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## Eye movement rehabilitation by CN-NINM intervention: A set of case studies

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The neurorehabilitation of sensory and motor functions after brain damage and loss of brain functions is underdeveloped, including the recovery of eye-movement control. There are very few methods that show the possibility of eye movements enhancement affected by brain injuries or disease. The goal of our research was to investigate how cranial-nerve non-invasive neuromodulation (CN-NINM) can recover the oculomotor function impairments and help to improve eye movement control for people with stroke, Parkinson's disease (PD), multiple sclerosis (MS) and traumatic brain injury (TBI) symptoms. The CN-NINM therapy includes a combination of targeted exercises for recovery of balance and gait motor control with electrotactile tongue stimulation, using the Portable Neuromodulation Stimulator (PoNStm device). Assessment of oculomotor function was performed before and after the CN-NINM intervention using special 4-channel binocular eye tracking goggles (VisualEyes, Micromedical Inc) and custom analysis software. To evaluate the state of subjects' eye movements, we used three static nystagmus tests (vertical and horizontal gaze, and spontaneous nystagmus) and two dynamic tests (random saccade and smooth pursuit). All of the tests were performed without tongue stimulation.

Balance, gait, and eye movement control gradually improved in all tests. We observed improvement of eye fixation, accuracy and stability in nystagmus and gaze tests, increased eye movement accuracy and precision, improved gain and velocity of target tracking, and changes in both smoothness and synchronization of binocular movement control in oculomotor tests. The improvements of eye movement control demonstrated by this set of case studies suggest that CN-NINM therapy may benefit people affected by stroke, PD, MS, and TBI, and would offer a novel treatment option for oculomotor disorders.

## Biography

Yuri P Danilov is a system neuroscientist with over 35 years' experience in research on brain functions and the special senses, including vision, taste, hearing and balance. He is the lead discoverer of the balance retention effect and continues to identify potential clinical and non-clinical application of neuromodulation and sensory substitution technology. He received the PhD degree in Neuroscience, in 1984, from the Pavlov Institute of Physiology, USSR Academy of Science. He was co-inventor of the Brain Port vision and balance systems. He is a co-inventor of the CN-NINM technology and his interest areas are neuroplasticity, neurorehabilitation and enhancement of human performance.

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