Quantitative EEG May Help Differentiating Bipolar Disorder at Old Age From Frontotemporal Dementia

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Introduction

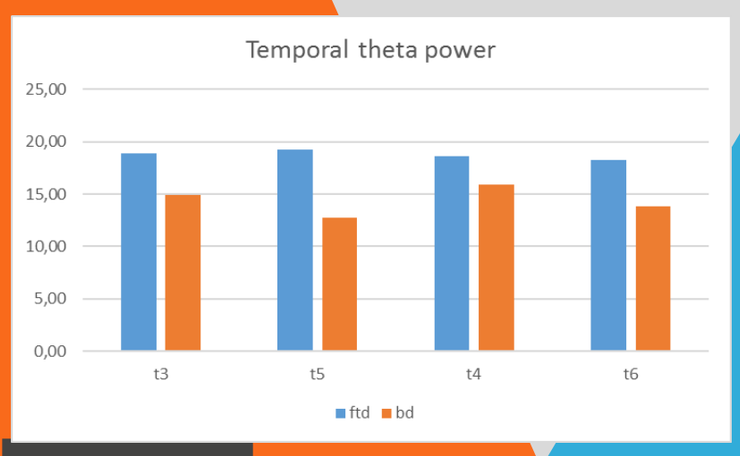
The behavioral variant Frontotemporal dementia (bvFTD) usually emerges with behavioral changes similar to changes in late life bipolar disorder (BD) especially in the early stages. According to the literature, a substantial amount of bvFTD cases has been misdiagnosed as BD. Altough imaging studies report some abnormalities in certain brain areas such as prefrontal cortex, striatum and amygdala; the specific neurophysiologic basis of bipolar disorder is still unknown. bvFTD commonly emerges with neuronal loss in frontal and temporal lobes as well as anterior insula. Since the literature lacks studies comparing differential diagnosis ability of electrophysiological and neuroimaging findings in BD and bvFTD; we aimed to show their classification power from an artificial neural network and genetic algorithm based approach.

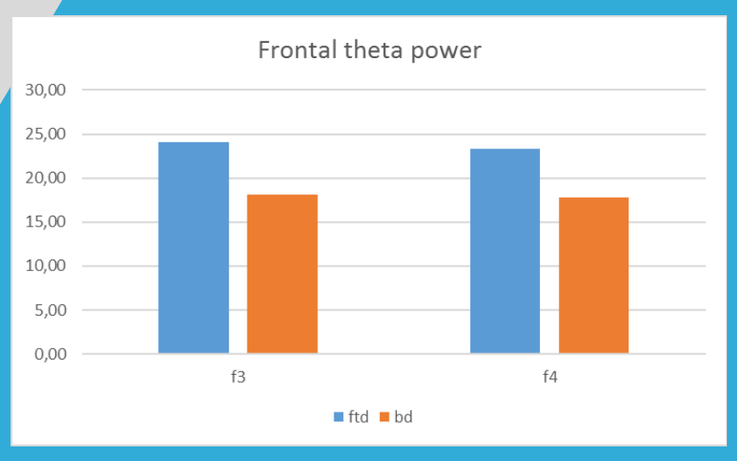
Method

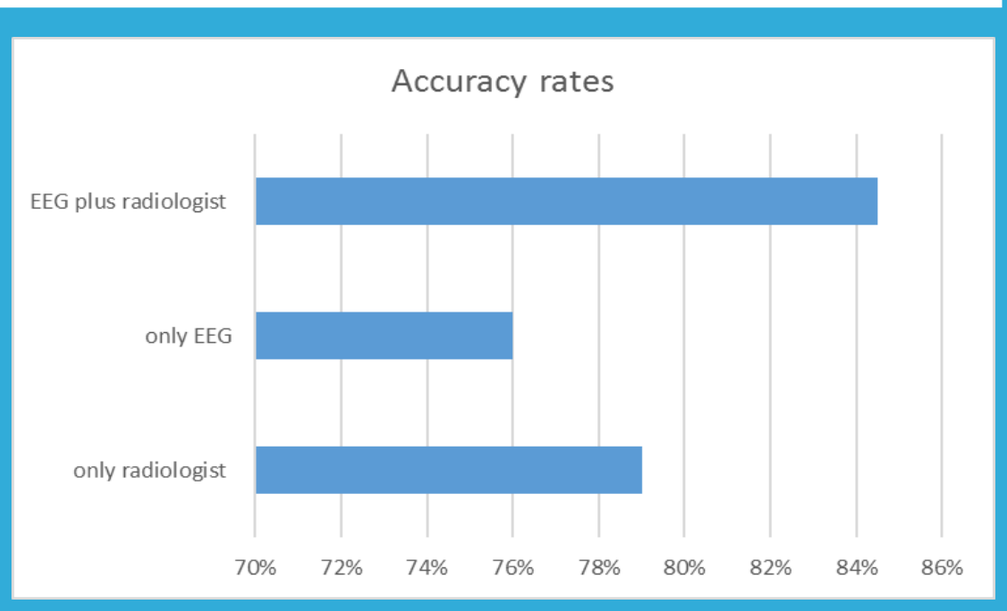
18 patients with the diagnosis of bvFTD and 20 patients with the diagnosis of late-life BD are included in the study. All patients' clinical MRI scan and electroencephalography recordings were assessed by a double blind method to make diagnosis from MRI data. MRI data was classifed as BD and FTD by a radiologist blind to the diagnosis. EEG and MRI classification powers were analyzed by means of Feature Selection and Classification Method. Firstly EEG and MRI data were analyzed seperately. Secondly, EEG and MRI data were combined and included to the analysis to assess the total classification power. Classification of 18 bvFTD and 20 BD from total 38 participants was performed using feature selection and a neural network based on general algorithm (GA). The GA was applied to features of all selected channels to reduce the dimension of feature vectors using the neural network evaluation function.

Results

The features selected by the optimization algorithm were F3, F4, T3, T4, T5, T6 for the theta frequency band. The ANN method classified BD from bvFTD with 76% overall accuracy only by depending on EEG power values. The radiological diagnosis classified BD from bvFTD with 79 % overall accuracy. When the radiological diagnosis was added to the EEG analysis, the total classification performance raised to % 84,5 overall accuracy.







Discussion

This was the first study comparing the dual accuracy of EEG and MRI data to dicriminate BD from bvFTD by using an Artificial neural network and genetic algorithm based approach. These results suggest that EEG and MRI combination has more powerful classification ability as compared to solely EEG or MRI data. Our results have important clinical implications and support the utility of neurophysiological and structural neuroimaging assessments for discriminating these two pathologies. Future studies should include larger samples and the neuropsychological assesments to reach more powerful accuracy rates.

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