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Processing of facial expressions of emotions in Antisocial, Narcissistic, and Schizotypal personality disorders: An event-related potential study

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ABSTRACT

Background: Antisocial, Narcissistic and Schizotypal personality disorders share dissocial traits, but have different impairments when recognizing facial emotions. Whether the differences are due to the early perceptual or late cognitive cerebral processes remains unknown.
Methods: We invited 12 patients with Antisocial, 13 with Narcissistic, 12 with Schizotypal personality disorder, and 25 healthy volunteers, to undergo the cerebral event-related potentials to facial expressions of Neutral, Anger, Happiness, and Sadness, and the anxiety and depression measures.
Results: Compared with healthy volunteers, reaction time to Happiness was prolonged in people with Narcissistic personality disorder; P3b amplitude to Sadness was smaller in people with Antisocial personality disorder. P2 amplitudes to Neutral and Happiness were negatively correlated with depression in people with Narcissistic personality disorder, and P3a and P3b latencies to Happiness were delayed in people with Schizotypal personality disorder relative to healthy volunteers.
Conclusions: When responding to facial emotions, the attention or cerebral process was shallow in Antisocial, emotionally-affected in Narcissistic, and time-expanded in Schizotypal patients.

1. Introduction

Dissocial or antisocial behavior, which is manifested by interpersonal hostility, aggressively judgmental attitudes, and callousness, has between- and within-generation continuities (Smith & Farrington, 2004), and disturbs social harmony (Bannister & O'Sullivan, 2013). People with dissocial traits have enhanced rapid-response impulsivity (Swann, Lijffijt, Lane, Steinberg, & Moeller, 2009), and lower executive–cognitive functions, such as verbal abstraction ability (Stevens, Kaplan, & Hesselbrock, 2003), which is particularly noticeable in early-onset of violent and dissocial behaviors (Witthoft, Koglin, & Petermann, 2011). In clinics, besides the Antisocial personality disorder, which is characterized by callousness and emotional detachment (Hare & Neumann, 2006), other personality disorders are linked with dissocial behaviors (Viding, Fontaine, & McCrory, 2012). For instance, the Narcissistic personality disorder is characterized by the lack of empathy (Marissen, Deen, & Franken, 2012), emotional over-reaction to perceived threat, but under-reaction to others' distress (Ronningstam, 2010), and the Schizotypal personality disorder also displays a higher aggression–hostility trait (Huang et al., 2011).

On the other hand, perceiving the facial expressions of emotion of other individuals correctly is an important aspect of social cognition, its dysfunction might trigger violent actions through misinterpretation of cues (Blair, 2006). Clinical studies have shown pervasive recognition deficits of facial expressions, such as of fear, sadness, disgust, or neutral emotions in Antisocial patients (Dawel, O'Kearney, McKone, & Palermo, 2012); disgust and fear in Narcissistic patients (Marissen et al., 2012). Investigations have demonstrated that attentional dysfunction underlies pervasive deficits in facial emotion processing (Dawel et al., 2012), for instance, inattention to eyes of others would lead to fear-recognition problems in children with antisocial traits (Dadds, El Masry, Wimalaweera, & Guastella, 2008). Moreover, participants with positive schizotypy pay less early attention to social rejection, and those with negative schizotypy usually pay more attention (Premkumar et al., 2015), both participants however tend to perceive emotional faces as more negative ones (Brown & Cohen, 2010). However, there is no study that illustrates the attentional (cognitive) processes of facial emotions in individuals with dissocial traits, while knowing these processes would help debrief mechanisms behind the traits, and provide some clues for their management.

Cerebral event-related potentials (ERPs) are often used to investigate the early perceptual and late cognitive processes of an outside stimulus due to its optimal temporal resolution (Slobounov, 2006). Studies have demonstrated prolonged P3 latency and decreased P3 amplitude in schizotypal patients during both active and passive “oddball”

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auditory ERPs (Mannan, Hiramatsu, Hokama, & Ohta, 2001; Niznikiewicz et al., 2000; Shen et al., 2008), implying the deficits of both active (Posner et al., 2003) and automatic (passive) (Shen et al., 2008) attentions in the disorder. Decreased P3 amplitude was also described in antisocial personality disorder using auditory or visual "oddball" modalities (Gao & Raine, 2009). However, there is no study exploring the facial emotion-triggered ERPs in personality disorder patients with dissocial traits or behaviors, especially in the Narcissistic type. Nevertheless, the P3b latency to happiness was negatively correlated with dissocial traits such as stimulus seeking, callousness, passive aggressivity and narcissism in healthy volunteers (Chai et al., 2012). Moreover, elevated P3 to fearful faces (Mardaga & Iakimova, 2014), and shortened P3 latencies to happy and fearful faces (Rossignol, Philippot, Douilliez, Crommelinck, & Campanella, 2005) were found in high anxious individuals; while reduced P3 to happy faces was reported in depressive patients (Rossignol, Philippot, Crommelinck, & Campanella, 2008).

We have hypothesized that (1) the facial emotion-triggered P3a and P3b latencies are longer and their amplitudes are lower in these personality disorder patients; (2) different ERP component deformations are related to their emotional states in different groups. Therefore, we have used facial expressions of Neutral, Anger, Happiness and Sadness to trigger ERPs. These facial emotions vary from each other and cover both positive and negative categories with different arousal levels (Russell & Bullock, 1985). Since fear and disgust were overlapped with surprise and anger respectively (Huang et al., 2009), we did not want to use fear or disgust to trigger ERPs in the current study. Moreover, we administered the Zung Self-rating anxiety (Zung, 1971) and depression (Zung, 1965) scales in our participants.

