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Review article

Brain activation during processing of genuine facial emotion in depression: Preliminary findings

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ABSTRACT

Objective: The current study aimed to examine the neural correlates of processing genuine compared with posed emotional expressions, in depressed and healthy subjects using a novel functional magnetic resonance imaging (fMRI) paradigm

Method: During fMRI scanning, sixteen depressed patients and ten healthy controls performed an Emotion Categorisation Task, whereby participants were asked to distinguish between genuine and non-genuine (posed or neutral) facial displays of happiness and sadness.

Results: Compared to controls, the depressed group showed greater activation whilst processing genuine versus posed facial displays of sadness, in the left medial orbitofrontal cortex, caudate and putamen. The depressed group also showed greater activation whilst processing genuine facial displays of sadness relative to neutral displays, in the bilateral medial frontal/orbitofrontal cortex, left dorsolateral prefrontal cortex, right dorsal anterior cingulate, bilateral posterior cingulate, right superior parietal lobe, left lingual gyrus and cuneus. No differences were found between the two groups for happy facial displays.

Limitations: Relatively small sample sizes and due to the exploratory nature of the study, no correction was made for multiple comparisons.

Conclusion: The findings of this exploratory study suggest that depressed individuals may show a different pattern of brain activation in response to genuine versus posed facial displays of sadness, compared to healthy individuals. This may have important implications for future studies that wish to examine the neural correlates of facial emotion processing in depression.

1. Introduction

Depression is characterized by negative biases in emotional information processing and it is believed that this may play a critical role in the development and maintenance of the disorder (Roiser and Sahakian, 2013). As such, there has been considerable interest in examining the neural correlates of emotion processing in individuals with depression.

Neural models of depression posit that negative affect and mood congruent biases arise from, or are related to, dysfunction within fronto-limbic circuits (Malhi et al., 2015). Frontal brain regions such as the dorsolateral prefrontal cortex (DLPFC) and dorsal anterior cingulate cortex (dorsal ACC) are thought to be hypoactive, whereas regions such as the ventral/rostral anterior cingulate cortex (ventral/rostral ACC) and amygdala are thought to be hyperactive; particularly in the context of mood congruent stimuli (Hamilton et al., 2013; Mayberg, 1997).

A number of functional magnetic resonance imaging (fMRI) studies have examined neural activity in depression using paradigms that involve facial emotion processing (Stuhrmann et al., 2011). Some studies have found evidence of decreased frontal activity in depressed individuals relative to controls (Fu et al., 2004; Siegle et al., 2007a, 2007b). However, others have found evidence of increased frontal

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activity during the processing of negative facial expressions (Anand et al., 2005; Keedwell et al., 2005; Lawrence et al., 2004; Rosenblau et al., 2012). There are similarly diverse findings with regards to limbic activation in response to negative stimuli, with a number of studies reporting increased limbic activity in depressed individuals versus controls (Anand et al., 2005; Siegle et al., 2002, 2007b), in contrast to others that have found no such differences (Lee et al., 2008; Scheuerecker et al., 2010). Inconsistencies between studies likely stem from heterogeneity among patient samples, the use of varying fMRI paradigms and stimuli, the differential effects of psychotropic medication and the use of differing neural models to interpret imaging findings.

A key issue of interest that has not been examined in detail, is whether there are differences in the way the depressed brain responds to *genuine* compared with *posed* displays of emotion. Genuine expressions are spontaneously generated as part of an emotional experience. In contrast, posed expressions are not coupled with their respective emotion and are used as a means to fake, mask or suppress emotional experience (Ekman and Friesen, 1982; Ekman and Rosenberg, 1997). Determining whether facial information specifies emotion or not, is crucial for effective social functioning. For instance, mistaking posed displays for genuine displays can result in negative outcomes for the social perceiver (Miles and Johnston, 2007). Any compromise in the ability to distinguish posed from genuine expressions of emotion might help explain why depressed individuals often find it difficult to engage socially. Indeed, using an Emotion Categorisation Task to assess sensitivity to genuine versus posed facial displays (McLellan et al., 2010), Douglas et al. (2012) have shown that depressed patients are less able than healthy controls, to differentiate between posed and genuine expressions of sadness. Interestingly, in an fMRI experiment in healthy subjects, this same task activated different brain regions when viewing and judging emotional veracity of genuine versus posed emotions (McLellan et al., 2012). However, whether this holds for depressed patients is unknown.

