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Wavelength selection for Alzheimer disease treatment with LED based transcranial photobiomodulation

Ivan Vladlenovich Fedosov✉, **Oxana Valerievna Semyachkina-Glushkovskaya**

Saratov State University, Scientific Medical Center, laboratory "Smart Sleep" (Saratov, Russia)
✉fedosov_optics@mail.ru

Alzheimer's disease (AD) is an age related brain pathology that is accompanied by progressive memory loss. With the global ageing of population the number of people over 65 with AD is doubling every 5 years dramatically increasing the need for efficient AD treatment technologies. However currently proposed pharmacological therapies for AD have failed to show effectiveness and safety.

The alternative approach can be based on non pharmacological technologies like non-invasive transcranial photobiomodulation PBM. As it was recently discovered PBM is capable for effective stimulation of lymphatic removal of vastes and toxins, including AD related amiloid-β (Aβ). Furthermore, it was demonstrated that the efficiency of PBM based activation of brain lymphatics increases if the stimulation is performed during deep sleep of the patient. Thus the concept of night photobiomodulation during sleep has been proposed for AD treatment.

In contrast to conventional PBM techniques widely used for clinical and ambulatory physiotherapy the novel approach requires for compact lightweight and safe autonomous light emitting devices suitable for overnight placement on patients head while ensuring comfortable sleep. These devices could be controlled via wireless interface to be activated once deep sleep stage was detected with a smart bracelet or other sleep tracking wearable instrument. Among the numerous actual engineering problems related with design of these novel instruments the proper selection of the light source plays central role since it defines future cost and performance of the technology.

In this paper we discuss the optimal selection of wavelength for transcranial near infrared PBM of AD during deep sleep of the patient. We review researches and clinical studies to date and also present original results obtained with the use of 880 nm, 1050 nm and 1300 nm LEDs on animal models of AD. We also discussed the impact of pulsed mode of photostimulation vs continuous wave one on the effectiveness and safety of PBM of AD during sleep.

Key words: neurotechnology, medicine, photobiomodulation, Alzheimer's disease, LED, sleep.

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