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Fractal optical stimulation to support the cognitive ability in aging and TBI

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Cognitive decline is characteristic of various pathological conditions including traumatic brain injury (TBI) and can accompany normal aging. Technologies of neurorehabilitation exploiting the structural-functional plasticity of the brain could promote the forming of new connections to compensate the cognitive deficit. Methods of cognitive rehabilitation include techniques of mental and physical training and different regimens of stimulation therapy such as transcranial magnetic and electrical stimulation, and low-intensity stimulation by sensory stimuli, positive effects of which were shown in many studies. However, taking into account that in aging and pathology potential of neuroplasticity is reduced, the efficacy of any methods of neurorehabilitation can be objectively restricted. Besides, in the stimulation therapy, optical, audio and other signals with a regular, periodic temporal structure are usually applied. The periodic rhythms can provide some improvement of the cortical activity in the particular range of EEG. But they cannot restore complex fractal dynamics of the brain's activity typical of a healthy person and improve the cognitive ability of the patient. We suppose that the fractal stimulation by complex-structured optical signals and sound tones will promote activating the structural-functional plasticity and improve cognitive functions in pathological conditions associated with the cognitive decline. Evoked changes in the cortical activity can ensure the impact of stimulation on cognitive functions. Because the fractal stimulation is supposed to increase the potential of neuroplasticity, during the period of enhanced plasticity (against the backdrop of a course of stimulation therapy) an increase in the efficiency of different others neurorehabilitation measures should be expected.

Biography

Marina Zueva is a Professor of Pathophysiology. She has completed her Graduation at the Lomonosov Moscow State University and PhD at Moscow Helmholtz Research Institute of Eye Diseases. Currently, she is the Head of the Division of Clinical Physiology of Vision at the Moscow Helmholtz Research Institute of Eye Diseases. She has published over 15 peer-reviewed full-length papers in English and presented near 70 topics at international conferences. Her research topics include "Clinical physiology and electrophysiology of vision, neurophysiology, age-related and neurodegenerative disorders of the visual system and the brain, neurocognitive technologies of the restoration, maintenance and improvement of the brain activity and cognitive functions".

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