Neural oscillatory dynamics of social feedback processing in women

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Background & Rationale

Rhythmic changes in theta power during social exclusion in Cyberball have recently been interpreted as a neural signature of social pain[1,2]. However, neural activity in Cyberball’s exclusion block may have been confounded by expectancy violation. Here we dissociated participants’ expectations about social evaluation from the social evaluative outcome itself. We examined the following questions:

1. Is theta power a neural signature of social pain?
2. Is theta power increased in females who are more sensitive to social evaluation?
3. Which stage in information processing is most sensitive in detecting social evaluative discomfort?

Method

- 56 healthy female undergraduates (age in years = 19.67)
- 64-channel Biosemi EEG acquisition
- 160 trials (50% social rejection feedback)
- Reference scheme: Current source density transformation
- Time-frequency decomposition via Morlet Wavelets
- Baseline: -500 to -200 ms pre-trial interval
- Frequencies of interest: Delta (1-4 Hz), Theta (4-8 Hz), Alpha (8-13 Hz), Beta (13-25 Hz)

Behavioral results: participants predicted social acceptance on 55.6% (SD = 8.70) of the trials.

Results: Feedback Anticipation

A. Time-frequency oscillatory activity

B. Beta power (15-25 Hz)

C. Alpha power (8-13 Hz)

D. Correlation analyses: beta power with depression

- Anticipation of social feedback coincides with increased power of beta and alpha oscillations.
- A significant increase in beta power was observed for anticipated social acceptance vs. social rejection.
- Alpha power did not differ between social acceptance and rejection predictions.
- Anticipatory beta power significantly decreased when females reported higher levels of depression.

Results: Feedback Processing

A. Time-frequency oscillatory activity

B. Peak feedback-related theta power (4-8 Hz)

C. Source estimation of theta power (4-8 Hz)

- A significant increase in theta power was observed when participants received unexpected social rejection feedback.
- Source modeling of theta power revealed a frontally distributed neural network, which was most active during the processing of unexpected social rejection feedback.
- Statistical comparison between the unexpected rejection (YN) vs expected acceptance (YY) conditions revealed a significant increase of activation in the medial prefrontal cortex, insula and superior temporal gyrus.

Conclusion

- Midfrontal theta oscillations respond significantly to processing of social rejection feedback, but only when this feedback is unexpected.
- Theta power during social evaluative feedback processing is not associated with individual differences in psychological constructs typically related to social evaluative distress.
- Beta power during social evaluative feedback anticipation is a putative neural marker of depression.

References