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Background

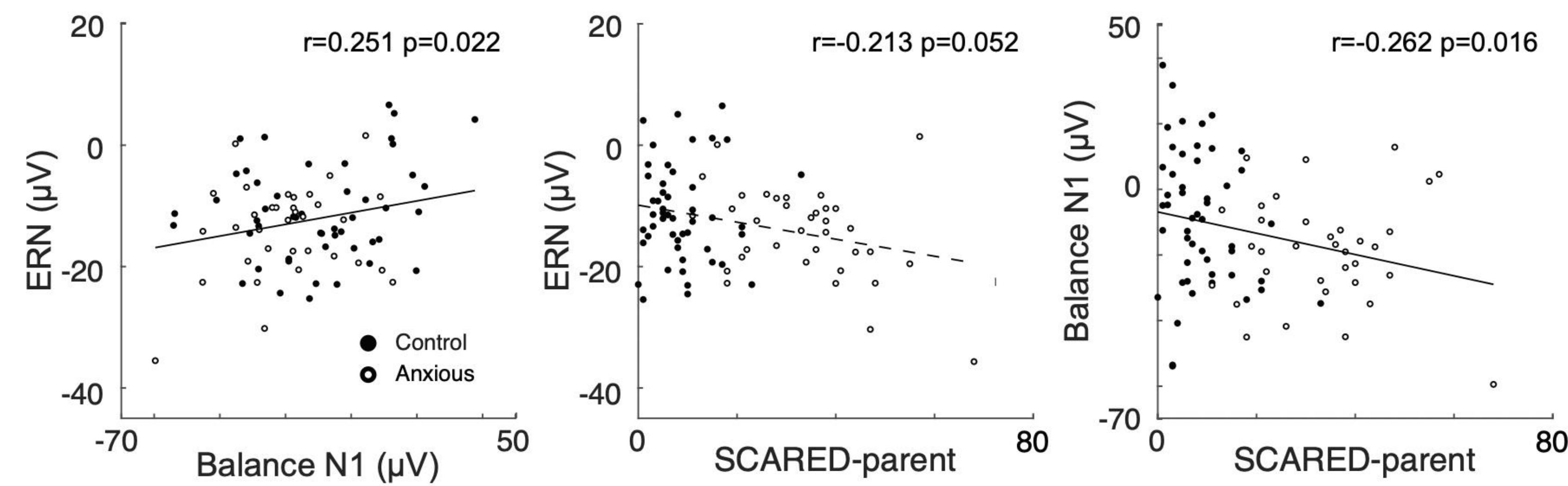
- A better understanding of the mechanisms underlying anxiety could aid the development of more effective treatments
- The error-related negativity (ERN) is a brain response evoked by mistakes that relates to anxiety, but can be hard to reliably measure^[1,2]
- The balance N1 is a brain response evoked by a loss of balance that has been proposed as a better alternative to the ERN^[3]
- We previously related the N1 to the ERN and to anxiety in children, and we now test whether an intervention impacts these brain responses in the same manner^[4]
- This psychosocial intervention has been adapted from an intervention shown to reduce ERN in adults^[5]
- We hypothesized that the intervention would reduce the ERN and N1 in the same manner in anxious children as further evidence of shared mechanisms underlying these brain responses

Methods

- We recruited 47 children with anxiety disorders (age 9-12) and 52 children as a control group
 - Anxiety symptom severity was measured by Screen for Anxiety and Related Disorder (SCARED) filled out by a guardian^[6,7]
 - The ERN was evoked by spontaneous mistakes in a Go/No-Go task and measured by frontocentral EEG electrodes^[8]
 - The balance N1 was evoked by sudden release of a cable supporting ~5% of the child's body weight in a forward leaning posture, and similarly measured by frontocentral EEG electrodes^[9]
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- The anxious group was then randomized into one of two conditions before remeasuring ERN and N1
 - A psychosocial intervention that reframes mistakes as opportunities to learn
 - An active control that focused on healthy lifestyle choices unrelated to error-sensitivity

