ENHANCED FEEDBACK-RELATED ACC ACTIVITY IN RELATION TO NEGATIVE EMOTIONALITY DURING ADOLESCENCE

Diane L. Santesso, Jane Dywan, Terrance J. Wade, & Sidney J. Segalowitz

Department of Psychology, Brock University, St. Catharines, Canada

Background

The FRN is a negative deflection in the ERP elicited by both positive and negative feedback [1], which has been localized to the ACC and other areas of the medial prefrontal cortex (mPFC) [2,3]. Recent adult studies have reported that the FRN is enhanced in the moderately depressed [4], in remitted depressed patients [5] and in high anxious individuals [6]. This suggests that depression and anxiety are associated with hyperresponsivity of the ACC and mPFC in response to feedback.

Goal: To see whether the extent of anxious and depressive symptoms in healthy adolescents relates to (i) neural activation associated with performance feedback as reflected in the scalp FRN, and (ii) activation within specific cortical regions (using LORETA) during the time of the FRN to positive and negative feedback.

Hypotheses: We expected that (1) the FRN would be greater to negative than positive feedback in healthy adolescents, (2) FRN amplitude would correlate with symptoms of anxiety and depression, (3) depressive symptoms would be associated with greater activity in the ACC in response to negative stimuli.

Method

Participants

• 24 boys, 21 girls, 12-15 years (Mean 13.2 years ± 0.8).

Self-report measure of negative emotionality

• Center for Epidemiologic Studies Depression (CES-D) Scale [7].

EEG recording and reduction

• EEG recorded continuously during the task using a 128-channel sensor array.

LORETA Source Localization

• LORETA current source density (CSD) from the loss trials (of both cue types) was derived from five ROIs in the ACC including the rostral, dorsal and subgenual ACC, Figure 3 (averaged over left and right hemispheres).

Low Resolution Electromagnetic Tomography (LORETA)

Used to examine intracerebral current density underlying the FRN within a 50 ms time window post-feedback, capturing the mean latency of the FRN.

Pearson correlations performed between current density in predefined regions of interest (ROIs) in the ACC and negative emotionality. Figure 3 (10).

Monetary Incentive Delay Task

• Participants pressed a key as quickly as possible to a green traffic light.

• Target duration was 280 ms on the first trial then adjusted +20 ms or -10 ms on subsequent trials to ensure participants won approximately one third of the time.

• Feedback indicated gain (thumbs up) or loss (thumbs down).

• Loss feedback FRN related to depression (r = .45, p = .001), negative affect (r = .46, p = .001), and anxiety (r = .31, p = .03), Fig 2A-C.

• The FRN to win feedback was unrelated to negative emotionality.

FRN Results

• FRNs were based on trials of both reward and loss cues, and did not differ between feedback conditions, t(44) = 24, p = .82, Figure 1.

• Thus, the adolescents did not show the adult pattern of larger FRN for negative than positive feedback.

• Cues signaled trials with potential large or small monetary reward (+), loss (-) or trials with no gain or loss (0).

• Participants were a key as quickly as possible to a green traffic light.

• Participants’ reaction times (RTs) would determine outcome (e.g., rapid RTs led to higher probability of winning money or avoiding loss).

• Target duration was 280 ms on the first trial then adjusted +20 ms or -10 ms on subsequent trials to ensure participants won approximately one third of the time.

• Feedback indicated gain (thumbs up) or loss (thumbs down).

• Pearson correlations performed between current density in predefined regions of interest (ROIs) in the ACC and negative emotionality. Figure 3 (10).

References


Address correspondence to sid.segalowitz@brocku.ca