Impact of psychotropic medication on Resting state EEG alpha power and performance on VEP task in children with Autism Spectrum Disorder in the ABC-CT Study

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Background

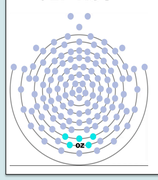
- Identification of biomarkers that may facilitate the understanding of treatment effects in ASD is a critical goal, and often includes use of EEG measures.
- It has been estimated that around 56% of children with autism spectrum disorder take at least one psychotropic medication, with 22% of these medications being in the stimulant class (Mandell et al., 2008).
- It is important to understand the implications of medications on EEG responses to better differentiate brain responses due to medication use versus responses related to autism or associated conditions.
- Moreover, as new treatments are tested, many children will already be utilizing a medication prior to treatment onset, and thus treatment effects and their impact on brain functioning will need to be understood above the baseline effects of medication.
- The aims of this project are to:
  - ✓ Examine the impact on EEG Resting state alpha power and Visual Evoked Potential (VEP) experiment performance at baseline (T1) of:
    - medication status (broadly defined as acting on CNS or nonCNS mechanisms)
    - number of psychotropic medication classes
  - ✓ Examine if CNS medication change across T1-T2 affects T1 and T2 EEG performance

Methods

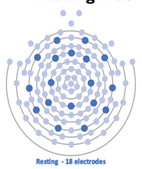
- N = 134 participants (ages 6-11 yrs) from the larger ABC-CT project (a 5-site, NIH-funded project to identify biomarkers to inform treatment effects in ASD).
- ASD diagnosis was confirmed via the ADOS-2 and ADI-R.
- High density EEG and a detailed medication history were collected from all participants at 3 time points.
- Inclusion for the current analysis required valid Resting EEG and VEP data at T1 (baseline) and T2 (+6 months) and a completed medical history.
- EEG included a (calm viewing) Resting task (screen saver-like videos) and a test of basic visual processing (VEP); images of a checkerboard reversing each 500 msec). Variables collected from regions of interest (ROI) included number of good trials, alpha power total, VEP Oz P1 amplitude, and VEP Oz P1 latency.
- Participant medications and use were categorized as:

1. CNS or nonCNS (broadly defined as acting on the CNS or nonCNS mechanisms)
2. CNS only, nonCNS only, CNS+nonCNS combinations
3. CNS medication change (start, stop, dosage change) from T1 to T2

VEP ROI



Resting ROI



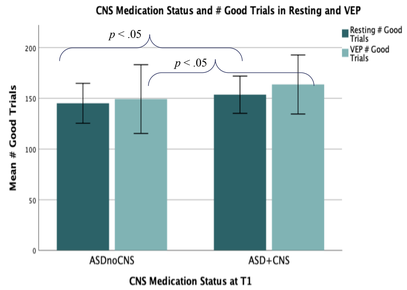
Total	ASD+ CNS meds	ASD+ nonCNS meds	Age at T1 (days)	ADOS CSS at T1	Full Scale IQ at T1	ADOS CSS at T2
134	78	53	105.40	7.50	101.07	7.31

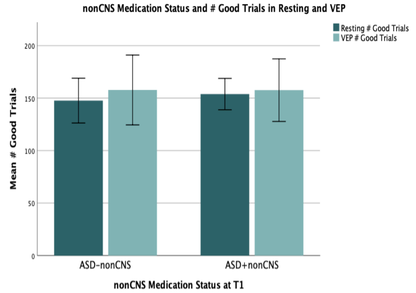
Table 1: Participant Characteristics (included in analysis)

Results

Q1: Impact of medication (CNS and nonCNS) on EEG Resting state alpha power and VEP P1 amplitude in children with ASD

Pairwise analyses were conducted to compare medication status (ASD vs. ASD+CNS, ASD vs. ASD+nonCNS) for alpha power total, Resting number of good trials, VEP P1 amplitude/latency and VEP number of good trials

