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Depression and its relation to posterior cortical activity during performance of neuropsychological verbal and spatial tasks

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Abstract

This study examined the relationship between individual differences in depression and brain asymmetry during task performance in a subclinical sample. It was investigated whether depression is associated with lower right posterior activation during performance of spatial tasks. We recorded electroencephalographic (EEG) activity from 31 university students during the performance of two verbal and two spatial tasks. As expected, individual differences in depression were associated with a relative right hypoactivation during spatial task performance. The findings imply that individual differences in right posterior activation are not specific to clinical states of depression but are also evident in healthy subjects with depressive symptoms.

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1. Introduction

There is evidence that depression is associated with specific patterns of hemispheric activation. EEG-Studies have reported greater left than right frontal alpha power in currently depressed patients (Gotlib, Ranganath, & Rosenfeld, 1998; Henriques & Davidson, 1991), in previously depressed patients (Gotlib et al., 1998; Henriques & Davidson, 1990), and in nonclinical groups with elevated scores in depression scales (Schaffer, Davidson, & Saron, 1983). Davidson (1995, 1998) assumes in his model of anterior asymmetry that left frontal hypoactivation in depression is associated with a deficit in approach related behavior and positive emotion. Right frontal activation is related to withdrawal related behavior and negative emotion. However some studies have also found posterior alpha asymmetry associated with depression indicating a reduced relative right sided activation (Allen, Iacono, Depue, & Arbisi, 1993; Bruder et al., 1997; Kentgen et al., 2000; Reid, Duke, & Allen, 1998). In two of these studies (Bruder et al., 1997; Kentgen et al., 2000) depressed patients without comorbid anxiety disorders were compared to depressed patients with anxiety disorders. Interestingly, the depressed individuals without comorbid anxiety showed a reduced right posterior activation but not an anterior asymmetry. However, the depressed group with anxiety did not show this specific posterior asymmetry.

Heller and colleagues (Heller, 1993; Heller & Nitschke, 1998) pointed out that inconsistencies in findings of right posterior activation deficits in depression could be explained by opposing effects of anxiety and depression on right posterior activity. They suggest that anxious arousal is associated with right parietotemporal hyperactivation while depression is associated with right parietotemporal hypoactivation. Two studies using a free vision chimeric faces task measuring a hemispatial bias for face processing in depressed patients (Keller et al., 2000) and students with high and low levels of depression (Heller, Etienne, & Miller, 1995; Keller et al., 2000) supported their assumption.

There is also evidence from neuropsychological research that cognitive deficits in depression are related to right posterior dysfunction. Several authors have reported a specific impairment in neuropsychological tests measuring spatial performance in depressive patients (Abrams & Taylor, 1987; Flor-Henry, 1976; Kronfol, Hamsher, Digre, & Waziri, 1978; Miller, Fujioka, Chapman, & Chapman, 1995a).

Studies using visual half-field or dichotic listening techniques (Bruder, Wexler, Stewart, Price, & Quitkin, 1999; Liotti, Sava, Rizzolatti, & Caffarra, 1991) also reported a left hemifield (right hemisphere) deficit for depressed patients. This right hemisphere deficit in depression seems to be associated with reduced cortical activation as reported in ERP studies using complex tone tasks (Bruder et al., 1995, 1998) or emotional stimuli (Deldin, Keller, Gergen, & Miller, 2000).

Henriques and Davidson (1997) pointed out that differences between high depressed and non depressed subjects in right posterior activation might be more likely to be detected, if the subject is challenged with a task that normally activates this cortical region during performance. To test the hypothesis of right posterior hypoactivation in depression Henriques and Davidson (1997) performed a study measuring EEG-activity in students with extreme depression scores during performance in a verbal (Word Finding) and a spatial (Dot Localization) task. As hypothesized, high depressive students showed a performance deficit in the spatial task and failed to show an expected activation pattern of relative right-sided activation during spatial task performance, in contrast to non-depressed controls. No group differences were found for verbal task performance and activation during this task.

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