Brain Photobiomodulation Improves Sleep Quality in Subjective Cognitive Decline: A Randomized, Sham-Controlled Study

Background: Sleep appears to be a sensitive biomarker that facilitates early detection and effective intervention for Alzheimer's disease, while subjective cognitive decline (SCD) is a risk factor for Alzheimer's disease. Prefrontal cortex atrophy is associated with both sleep disruption and cognitive decline. Transcranial brain photobiomodulation (PBM) therapy can enhance frontal cortex oxygen consumption, increasing frontal cortex mediated memory function.

Objective: This study aimed to test whether PBM therapy targeting the frontal cortex could improve sleep and cognitive function in SCD.

Methods: Fifty-eight SCDs were divided into the PBM group (N = 32) in which real light therapy was administered and a sham light therapy group (N = 26). All the participants received either real light or sham light therapy for 6 days

consecutively, while the sleep data were recorded. The n-back task was employed to measure each participant's working memory.

Results: We found no differences in sleep efficiency change (F = 211, p = 0.279), REM stage percent change (F = 420, p = 0.91), and wake-up time (F = 212, p = 0.277) between the two groups. The sleep efficiency and REM were improved within the true light group on the fifth day. The true light group perform better than the control group in the n-back test, the accuracy was higher in the 2-back test (88.6% versus 79.6%, p = 0.001), and the reaction time in 1-back was shorter (544.80±202.00 versus 592.87±222.05, p = 0.003).

Conclusion: After five days of PBM therapy targeting the prefrontal cortex, sleep efficiency and N-back cognitive performance were improved on the fifth day.

Keywords: Alzheimer's disease; photobiomodulation; sleep; subjective cognitive decline.