Exploring neuronal activation during response to reward utilizing fMRI correlated with simultaneous EEG among undergraduates having problematic smartphone usage

Hamed Sharifat[1,2], Nisha Syed Nasser[1,3], Vengkatha Priya Seriramulu[1,2]

[1]Department of Radiology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor, Malaysia, [2]Pusat Pengimejan Diagnostik Nuklear, Universiti Putra Malaysia, Selangor, Malaysia, [3]Nanyang Technological University, Singapore

ABSTRACT

Introduction: Smartphone usage among young Malaysian adults has increased dramatically in the past decade leading to smartphone addiction (SPA) particularly involving social networking applications such as Instagram. SPA prevalence has been noted to be as high as 47% among medical students in a Malaysian university. There is a need to objectively assess the cerebral mechanisms that respond to reward using electroencephalography (EEG)-informed functional magnetic resonance imaging (fMRI) also known as EEG-fMRI as a potential biomarker. **Materials and Methods:** An observational study using simple random sampling from a phase one cross sectional study, was conducted among 24 UPM students using the Smartphone Addiction Scale-Malay version (SAS-M) questionnaire, modified Instagram Addiction Scale (IAS) and EEG-fMRI. Subjects with SAS-M scores ≥ 98 and IAS ≥ 37 were considered as high scorers (HS) and deemed to be having SPA, whereas subjects with SAS-M scores < 98 and IAS < 37 were considered low scorers (LS) and deemed as healthy controls. A 64-channel EEG scalp electrode was placed on the participants (12 HS, 12 LS) and a task-based fMRI was performed with simultaneous EEG recordings. Evoked response potential (ERP) derivatives of EEG namely the P300 peak waves and contingent negativity variance (CNV) were analyzed using Brain-Vision EEG analyzer and fMRI dataset were analyzed using Statistical Parametric Mapping (SPM). **Results:** There was significant difference in the P300 wave amplitude between HS and LS, which corresponded well with cerebral activations regions related to response to reward. **Conclusion:** The combination of the high spatial resolution of fMRI with the high temporal resolution of EEG to correlate cerebral regional activation, in response to cue related reactivity during response to reward task among smartphone addicts, has the potential to be a surrogate biological marker for assessment of Instagram addiction.