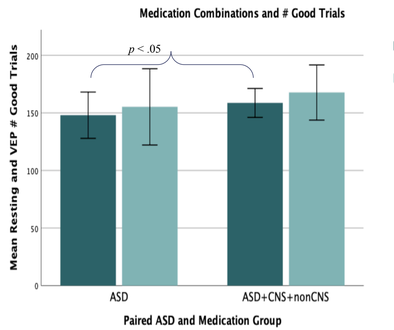




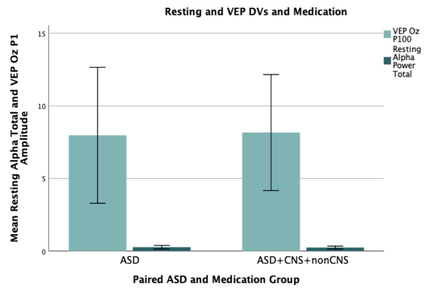
There was a significant effect of CNS medication on the number of good trials in Resting, F (1,132) = 6.57, $\boldsymbol{p = .01}$, and VEP, F (1,132) = 6.96, $\boldsymbol{p = .009}$. ASD children on CNS meds on average had more good, artifact free trials. No effects were observed for alpha power (F = 0.5, p =. 81), VEP P1 amp (F = .59, p = .44) or P1 latency (F = 1.60, p = .21) in CNS pairs and no effects were observed for alpha power (F = .05, p =.82), VEP P1 amplitude (F = .31, p = .58), P1 latency (F =.008, p =.93), Resting good trials (F = 3.41, p = .07) or VEP good trials (F = .001, p = .98) in nonCNS pair (ASD vs. ASD+nonCNS).

Q2: Impact of medication classes on EEG Resting state VEP Performance in children with ASD

Pairwise analyses were conducted to compare different medication classes (ASD/ASD+CNSonly, ASD/ ASD+nonCNSonly and ASD/ASD+CNS+nonCNS) for Resting alpha power and VEP P1 amplitude



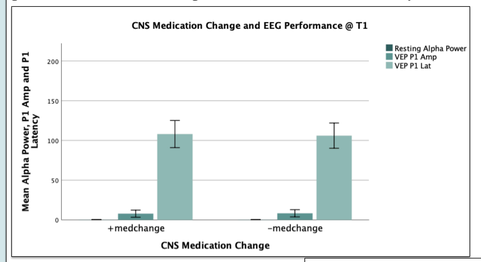
There was a main effect of medication combination on number of good trials in Resting F (1,132) = 6.65, $\boldsymbol{p = .01}$. ASD group had fewer good Resting trials than ASD+CNS+nonCNS group. VEP Good trials F (1, 132) = 3.26, p = .07.



No significant difference was observed in any Resting power or VEP P1 in ASD/ ASD+CNS+nonCNS group or any of the other paired groups (all ps > .05).

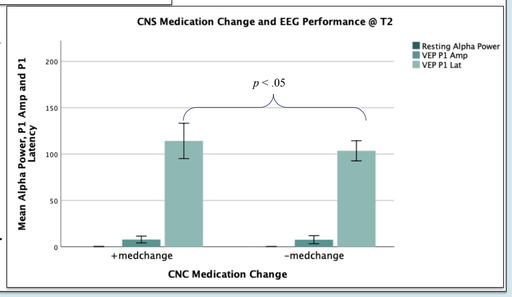
Q3: Impact of CNS medication change on EEG Resting state alpha power and VEP performance at T1 (baseline) and T2 (+ 6 months) in children with ASD

ANOVAs were conducted to examine CNS medication change from T1 to T2, Resting EEG alpha power and VEP P1 amplitude, and VEP P1 latency



There was no effect of medication change on Resting alpha power (F = .004, p = .95), VEP P1 amplitude (F =.15, p = .69); VEP P1 latency (F = .23, p = .63) at T1.

There was an effect of medication change on VEP P1 latency at T2, F (1,80) = 9.83, $\boldsymbol{p = .002}$. Medication change group had slower P1 latency at T2. There was no effect of medication change on Resting alpha power (F = .27, p = .71) or VEP P1 amplitude (F =.02, p = .88) at T2.



Discussion

- Overall, results showed that CNS medication has an impact on the number of good trials obtained during EEG acquisition, perhaps by increasing compliance during EEG.
- CNS medication change from T1-T2 showed an impact on T2 VEP posterior (Oz) P1 latency within the ASD group in that those who had a change of CNS medication had slower latency values than those without a change of medication. No difference was noted at T1.
  - Results suggest that a change in stable medication can create more variability in brain functioning although we did not explore involvement of specific classes of medication (ex: stimulants only).
- Many children who enter into research studies and clinical trials use medication prior to enrollment, likely influencing baseline brain measures. Accounting for baseline medication, changes in use, and impact on neural functioning is essential for understanding heterogeneity in brain functioning as well as response to new treatments.

References & Acknowledgements

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Poster link: https://medicine.yale.edu/ycci/programsprojects/autism/postersandpapers/insar2020/

References:
1. Mandell, D. S., Morales, K. H., Marcus, S. C., Stahmer, A. C., Doshi, J., & Polsky, D. E. (2008). Psychotropic medication use among Medicaid-enrolled children with autism spectrum disorders. *Pediatrics*, *121*(3), e441-e448.