**Supplementary Materials**

**Supplement Table 1.** Results of a repeated measures ANOVA on the difference of visual WM in ADHD children and TD children

|  |  |  |  |
| --- | --- | --- | --- |
|  | *F(df)* | *p* |  |
| Load | 110.624 | < 0.001 | 0.389 |
| Group | 15.589 | < 0.001 | 0.082 |
| Load×Group | 7.364 | 0.007 | 0.041 |

**Supplement Table 2.** Correlation analysis results of MMN, P3a, and P3b amplitude and WM capacity in children with ADHD and TD.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | K2 | | K4 | |
| *r* | *p* | *r* | *p* |
| ADHD | non-target MMN | 0.169 | 0.123 | 0.319 | 0.003 |
| target MMN | 0.077 | 0.483 | 0.230 | 0.034 |
| P3a | -0.186 | 0.088 | -0.194 | 0.076 |
| P3b | -0.094 | 0.394 | -0.003 | 0.975 |
| TD | non-target MMN | -0.043 | 0.688 | -0.233 | 0.028 |
| target MMN | -0.002 | 0.982 | -0.287 | 0.006 |
| P3a | 0.051 | 0.633 | 0.112 | 0.294 |
| P3b | -0.046 | 0.671 | 0.057 | 0.595 |

**Supplemental Table 3.** Correlation analysis results of MMN, P3a, and P3b amplitude and symptom in children with ADHD and TD.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | SNAP-inattention | | SNAP-hyperactivity | | SNAP-full scales | |
| *r* | *p* | *r* | *p* | *r* | *p* |
| ADHD | non-target MMN | -0.214 | 0.049 | -0.253 | 0.019 | -0.272 | 0.012 |
| target MMN | -0.035 | 0.751 | -0.015 | 0.895 | -0.027 | 0.805 |
| P3a | 0.013 | 0.906 | 0.049 | 0.658 | 0.038 | 0.729 |
| P3b | -0.150 | 0.170 | -0.035 | 0.751 | -0.099 | 0.367 |
| TD | non-target MMN | 0.004 | 0.974 | -0.060 | 0.579 | -0.025 | 0.817 |
| target MMN | -0.082 | 0.446 | -0.112 | 0.297 | -0.101 | 0.346 |
| P3a | -0.041 | 0.705 | 0.040 | 0.706 | -0.007 | 0.951 |
| P3b | 0.155 | 0.146 | 0.219 | 0.039 | 0.195 | 0.067 |

Note. SNAP-inattention, SNAP-IV, attention deficit scale; SNAP-hyperactivity, SNAP-IV, hyperactivity/impulsivity scale; SNAP-full scales, full version of SNAP-IV;

# Supplementary Figure 1. Hierarchical Linear Regression Plot of K4 and MMN in ADHD and TD Groups.

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We conducted examined whether the group factor acts as a moderator influencing the correlation by creating a new interaction variable, “interaction = Group×MMN,” to analyze the interaction effect between the Group factor and MMN. In the regression model, the interaction effect was found to be significant (non-target: unstandardized coefficient = - .991, *t* = -4.612, p < 0.001; target: unstandardized coefficient = -0.542, t = -3.171, p = 0.002). These results indicate that the interaction effect is significant in the model, further suggesting a significant difference in the correlation between the two groups and that the Group factor plays an important role as a moderator.

**Supplementary Materials 1.** The analysis of differences between ADHD and TD children with age as a covariate

**Although the difference in age between the ADHD and TD groups was not statistically significant, as a secondary analysis, we still conducted an ANOVA with covariates controlling for age to explore the potential impact age may have on the results. This section presents the results of the analyses based on the age covariates and is intended to provide a more comprehensive perspective on the study.**

The results indicated no significant main effect of Load (*F* (1, 174) = 1.574, *p* = 0.211, = 0.009), but significant main effects of Group (*F* (1, 174) = 11.926, *p* = 0.001, = 0.064) and Age (*F* (1, 174) = 24.639, *p* < 0.001, = 0.125) were observed. Furthermore, significant interactions were found for Load×Group (*F* (1, 174) = 5.076, *p* = 0.026, = 0.029) and Load×Age (*F* (1, 174) = 13.589, *p* < 0.001, = 0.073). The simple effects analysis indicated that under both the low- and high-load conditions, the performance of children with ADHD was significantly lower than that of the TD group (low: *F* (1, 174) = 7.515, *p =* 0.007, = 0.042; high: *F* (1, 174) = 9.850, *p =* 0.002, = 0.054).

For MMN, a repeated-measures ANCOVA was conducted with Group (ADHD, TD) as the between-group factor and Sound Type (non-target, target) as the within-group factor, while controlling for age. The results revealed significant main effects of the Sound Type (*F* (1, 174) = 17.758, *p* < 0.001, = 0.093) and Group (*F* (1, 174) = 7.063, *p* = 0.009, = 0.039). However, the effect of Age was not significant (*F* (1, 174) = 0.716, *p* = 0.399, = 0.004). Additionally, the interaction of Sound Type×Group was not significant, whereas the interaction of Sound Type×Age was significant (*F* (1, 174) = 7.490, *p* = 0.007, = 0.041).

