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BRIEF REPORT

Facial Emotion Perception in Young Female Students with Single Panic Attacks

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ABSTRACT

The study aimed to examine the behavioral and neural correlates of facial emotion recognition in a non-clinical group of 13 young female students with single Panic Attacks (PA) compared to 14 matched healthy controls. Subjects were asked to recognize angry, fearful, happy, disgusted, sad and surprised faces, and reaction time and Event-Related Potentials (ERPs) were recorded. Significant between-group differences in reaction time were not found, but the PA subjects reacted more slowly to angry and fearful expressions than to happy ones. More distinct between-group differences were observed in the ERPs: the PA subjects demonstrated increased amplitudes of the P100 components in the occipital area. The increased amplitude of the occipital P100 component for threat-related faces suggests that this type of high-arousal negative emotions is particularly meaningful for the PA individuals.

Introduction

Today's world with its stream of negative information and stress factors creates strong prerequisites for anxiety disorders and especially Panic Disorder (PD). PD patients are particularly sensitive to dangerous environmental signals and are highly vulnerable to unexpected anxiety experiences [1]. Epidemiological studies have shown that subthreshold mental illnesses, especially in the area of affective disorders, occur in all age groups and are two to four times more common than illnesses with specific diagnoses [2].

Many authors have described the behavioral and neurophysiological correlates of an attentional bias toward threat-related facial stimuli in patients with PD [3,4]. In the present study, we investigated behavioral characteristics and cortical visual Event-Related Potentials (ERPs) during the task of recognizing different emotional facial expressions in a group of young female students with single Panic Attacks (PA). The selected subjects experienced infrequent panic attacks only during examinations; they had not sought medical help, were not medicated and were identified unexpectedly during a survey of a large group of medical students. The control group consisted of healthy young female students of similar age and educational level.

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Methods

Subjects

Twenty-seven young female students were recruited from Pirogov Russian National Research Medical University, Moscow. Inclusion criteria were right-handedness and no current or previous severe neurologic or psychiatric disorder. Thirteen young female students (mean age 19.9 ± 0.5 years) were included in the Panic Attack group (PA), and fourteen healthy female students (21.5 ± 0.5) were included in the control group (Norm). All subjects were tested using Spielberger's anxiety state questionnaire (State-Trait Anxiety Inventory, STAI) [5].

Stimuli

We used color photographs of emotional faces from the Radboud University standardized database [6].

Procedure

During the experiment, participants were seated in a dark and sound-attenuating recording chamber at a distance of 120 centimeters from a computer monitor. Stimuli were presented in the center of the screen. Each type of emotional facial expression (angry, fearful, happy, disgusted, sad and surprised) was displayed 64 times on the monitor. Participants were asked to identify the emotion and press the corresponding button on the keyboard as quickly as possible. Individual reaction times were averaged across sessions for each emotional expression. The Electroencephalogram (EEG) was recorded using a 128-channel Geodesic Sensor Net (Electrical Geodesics Inc., USA) that matched the participant's head size. Offline analysis of the EEG data was performed using Net Station Software. The artifact-free EEG fragments were then averaged for each subject across all correctly answered trials, separately for each emotional expression. In this paper, we present the analysis of P100 components in the occipital area.

Results and Discussion

Anxiety scores

The participants with PA differed from the Norm participants by having higher scores on trait anxiety (55.15 ± 3.89 vs 41.13 ± 2.12 ; $T = 3.98$, $df = 30$, $p = 0.003$). No differences in state anxiety scores were found between groups.

Behavioral and ERP data

Response Time (RT) was significantly affected by Emotion, $F(5,125) = 5.53$, $p = 0.0000$, $\eta^2 = 0.181$. Post-hoc comparison showed that RT to happy expressions was shorter than RT to other expressions ($0.0001 < p < 0.01$). The effect of Group was insignificant. We evaluated the effects of emotions in each group. The PA subjects responded more slowly to fearful and angry expressions than to happy ones (all p -values < 0.05). No significant effects were found in the Norm subjects.

Analysis of the P100 component in the occipital area. Repeated measures ANOVA (Emotion, Hemisphere, Group) revealed a significant main effect of Group, $F(1,25) = 8.61$, $p = 0.007$, $\eta^2 = 0.25$. The PA subjects showed greater P100 amplitude compared with the Norm subjects. The between-group differences are presented in figure 1. ANOVA RM also revealed a significant effect of Emotion, $F(5,125) = 5.374$, $p = 0.0002$, $\eta^2 = 0.18$, and the Emotion \times Hemisphere \times Group interaction, $F(5,125) = 2.49$, $p = 0.03$, $\eta^2 = 0.09$. The Norm subjects showed lower P100 amplitude for surprise compared to happiness ($p=0.0001$, Tukey test) and sadness ($p=0.01$) in the right hemisphere. In turn, the PA subjects showed higher P100 amplitude for angry faces compared to frightened, disgusted and surprised faces in both hemispheres ($0.0001 < p < 0.05$).

