Neuromyelitis Optica Spectrum Disorder (NMOSD) is an autoimmune disease leading to disability and vision loss as a result of optic neuritis. Patients with NMOSD may also present with cognitive deficits the cause of which remains unclear. Evidence from vision neuroscience research suggests a coupling of visual and attentional processing neural networks converging on the primary visual cortex and the thalamus. The objective of this study was to investigate the association of functional connectivity of the primary visual network with cognitive deficits in a cohort of NMOSD patients.

Methods

Twenty-nine NMOSD patients and 22 healthy controls (HC) matched on age, gender and level of education were included and completed the cognitive, visual and MRI testing. The German version of Rao’s Brief Repeatable Battery of Neuropsychological Tests (BRB-N) was utilized. Cognitive domains reported here include a global cognitive performance score (BRB-N Index) and the Attention & Concentration domain. Z-scores of individual tests were weighted in each domain, adjusted and scaled to the healthy local population.

High resolution T1 scans were acquired with a 3-T Siemens Magnetom scanner. Primary visual network functional connectivity (FC) at resting state was analyzed using FMRIB Software Library and was correlated with BRB-N. Fisher’s z test estimated group effects on correlations and Cohen’s d is reported for effect size of group comparisons.

Results

On average, patients performed worse than healthy controls on all cognitive domains, which reached statistical significance only for the Attention & Concentration and the BRB-N Index (Table 1). Among HC, there was a moderate negative correlation between cognitive performance and FC of the primary visual network. Among patients, these correlations were all positive and greatly attenuated in strength. (shown only with BRB-N Index, Table 2, Figure 1)

Discussion

In the absence of vision loss in either group, we report a moderate negative association of cognitive performance and functional connectivity of the primary visual network in healthy controls, which is positive among patients for all cognitive domains. This may occur as a result of the visual network maladaptation, providing a partial explanation for patients’ cognitive deficits. Our findings extend neuroscientific concepts on sensory-cognitive parallel processing neural networks to a clearly defined pathological state.