For P3a and P3b, the repeated-measures ANCOVA revealed a significant main effect of Sound Type (*F* (1, 174) = 10.680, *p* = 0.001, = 0.058). However, neither Group (*F* (1, 174) = .626, *p* = 0.430, = 0.004) nor Age (*F* (1, 174) = 1.270, *p* = 0.261, = 0.007) had a significant effect. The interaction of Sound Type×Group was not significant (*F* (1, 174) = 3.201, *p* = 0.075, = 0.018), whereas the interaction of Sound Type×Age was significant (*F* (1, 174) = 11.031, *p* = 0.001, = 0.064). The simple effects analysis indicated that the P3a amplitude of children with ADHD was significantly larger than that of TD children(*F* (1, 174) = 3.328, *p* = 0.070, = 0.019), whereas no significant difference in the P3b amplitude was observed between the ADHD and TD groups (*F* (1, 174) = 0.084, *p =* 0.772, *=* 0.000).

# Supplementary Materials 2. Results and discussion of hemispheric MMN differences between children with ADHD and TD children.

The ANOVA results revealed that the three-way interaction effect was not significant, but we observed a trend toward hemispheric differences in the topographic maps. Based on this observation, we chose to move the t test and discussion of hemispheric effects from the manuscript to the Supplementary Material. The details are as follows.

The results showed that there was only a significant difference between the ADHD group and the TD group with regard to the right hemisphere non-target MMN in the right auditory stimulation condition (*t =* 2.671*, p = 0.*008). However, for the other three conditions (left hemisphere left stimulus, left hemisphere right stimulus, right hemisphere left stimulus), the difference of MMN between groups was not significant (*ps* > 0.05). In the target MMN, a significant difference was also observed between the ADHD group and the TD group in the right hemisphere in the right auditory stimulation condition (target: *t =* 2.134*, p =* 0*.*034).

Several meta-analyses have focused on tasks such as executive function and attention, and these studies have found that the right hemisphere, especially the right frontotemporal-parietal network responsible for cognitive control, is less activated in ADHD patients than in healthy controls (Cortese et al., 2012; Hart et al., 2013). These functional abnormalities may be due to delayed brain functional maturation in ADHD patients (Rubia et al., 2014; Shaw et al., 2007; Shaw et al., 2012; Sripada et al., 2014). Consistent with this, our study observed that the reduced MMN in children with ADHD occurred primarily in the right hemisphere rather than the left hemisphere, which may reflect the specific differences in brain function in children with ADHD.

**Supplementary References:**

Cortese, S., Kelly, C., Chabernaud, C., Proal, E., Di Martino, A., Milham, M. P., & Castellanos, F. X. (2012). Toward systems neuroscience of ADHD: a meta-analysis of 55 fMRI studies [Journal Article; Meta-Analysis; Research Support, N.I.H., Extramural; Research Support, Non-U.S. Gov't]. *American Journal of Psychiatry*, 169(10), 1038-1055. http://doi.org/10.1176/appi.ajp.2012.11101521

Hart, H., Radua, J., Nakao, T., Mataix-Cols, D., & Rubia, K. (2013). Meta-analysis of functional magnetic resonance imaging studies of inhibition and attention in attention-deficit/hyperactivity disorder: exploring task-specific, stimulant medication, and age effects [Journal Article; Meta-Analysis; Research Support, Non-U.S. Gov't]. *Jama Psychiatry*, 70(2), 185-198. http://doi.org/10.1001/jamapsychiatry.2013.277

Rubia, K., Alegria, A., & Brinson, H. (2014). Imaging the ADHD brain: disorder-specificity, medication effects and clinical translation [Journal Article; Research Support, Non-U.S. Gov't; Review]. *Expert Review of Neurotherapeutics*, 14(5), 519-538. http://doi.org/10.1586/14737175.2014.907526

Shaw, P., Eckstrand, K., Sharp, W., Blumenthal, J., Lerch, J. P., Greenstein, D., Clasen, L., Evans, A., Giedd, J., & Rapoport, J. L. (2007). Attention-deficit/hyperactivity disorder is characterized by a delay in cortical maturation [Journal Article; Research Support, N.I.H., Intramural]. *Proceedings of the National Academy of Sciences of the United States of America*, 104(49), 19649-19654. http://doi.org/10.1073/pnas.0707741104

Shaw, P., Malek, M., Watson, B., Sharp, W., Evans, A., & Greenstein, D. (2012). Development of cortical surface area and gyrification in attention-deficit/hyperactivity disorder [Journal Article; Research Support, N.I.H., Intramural; Research Support, Non-U.S. Gov't]. *Biological Psychiatry*, 72(3), 191-197. http://doi.org/10.1016/j.biopsych.2012.01.031

Sripada, C. S., Kessler, D., & Angstadt, M. (2014). Lag in maturation of the brain's intrinsic functional architecture in attention-deficit/hyperactivity disorder [Journal Article; Research Support, N.I.H., Extramural; Research Support, Non-U.S. Gov't]. *Proceedings of the National Academy of Sciences of the United States of America*, 111(39), 14259-14264. http://doi.org/10.1073/pnas.1407787111