

football players, which would largely ensure the success of their sporting activities and their comfortable psychological state. Consequently, the use of psychophysiological analysis and correction of the psycho-functional state and neurophysiological functions of the neuromuscular system of a football player is dictated by the need and the possibility of increasing the sports performance of players.

The currently existing software and hardware complexes for the study of psychophysiological indicators of players are practically not adapted to carry out a subsequent personalized correction of their condition, and training programs for athletes do not use innovative technologies to correct the psychological and functional state of players by using physiotherapy methods.

With the purpose of increasing sports performance and the effectiveness of rehabilitation of football players, the authors developed a technology for correcting the psycho-functional and psychophysiological state of football players on the basis of combined application of personalized photodynamic, magnet-laser therapy and neuro-acoustic stimulation on physiologically comfortable rhythms in combination with endonasal breathing of a singlet-oxygen mixture in a magnetic field [3, 4].

As the main hypothesis for developing protocols for photodynamic correction of the psycho-functional and physiological state of football players, the following axioms were adopted:

- the possibility of increasing the functionality of neuromuscular tissue using photodynamic stimulation;
- possibility of correction of the psycho-functional state of football players on the basis of transcranial photo- or magnet-laser stimulation;
- the possibility of correcting the psychological state of athletes by methods of neuro-acoustic stimulation on personalized physiologically comfortable rhythms;
- the possibility of compensating the aerobic starvation on the basis of the application of endonasal breathing with a singlet-oxygen mixture in a magnetic field [4].

To perform photodynamic stimulation, MIT series of machines (Medinteh, Kiev) was developed for zonal and general effects on the muscular tissue of players. The appearance of the machine is shown in Fig.1. A distinctive feature of the technical implementation of the machine is the simultaneous application of electromagnetic radiation of the 3 spectral ranges (Blue 0.45-0.46 μm, Red 0.63-0.65 μm, Infrared 0.7-0.8 μm) in a pulsed magnetic field on personally matched functionally selected rhythms in the range of 6-77 Hz [4, 5].

Fig. 1A. The machine MIT-MT

Fig.1b. Software and hardware complex "Zhiva"

To perform the correction of the psycho-functional state of players on the basis of transcranial magnet-laser and neuro-acoustic stimulation in combination with the use of endonasal breathing of the singlet-oxygen mixture in a magnetic field, the machine "Helmed" was used [6]. Appearance of the device is shown in Fig. 2

Fig.2. The appearance of the machine «Helmed».

«Helmed» provides the possibility of simultaneous or separate use of:

1. Transcranial photodynamic stimulation by electromagnetic radiation of two spectral ranges (Blue 0.45-0.46 μm and Red 0.63-0.65 μm) at personally selected frequencies in the range 0.1-99.9 Hz.

2. Neuro-acoustic stimulation with the use of relaxing music, isochronous or binaural individual rhythms.

3. Breathing of a singlet-oxygen mixture in a magnetic field (in combination with a MIT-C apparatus).

Photodynamic stimulation of the skin integument of the body in combination with neuro-acoustic stimulation of the brain at alpha rhythm frequencies in the process of endonasal respiration with a singlet-oxygen mixture in a magnetic field with simultaneous exposure to a magnetic field and an optical flow of the visible range of the spectrum onto the projection of the cerebral cortex provides a reduction in the level of anxiety-depressive disorders and stimulation of physiological abilities of football players.

To optimize the process of correction of the player's psycho-functional state, the authors were asked to perform several physiotherapeutic procedures in combination, namely: during the endonasal respiration of the singlet-oxygen mixture in a magnetic field, transcranial magnetic field and optical flow of the visible spectrum, neuro-acoustic stimulation of the brain on psychologically comfortable rhythms in the range of 6-77 Hz, additionally simultaneously carry out photodynamic stimulation of the nervous-muscles system by the visible and infrared spectrum of the optical flow in the magnetic field on the individually selected frequencies.

The additional photodynamic stimulation of the neuromuscular system by the optical flow of the visible and infrared spectrum of electromagnetic radiation in a magnetic field at individually selected frequencies will provide an increase in the physiological parameters of the players.

The proposed method is implemented as follows.

Endonasal respiration with a singlet-oxygen mixture is performed using the machine MIT-S. The effect of the magnetic field and optical flow of the visible range of the spectrum on the oblong brain and interbrow arches is performed using the machine "MIT-MT" [5].

Binaural correction of the player's psychological state is carried out using the hardware-software complex "Helmed" against the background of relaxing music and a frequency of additional sounding 99.5 Hz for the left channel. The frequency of the right channel sound is set as the difference between the sound frequency of the left channel and the individual psychologically comfortable frequency obtained as a result of the preliminary study. The definition of an individual psychologically comfortable frequency is performed using the Samosyuk-Chukhraiev method [3]. All the players participating in the study had a frequency of 10.2 ± 3.1 Hz. Footballers set the volume of music sounding by their own on the basis of subjective comfortable sensations. The eyes of a footballer are closed during the procedure.

In addition, it is simultaneously necessary to carry out photodynamic stimulation of the neuromuscular system of the body by the optical flow of the visible and infrared spectrum of electromagnetic radiation in a pulsed magnetic field at individually selected frequencies using the MIT-MT apparatus with a specially designed photodynamic stimulation system in the form of a suit. The pulse repetition frequency is adjustable in the range of 6-77 Hz.

The duration of one procedure is 25-40 minutes. Stimulation procedures are conducted during the preparation for the game. Procedures for the rehabilitation of players are held within 2-3 days after the game. To assess the effectiveness of the proposed method, the authors carried out observations in 2 groups of volunteers with 8 players on the basis of the FC Dynamo Kyiv medical center (Kiev).

In the first group, the training was performed according to the usual scheme without additional psycho-functional correction. In the second group, the players additionally underwent psycho-functional correction using transcranial photodynamic and neuro-acoustic stimulation in combination with endonasal breathing of the singlet-oxygen mixture in a magnetic field and zonal photo-stimulation of the lower limbs muscles.

As a result of applying the proposed variant of photodynamic correction of the psychophysiological state, the players of the second group subjectively noted a decrease in the level of anxiety and depression, increased stamina, speed, reduced fatigue, and improved overall well-being.

Based on the processing of the obtained results, it was found that the use of the proposed method of the psychophysiological state correction of football players by 21-23% has lower levels of depression (based on the results of testing using psychometric tables of A. Beck) and anxiety (according to the results of testing using psychometric tables of Spilberger-Hanin) and physiological indicators an average of 12-15% higher than in the group where the correction was not carried out.

It is advisable to use the developed technologies to optimize the rehabilitation and training process, which will contribute to increasing the psycho-functional and physiological parameters of football players.

Correction of psychophysiological indices on the basis of photodynamic and neuro-acoustic stimulation in combination with endonasal breathing of singlet-oxygen mixture in a magnetic

field contributes to a higher readiness of players to play and increasing the effectiveness of the rehabilitation process after responsible competitions.

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