Investigating Brain Response of People with Cognitive Impairment during Meditation with wireless Muse EEG in a Smart-Home Setting

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Abstract

Meditation is considered as an important intervention for people with Alzheimer's Disease (AD) especially at early stages. The present study explores how multiple meditation practices affect the human brain in people with cognitive impairment due to AD by using a portable EEG in a simulated smart-home environment (https://smarthome.iti.gr/).

40 participants took part in the study (13 healthy controls -HC, 14 Subjective Cognitive Decline - SCD and 13 Mild Cognitive Impairment - MCI) and undergo, Resting state at baseline, Mindfulness (MBSR) and Kirtan Kirya (KK) meditation practices and Resting state at the end of the meditation. All participants underwent a detailed neuropsychological assessment prior to their participation in the study, while brain signals were collected using Muse portable EEG and brain waves (alpha, theta, gamma and beta) were calculated for each session. In order to explore brain waves in the three groups we performed Kruskal-Wallis for each different meditation practice, while for the within group analysis, we used Wilcoxon test.

The statistical analysis was conducted using the five main electrodes (AF7, AF8, FPz, TP9 and TP10). For each subject, EEG data were recorded during 1-min baseline and follow up resting state and 10 min of a specific condition (MBSR and KK). Statistical analysis included the Kruskal–Wallis (KW) nonparametric analysis of variance. The results reveal that both states of MBSR and KK lead to a marked difference in the brain's flow of information. Wilcoxon Signed-ranks test indicated for HC that Theta frequency at TP9, TP10 and AF7, AF8 in Session 3-KK was statistically significantly reduced compared to Session 1-RS $Z=-2.271$, $p= 0.023$, $Z= -3.110$, $p= 0.002$ and $Z= -2.341$, $p= 0.019$, $Z= -2.132$, $p= 0.033$ respectively.

Altogether, these results suggest that a change in both meditation conditions (MBSR and KK) as well as differences among the three different groups can give us insights about early cognitive decline related to AD (HC, SCD, MCI).