Conclusion

The young girls with single panic attacks differed from the healthy subjects in higher trait anxiety scores. No significant between-group differences in RT during the facial expression recognition task were found. The only difference was that RT was increased for fearful and angry expressions compared to other emotions in the PA subjects. ERP analysis revealed that the participants with single PAs had higher amplitude of the occipital P100 component than healthy controls. Within-group analysis revealed a higher P100 amplitude for angry facial expressions compared to other expressions in the PA subjects. This result is not entirely consistent with some previous findings where an enhanced response to fearful facial stimuli served as a marker of panic disorder [7]. The increased focus on angry facial expressions in the PA individuals may be due to being in the early stages of panic disorder or having high trait anxiety scores [8]. A similar bias towards threatening stimuli has been described in non-clinical anxious individuals [9]. It

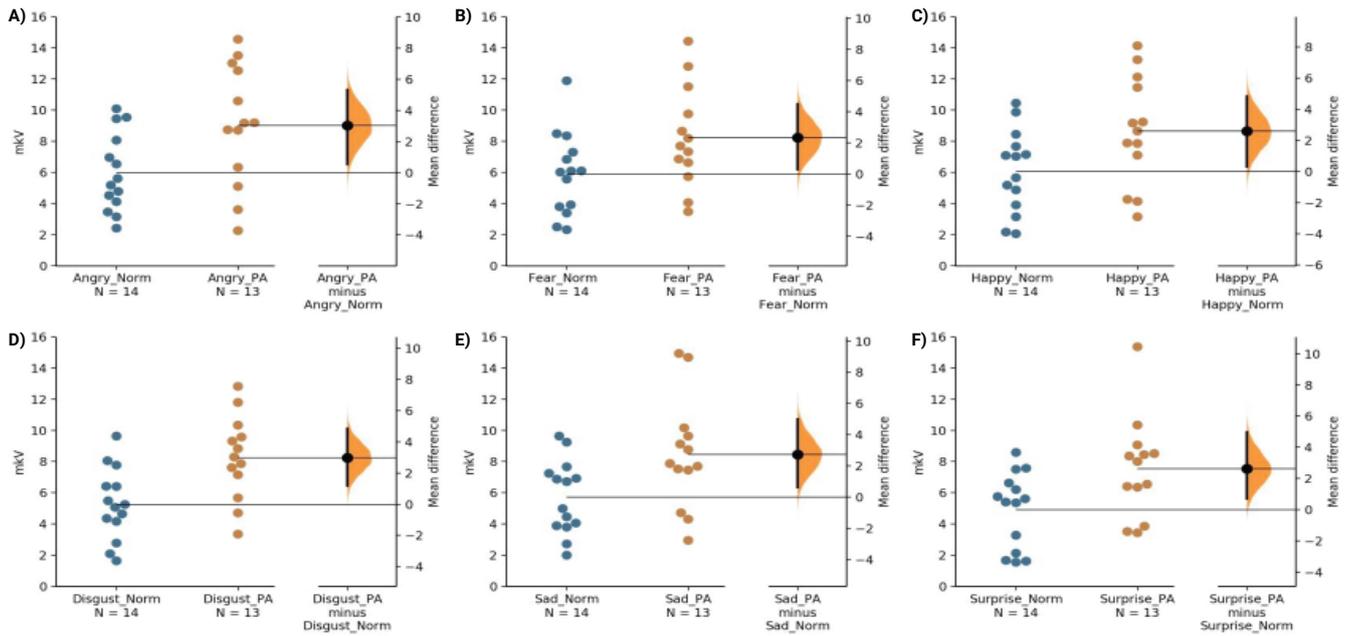


Figure 1 Estimation plots representing the differences in P100 amplitude in the right occipital area between the PA and Norm subjects. Top panel: plots for angry, fearful and happy expressions. Bottom panel: plots for disgusted, sad and surprised expressions. Vertical axis - amplitude of P100 component, mkV.

is noteworthy that PA subjects demonstrated a larger amplitude of the positive components of ERPs in the occipital area. Neuroimaging studies have shown that visual presentation of emotionally charged stimuli activates not only emotion-specific brain areas but also areas in the extrastriate cortex [10]. Our results suggest that PA subjects pay increased attention to expressive facial patterns, as if “picking” them out of the visual environment. The increased amplitude of the occipital P100 component for threat-related faces, suggests that this type of high-arousal negative emotion is particularly meaningful for the PA individuals.

In a non-clinical set of young female students single panic attacks associated with distinct disturbances of threat-related environmental signals processing were found. We suggest, that in some cases single panic attacks can be considered as manifestation of full-blown anxiety disorders, including panic disorder. A small size of the group does not allow to draw the ultimate conclusion, hence neurobiological studies of the emotional state of young people should be continued. This seems to be important as subthreshold forms of mental disorder cause a similar impact on the quality of life to those with full-blown mental disorders.

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