

Differential brain activation associated with the effects of emotional and non-emotional distractors during a delayed-response working memory task in patients with schizophrenia

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Synopsis: Impairment of working memory (WM) is an important factor of the cognitive deficits in patients with schizophrenia. Dysfunction of the dorsolateral prefrontal cortex (DLPFC) closely related to delayed-response WM is potentially involved with cognitive impairment of the WM observed in schizophrenia patients. The purpose of this study was to assess the differential frontal activation patterns reflecting the effects of emotional and non-emotional distractors during maintenance processes of WM for the human faces in patients with schizophrenia and healthy controls by using a 3 Tesla function magnetic resonance imaging (fMRI).

Subjects and Methods: A total of 12 patients (mean age = 35.5 ± 7.2 years) with schizophrenia and 8 healthy controls (mean age = 35.5 ± 6.5 years) with no history of neurological or psychiatric illness were participated in this study. Patients with schizophrenia were assessed by a psychiatrist using the Structured Clinical Interview for DSM-IV Axis II Personality Disorders.

The paradigm consisted of a string of "encoding - WM maintenance - retrieval - fixation baseline". In the encoding task, three different human faces sequentially appear once. The subjects performed a WM maintenance for faces with either non-emotional distractors (faces or scrambled faces) or emotional distractors (unpleasant or neutral scenes) (Fig. 1.). The subjects were instructed to look at the distractors while maintaining the WM. In the retrieval task, either of the previously used human face or a new human face appears. The brain activation maps and their resulting qualification were analyzed by statistical parametric mapping (SPM2) program.

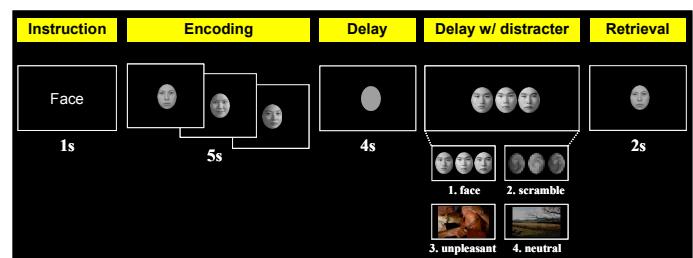


Fig. 1. A diagram for the recognition task of human faces with distractors

Results and Discussion: The scores for the face recognition task of the face and unpleasant scene distractors in healthy controls were 65.4% and 65.6%, respectively, while the scores in patients with schizophrenia were 52.6% and 53.3%, respectively.

Emotion and non-emotional distractors influenced the differential activation patterns between patients with schizophrenia and healthy controls ($p < 0.01$) in the frontal cortical areas during the delay interval of a WM task. In both patients with schizophrenia and healthy controls, non-emotion distractors showed increased signal intensities in the DLPFC, whereas emotion distractors showed decreased signal intensities in the DLPFC (Fig. 2,3). Compared to healthy controls, patients with schizophrenia showed significantly decreased activation in the DLPFC during a delayed-response WM with emotional and non-emotional distractors (Fig. 4). It is noted that patients with schizophrenia showed dysfunction of the DLPFC during a delay-response WM with distractors over healthy controls, providing poorer task performance.

Conclusion: This finding demonstrates the differential brain networks between patients with schizophrenia and healthy controls in the WM task with emotional and non-emotional distractors. This finding will be helpful to assess the neural mechanism related to general impairment of emotional and cognitive function observed in schizophrenia patients.

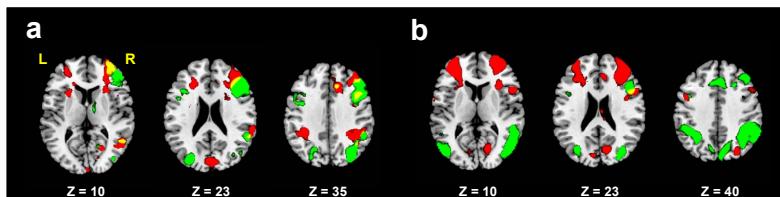


Fig. 2. Differential brain activation patterns associated with WM maintenance for faces with distractors between healthy controls (a) and patients with schizophrenia (b). Green color : {faces>scrambled faces}, red: {faces>unpleasant scenes}, yellow : {faces>scrambled faces} \cap {faces>unpleasant scenes} .

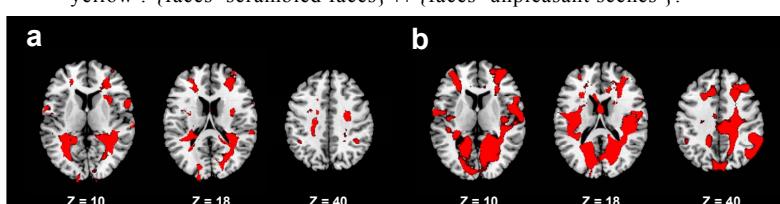


Fig. 3. Differential brain activation patterns associated with WM maintenance for faces with distractors between healthy controls (a) and patients with schizophrenia (b). Red color : {neutral>unpleasant scenes} .

References

1. Dolcos et al., Neuroreport 2006;17:1591-1594.
2. Dolcos et al., Brain Research 2007;1152:171-181.

Acknowledgment

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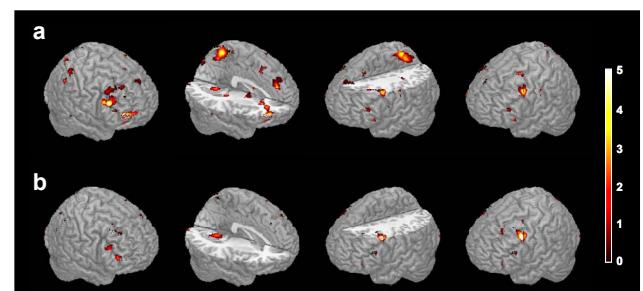


Fig. 4. Brain activation patterns associated with WM maintenance by presenting face (a) and unpleasant distracters (b) in the healthy controls compared to patients with schizophrenia.