Medical Xpress

Photobiomodulation for Alzheimer's disease with modulated 1070-nm light

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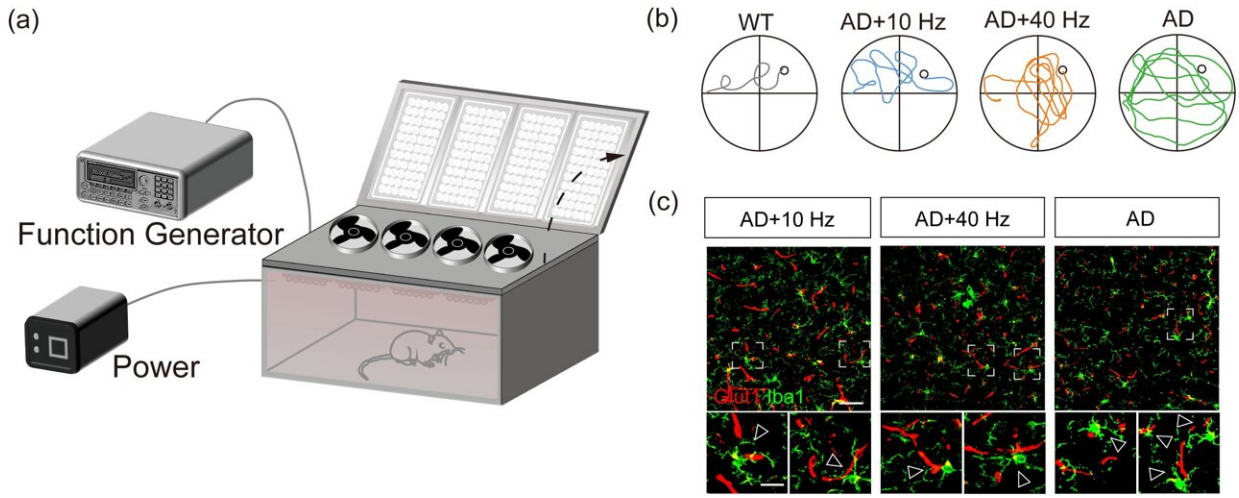

a. The 1070-nm light irradiation apparatus and the transmittances of 1070-nm light. b. typical swimming path of mice during Morrie Water Maze. c. Perivascular microglia in the cortex of APP/PS1 mice (scale bar, 50 μm). Credit: by Lechan Tao, Qi Liu, Fuli Zhang, Yuting Fu, Xi Zhu, Xiaofu Weng, Hongbin Han, Yong Huang, Yuanzhen Suo, Liang Chen, Xiaoling Gao and Xunbin Wei

AD is associated with progressive impairments in memory, language, orientation, and other cognitive skills that affect daily activities throughout the disease course, ultimately leading to death. There is a dire need for effective therapeutic strategies for AD treatment. PBM refers to the low-power light (1–500 mW) in the visible and near-infrared (NIR) spectra to trigger beneficial biological processes in cells and

tissues, leading to physiological alterations. PBM has been considered as a promising approach for AD, while its exact mechanism is still unclear.

In a new paper published in *Light Science & Application*, a team of scientists, led by Professor Xunbin Wei from Med-X Research Institute and School of Biomedical Engineering, Shanghai Jiao Tong University, China, Biomedical Engineering Department, Peking University, and co-workers has conducted PBM with a specific stimulating pattern to treat AD mouse model. They explored the effects of 1070 nm light pulsed at 10 Hz on the treatment of APP/PS1 mice. The parameters used in this study were based on a previous study of their team.

"The apparatus consisted of a chamber and a light-emitting diode (LED) array as the lid. During treatments, mice can ambulate, explore, and rest. Mice in the AD and WT groups underwent the same procedures as the treatment groups, except that the 1070-nm light device remained off," the team says.

After light treatment, they explored the effect of light on mice at a different stage of AD. They demonstrated that 1070-nm light improved the memory and cognitive abilities of AD mice via decreasing the Aβ load. In addition, they found that 1070-nm could trigger microglia responses rather than astrocyte responses to promote the Aβ clearance. The perivascular microglia were observed to decrease after light stimulation, while the vessel density increased. They found that increased vessel density also promoted the clearance of Aβ.

"Our results demonstrate the effects of 1070-nm light on microglia modulation and cerebral vessels during different phases of AD and provide valuable insight into the mechanisms of 1070-nm light treatment to AD," the team explains. "This is beneficial for the exploration of optimal parameters when administering PBM as well as the development of a promising and novel therapeutic approach for AD."

More information: Lechan Tao et al, Microglia modulation with 1070-nm light attenuates Aβ burden and cognitive impairment in Alzheimer's disease mouse model, *Light: Science & Applications* (2021). DOI: 10.1038/s41377-021-00617-3

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