EEG Microstate Analysis-Based Classification of Patients with Major Depressive Disorder and Bipolar Disorder

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Studies comparing bipolar disorder (BD) and major depressive disorder (MDD) are scarce, and the neuropathology of these disorders is poorly understood. Although BD and MDD are both mood disorders, patients with BD and patients with MDD have distinct clinical features and require different treatment approaches. This study investigated the microstate features to classify patients with MDD and BD using resting-state electroencephalography (EEG). The 70 patients with MDD were enrolled and recorded EEG. Among 70 patients with MDD, 17 patients with MDD were converted to BD during the study period. Resting-state EEG data were recorded using a NeuroScan SynAmps2 amplifier (Compumedics USA, Charlotte, NC, USA) with 62 Ag-AgCl electrodes. For the microstate analysis, we calculated each subject□s global field power (GFP) and extracted peaks. Then, we applied all extracted peaks to the clustering algorithm. After back-fitting the template microstates to each subject data, we computed microstate features: duration, occurrence, coverage, and transition probabilities. Additionally, we applied the same microstate analysis to different frequency bands (delta, theta, alpha, and beta). Finally, we applied machine learning techniques to classify the two groups using microstate features. In the 1-30 Hz band, we found that the duration, occurrence, and coverage of microstate B were significantly greater in patients with BD compared with those with MDD. In the different frequency bands, microstates A and B exhibited statistically significant differences between the two groups regarding the microstate features. For classification between BD and MDD groups, the best classification performances showed 77.14% accuracy, 76.47% sensitivity, and 77.36% specificity with eight microstate features based on the five frequency bands. Our results suggest that microstate features of the patients with BD and MDD might serve as candidate biomarkers for differentiating between two distinct mood disorders.