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Quantitative electroencephalographic evaluations of electrophysiological biomarkers and impaired functional networks of older adults diagnosed with dementia

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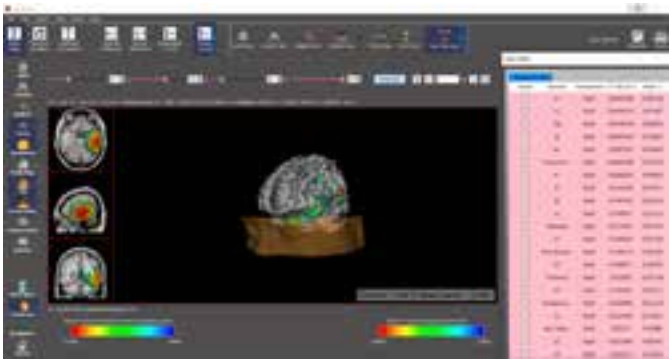
Alzheimer's disease (AD) is a neurodegenerative disorder associated with affective dysregulation, cognitive impairment, psychosis, and delusion. Because the neurodegenerative processes of AD vary according to the severity and progression of this disorder, divergent neurophysiological profiles may be present across this clinical disorder. Considerations of quantitative electroencephalographic (qEEG) biomarkers across the delta, theta, alpha, and beta bands were examined to determine whether exposure to photobiomodulation (PBM) induced significant alterations across divergent Brodmann areas and functional connectivity networks compared to sham intervention. PBM is the application of light therapy that allows photons to alter the activity of molecular and cellular processes in the tissue where the stimulation is applied. Because the photons associated with the therapeutic mechanisms of PBM affect processes associated with the mitochondria, it is hypothesized that PBM increases ATP synthesis, which thereby induces healing to damaged tissues via regeneration. Examination of electrophysiological alterations were evaluated utilizing 1 Hz resolution and across the delta, theta, alpha, and beta frequency bands using standardized weighted low resolution topographic (swLORETA) analyses. Current source density and surface topographical analyses were utilized to determine alterations across eyes-open and eyes-closed conditions across the experimental and control groups. Furthermore, specific functional networks examined include the salience, default mode, executive, working memory, and face/object recognition networks. Results of the study indicate that only the eyes-closed condition for the PBM group reached statistical significance. Significance was observed across the salience, default mode, and working memory networks. However, statistical significance was not approached within the executive network irrespective of group assignment or EEG assessment condition.



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Biography

Dr. Kris Williams is a recent PhD graduate with expertise in quantitative electroencephalography, neuroimaging, and neurophysiology. She has trained across several academic institutions, including Harvard Medical School where she completed their certificate program in pharmacology. Dr. Williams currently serves as an IRB specialist at Columbia University. Her academic training also involved exposure to divergent clinical populations which include pediatric neurological patients and individuals with Alzheimer's/dementia, ADHD, and autism. By conducting research using quantitative electroencephalography, her work aims to elucidate neurophysiological biomarkers across functional networks that are associated with the clinical disorder of interest. Thus, by incorporating neuroimaging software and clinical neuroscience she hopes that her research may elucidate clinicopathogenic correlates and biomarkers that will improve clinical treatment and diagnosis.

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