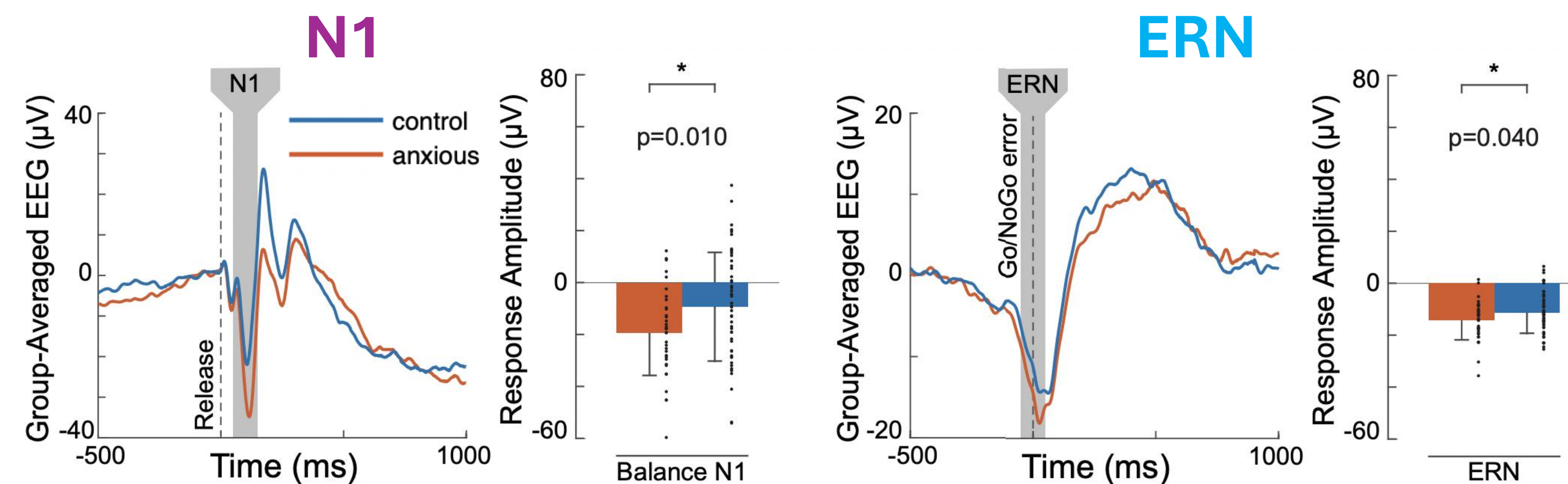
*for statistical analyses see top right

ERN and N1 correlated with each other and anxiety



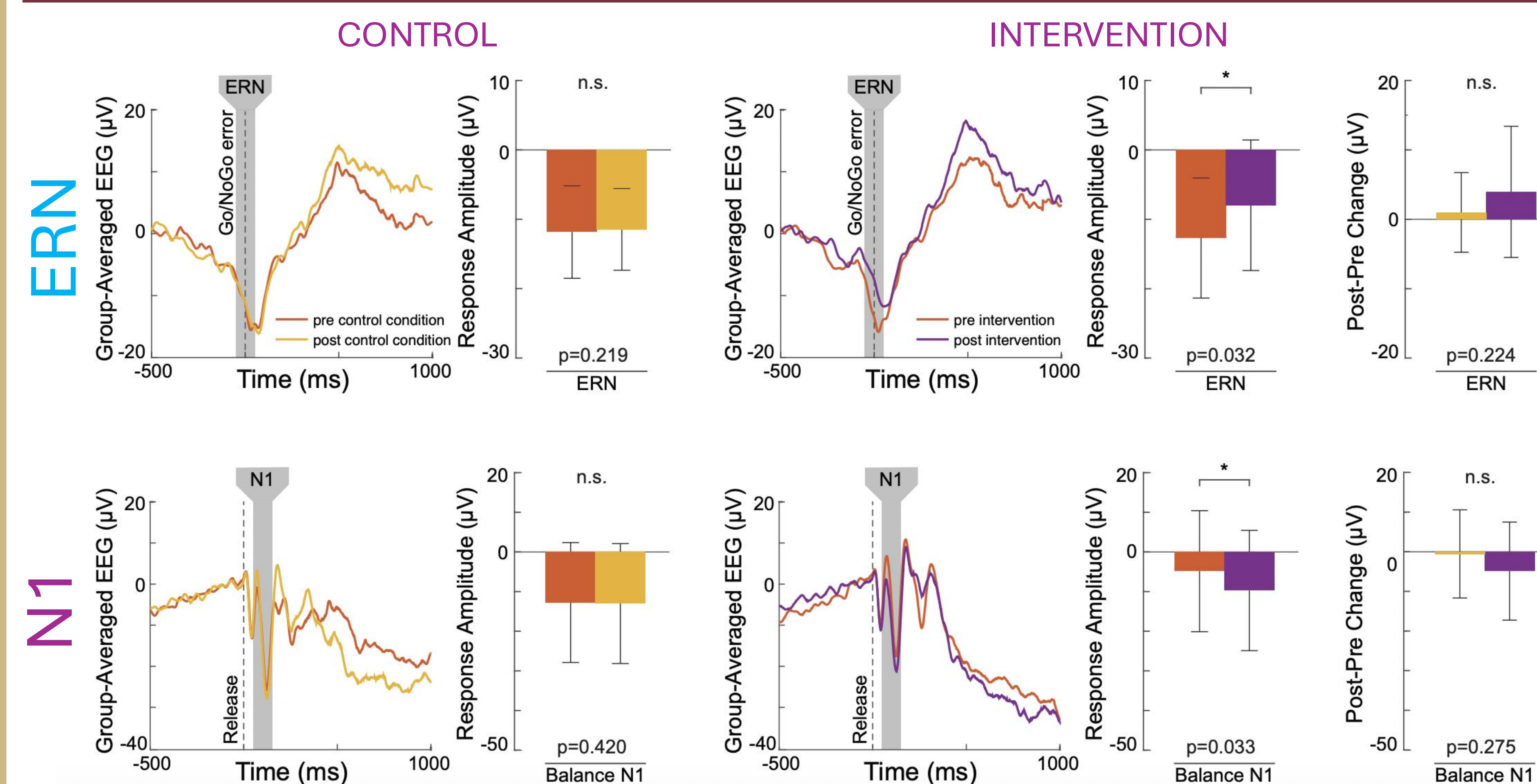
Baseline levels of ERN and N1 correlated with each other
Both ERN and N1 were larger in kids with more symptoms of anxiety

N1 and ERN are larger in Anxious children



Anxious kids showed larger brain responses in both tasks

Intervention decreases ERN, increase balance N1



Active control condition had no effect

Intervention increased the N1 and decreased the ERN

Overall effect of the intervention was not significant (time-by-condition interaction)

Statistical Analysis

- T-tests were used to test whether the anxious group had larger evoked brain responses than the control group at baseline
- Linear regressions were used to test for correlations between baseline brain responses and anxiety symptom severity
- Paired t-tests were used to test whether brain responses changed after the intervention or control conditions
- A repeated measures ANOVA was used to test for a time*condition interaction to determine whether the intervention had a significantly larger effect than the control condition on the evoked brain responses

Discussion

- The observed correlation support the hypothesized relationship between these brain responses and anxiety
- However, their opposing responses to the intervention marks the first evidence of a difference between the two responses, suggesting that the intervention may target an aspect not shared between them
- It is possible that the intervention confounded the interpretation of ERN task instructions, rather than acting on mechanisms that connect ERN and anxiety
- However, it is also possible that the diverging outcomes result from differences in the nature of errors in each task
 - As the intervention reframes the significance of errors, it may help children differentiate between significant and insignificant mistakes
 - Children may have learned that mistakes in the computer task carried no real consequences, while maintaining the natural significance of a loss of balance
- Teaching children to appropriately value mistakes according to their potential consequences could help address excessive error reactivity in anxious children, however, a brief intervention may be insufficient to drive meaningful change in structure and function the brain
- A better understanding of how these brain responses relate to anxiety could provide greater insight into the development and maintenance of anxiety disorders and aid in the development of better treatment strategies

References