1.1. Aims of the study

The current study aimed to examine the neural correlates of processing genuine and posed facial expressions in depression, using the Emotion Categorisation Task. Based on extant neural models of depression, it was hypothesised that there would be a discernible difference in regional brain activity in response to genuine versus posed facial expressions of emotion, in the depressed group compared with controls.

2. Method

2.1. Participants

Nineteen right-handed depressed participants (7 male: 12 female; 22–57 years of age) were recruited from a randomised outpatient psychotherapy trial of Cognitive Behaviour Therapy (CBT) and Metacognitive Therapy (MCT) for depression (Jordan et al., 2014). Inclusion criteria for the clinical trial included a current primary DSM-IV diagnosis of major depressive disorder or bipolar II disorder-depressed phase, an age of 18 years or older and the ability to converse and answer questionnaires in the English language, and provide informed consent. Exclusion criteria included bipolar I disorder, schizophrenia, current severe substance misuse, an adequate course of CBT or MCT in the past year, use of psychotropic medication (other than intermittent short term hypnotic use), or severe physical illness. Participants of the clinical trial were required to be drug free for a minimum of two weeks or five drug half-lives. A research nurse screened referrals for the clinical trial's inclusion/exclusion criteria and potential participants were contacted by the next available therapist and booked for a clinical interview. Informed consent was obtained from eligible participants. Clinician-rated diagnostic assessments of mood were conducted using the Structured Clinical Interview (SCID I and II) for the Diagnostic and Statistical Manual of Mental Disorders-IV (American Psychiatric Association, 2000) and clinician ratings of current mood severity were made using the 16 item Quick Inventory of Depressive Symptomology (QIDS16-C) (Rush et al., 2003), and the Montgomery Asberg Depression Rating Scale (MADRS) (Montgomery and Asberg, 1979). The nineteen depressed participants taking part in the present fMRI study were a consecutively recruited subgroup of the larger clinical trial sample. Further inclusion criteria included a willingness to participate in the fMRI scanning component of the study. Thirteen right-handed healthy controls (7 male: 6 female) with no history of depression, were also recruited. Control participants were a convenience sample and were matched for age bands (+/− 5 years) with the depressed outpatients. The healthy controls had no history of depression, which was assessed using the SCID for DSM-IV and symptoms were assessed using the Depression, Anxiety, Stress Scales (DASS; (Lovibond and Lovibond, 1995)). Exclusion criteria for both patient and control participants in the fMRI study were left-handedness and any medical conditions that might interfere with MRI scanning (e.g. pacemaker, metal implants). Informed consent was obtained from all participants prior to being scanned. Ethical approval was received from the Upper South B Regional Ethics Committee, New Zealand (URB 09/03/012).

2.2. Emotion categorisation task

The stimuli used during the fMRI paradigm were photographs depicting a female target (five different targets were used). The target displayed either posed or genuine facial expressions (happy or sad) or a neutral expression (see Fig. 1 for example). The facial displays used were taken from an established behavioural task (McLellan et al., 2010) and met the FACS (Ekman and Friesen, 1975) criteria as being indicative of their respective emotions.

fMRI data was collected in four 7-min runs, with images presented

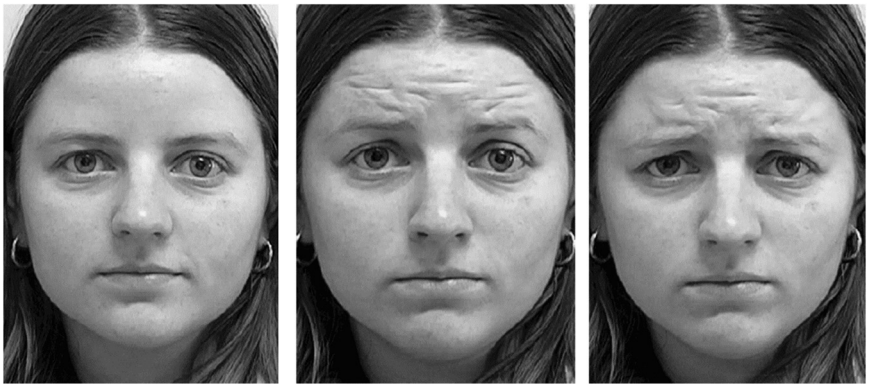

Fig. 1. Examples of a neutral, posed sad and genuine sad expressions from the Emotion Categorisation Task.