A MEG study of functional connectivity during preparation for saccades in ASD

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*Abstract:*Individuals with ASD consistently show an increased error rate on antisaccade paradigms. Antisaccades require inhibition of the prepotent response of looking towards a suddenly appearing visual stimulus (prosaccade) and the substitution of the novel behavior of looking in the opposite direction. Successful antisaccade performance depends on a network of brain regions including the frontal eye field (FEF), anterior cingulate cortex, and dorsolateral prefrontal cortex. Given compelling evidence of cortical hypo-connectivity in autism, we investigated long-range coherence in ASD during fixation and in preparation for prosaccades and antisaccades. We hypothesized that coherence in the network subserving volitional ocular motor control would be reduced in ASD.

To this end, we studied 10 high functioning adults with ASD and 11 age and gender matched healthy controls during performance of a pseudorandom series of fixation, prosaccade and antisaccade trials, while recording whole head magnetoencephalography (MEG). For each subject, we analyzed frequency band specific MEG amplitude and coherence in both sensor space and source space (i.e., cortical space), during fixation, and during preparation to perform either a prosaccade or an antisaccade.

In sensor space ASD participants showed significantly reduced coherence relative to controls, most prominently in the alpha band, with the right hemisphere showing significantly greater reduction in coherence relative to the left hemisphere. Accordingly, in source space, we focused on alpha coherence and used the frontal eye field (FEF), the key cortical region for saccade generation, as the seed region. We compared groups with regard to coherence between FEF and each source in the cortex. Relative to controls, ASD participants showed reduced alpha band coherence between the FEF and the intraparietal sulcus mostly during fixation and preparation for prosaccades, between FEF and anterior cingulate cortex primarily during preparation for antisaccades, and between FEF and dorsolateral prefrontal cortex primarily during preparation for a saccade of either type. Reduced coherence in ASD was more pronounced for the right, rather than left, FEF seed. These findings suggest that reduced communication between the anatomical components of a right-hemisphere dominant network for spatially-directed attention and eye gaze in ASD may contribute to deficient inhibition of prepotent, but contextually inappropriate responses.