2. Methods

2.1. Participants

The 62 participants had received more than 12 years of education, and were drug-, and alcohol-free for at least 72 h prior to the test. Twenty-five healthy volunteers (12 women; mean age: 26.08 years with 8.12 S.D.; range: 19–51 years) were recruited from students, hospital staff and paid volunteers from a general population. They were not suffering or had not suffered from any psychiatric problems, including alcohol or tobacco abuse, or other types of personality disorder through a semistructured clinical interview by an experienced psychiatrist (WW) according to the DSM-5 criteria (American Psychiatric Association, 2013). Twelve outpatients suffering from Antisocial personality disorder (2 women; mean age: 26.00 ± 6.03; range: 18–35), 12 Schizotypal (4 women; mean age: 28.42 ± 11.88; range: 18–53), and 14 Narcissistic (4 women; mean age: 24.77 ± 6.34; range: 18–39) were also diagnosed by the experienced psychiatrist (WW) according to the DSM-5 criteria. Almost all patients received a comorbid diagnosis of depression or anxiety or both, and about 50% of patients had received routine anxiolytics or antidepressants before presenting to our clinic. Patients did not have any brain lesions as determined using computerized tomography or magnetic resonance imaging scans, and did not suffer from alcohol abuse or tobacco use, or other types of psychiatric disorder. The study protocol was approved by a local Ethics Committee, and all participants had provided their written informed consent to the current study.

2.2. Questionnaires

The anxiety symptoms were measured by a four-point evaluation, the Zung 20-item Self-rating anxiety scale (Zung, 1971), and the depression symptoms were by another four-point evaluation, the Zung 20-item Self-rating depression scale (Zung, 1965). They have proven to be reliable in Chinese culture (Xu et al., 2014).

2.3. Facial picture stimuli

Facial expressions of Anger (picture ID code: E2), Happiness (E36), Sadness (E43), and Neutral (N13) were selected from the Japanese and Caucasian Facial Expressions of Emotion (JACFEE) and Neutrals (JACNEUF) pools (Matsumoto & Ekman, 1988).

2.4. ERP designs and recordings

Participants were seated in a dimly lit room at 100 cm in front of a computer screen. All photographs (400 ms in duration) were horizontal (768 × 512 pixels), sustaining about 19.8° × 13.5° of visual angles and were delivered every 2 s. Four stimulation blocks of Neutral, Anger, Happiness, and Sadness were randomized during the test. During each block, one of the facial expressions was randomly delivered 30 times (20%) as the target stimulus while a landscape picture (the Bliss wallpaper of Microsoft Windows XP software) was delivered 120 times (80%) as the standard one. Participants were asked to respond to the target stimuli by pressing a button using their thumb of the dominant hand.

Three midline electrodes, Fz, Cz and Pz were chosen for recording. The reference electrodes were attached to the linked mastoids of two sides. Bipolar recordings of the electro-ocular activity (EOG) were made with electrodes placed at the outer canthus and supraorbitally to the right eye. The impedance was kept below 5 kΩ. The potentials were analyzed offline with a Nihon Kohden Neuropack-sigma device using a band-pass of .01–.50 Hz, and a sampling rate of 500 Hz. The sampling epoch was 100 ms pre-stimulus and 900 ms post-stimulus. A sweep in which the EEG exceeded ±100 μV was excluded from averaging.

ERP waves were analyzed in terms of peak latency and baseline-to-peak amplitude determined by visual inspection. Latency ranges designated for potentials were: 140–200 ms for N1 (N170), 180–250 for P2, 200–400 for N2, 250–500 for P3a and 400–600 for P3b. Moreover, the reaction times (RTs) and number of errors (about 10%) in response to facial emotion target in each participant were also noted.

2.5. Statistical analyses

Age distributions and mean anxiety and depression scores in the four groups were analyzed by one-way ANOVA, and gender distributions by χ^2 test. Two-way (group × facial emotion) ANOVA was used to analyze their mean RTs to facial emotions. Their mean ERP component latencies and amplitudes were evaluated by three-way (group × facial emotion × electrode site) ANOVA. Once an effect was detected, a post-hoc Least Significant Difference test was used. Relationships between RT, ERP and anxiety/depression parameters were analyzed using the Spearman rank order correlation, and significant correlations at no less than two midline electrodes were considered stable and meaningful. The alpha level of significance (p) was set at ≤.01. With the present sample size, power to detect an effect (e.g., one facial type on one electrode) was larger than 80% at $p \leq .01$, based on a sample of 12 subjects per group (the smallest groups in the present study).

3. Results

There were no age ($F[3, 58] = .57$, $MSE = 45.51$, $p = .64$) or gender ($n = 62$, Pearson $\chi^2 = 3.66$, $df = 3$, $p = .30$) distribution differences among the four groups of participants. The anxiety ($F[3, 58] = 9.45$, $MSE = 938.14$, $p < .01$) and depression ($F[3, 58] = 5.63$, $MSE = 934.41$, $p < .01$) levels were significantly different among the groups. The Schizotypal patients (62.67 ± 10.68, range: 46–76; $p < .01$, 95% confidence interval (CI): 9.78–23.79) scored highest on anxiety, then the Antisocial (57.42 ± 8.06, range: 43–71; $p < .01$, 95% CI: 4.53–18.54), followed by the Narcissistic patients (57.15 ± 10.31, range: 38–76; $p < .01$, 95% CI: 4.45–18.09) and the healthy participants (40.88 ± 10.23, range: 20–60). When scrutinizing the individual data, 2 healthy