

Effect of Low-level Light Therapy in the Elderly and Patients with Mild Cognitive Impairment

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Objective

Low-level light therapy (LLLT) is used to stimulate cell function or to reduce pain by applying light emitting diodes (LED) to the skin. LLLT is also known to contribute to enhance neuronal reconstruction of brain tissue for the treatment of degenerative disorders in the animal studies. This study aimed to investigate the effects of LLLT in patients with mild cognitive impairment (MCI) and the elderly.

Materials and Methods

Twenty-one patients with MCI (17 females; mean age 67.19±6.02 years) and 24 elderly persons (13 females; mean age 63.50±5.96 years) participated from two medical centers. Participants were randomly divided into four conditions; carotid artery stimulation (CA), vertebral artery stimulation (VA), simultaneous carotid and vertebral artery stimulation (CA-VA), or sham stimulation (sham) groups. Participants received LLLT using Color DNA[®] (Color Seven Co.) for 30 minutes per day during 20 weekdays of consecutive 4 weeks. To confirm the effect of cognitive function, the Seoul Neuropsychological Screening Battery-II (SNSB-II) was conducted before and after the LLLT intervention for 4 weeks. The Mann-Whitney U test was used for comparisons between two groups. The hemodynamic responses were recorded by an fNIRS system (NIRScout[®], NIRx Medical Technologies, Germany). Nine patients with MCI and eleven elderly participants were recorded hemodynamic responses during LLLT from one medical center. Seventy-four channels were placed in the whole brain area. fNIRS measurement was applied for 5 min before LLLT, 30 min during LLLT, and 10 min after LLLT. To increase signal-to-noise ratio, data were averaged into 4 regions. Raw data from each channel was converted into the z-score and applied moving average filter.

Results

All participants completed the LLLT intervention without any significant side effect. In MCI patients, each CA and CA-VA condition demonstrated significant improvements in memory scores of SNSB-II measured by Seoul verbal learning test and Rey complex figure test compared to the sham condition after LLLT ($p < 0.05$). There were also a significant improvement of Geriatric Depression Scale in each three stimulation condition after the LLLT ($p < 0.05$), but not in the sham condition. In the elderly group, the VA condition demonstrated a significant improvement in SVLT recognition scores compared to the sham condition ($p < 0.05$). In both MCI patients and the elderly, the changes of oxy-hemoglobin concentration increased in the 4 cerebral regions during LLLT compared to the resting state, and these changes are more contrasting in the CA-VA condition.

Conclusion

The results of this study suggested that the LLLT applied to a carotid artery and both carotid and vertebral arteries might have positive impacts on memory and mood of the patients with MCI and the elderly. Also, the results of this study revealed that LLLT could change the oxy-hemoglobin concentration in the cerebral hemodynamics

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