

Introduction

- ERP P3 is known to change their characteristics from children to adult.
- Correlation between cognitive tests and P3b of 10-13 years children during auditory oddball tasks (Boucher et al., 2010)
 - P3b latency correlated to stimulus classification, and amplitudes correlated speeded response and selective attention as same as in adult.
 - ✓ Is the results replicated in visual modality?
 - ✓ To examine about P3a is needed, because P3a and P3b might be mixed in 2-stimulus oddball task.

Our purpose: to examine correlation between cognitive score and ERP during visual 3-stimulus oddball task.

Methods

Study population: Participants in the hospital-based **prospective birth cohort study, Hokkaido Study on Environment and Children's Health**, which enrolled pregnant women from 2002 to 2005 in Japan (n=514).



Face to face examination: The WISC-III was implemented when the children were at 7 years old (n = 114), and ERP data was recorded at 13 years old (n = 138), for the Hokkaido study participants who agreed to join each examination.

ERP Procedure: 3-stimulus visual oddball task. The stimulus was presented during 300 ms, once every 2 s. Participants pressed the button when target stimulus was presented. 100 trials x 4 Block for each Easy and Difficult condition. Discrimination between Target and Standard stimulus was easier in the Easy condition than in the Difficult condition.

Recording: 4 scalp sites (Fz, Cz, Pz, Oz) with nose reference, sampling rate of 1000 Hz, TC 3s. Re-reference with averaged earlobes, and low-pass filter of 30 Hz. Analysis interval was 1000 ms with 200 ms pre-stimulus baseline.

Statistical Analysis: We analyzed data from **33 children** who had both WISC-III and ERP data, and without congenital anomaly. We implemented Pearson's Correlation Analysis to examine correlation between WISC-III score and both P3.

Condition	Stimulus configuration of oddball task		
	Target (15%)	Standard (70%)	Non-target (15%)
Easy	●	●	■
Difficult	●	●	■

Results & Discussion

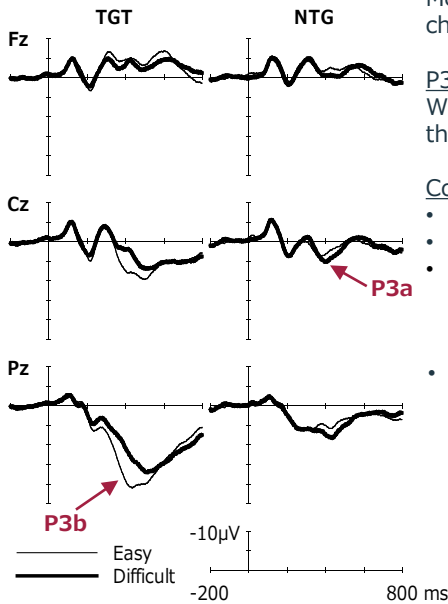


Fig.1 P300 grand average waveform.

Characteristics of participants:

Mean age of children was 12.1 years old (SD 0.8). Distribution of the participant's characteristics in this study were not different from that in the original cohort (Kishi 2017).

P300 and characteristics of participants:

We observed P3a for non-target over the central electrodes, and P3b for target over the parietal electrodes from 300 to 500 ms. (Fig.1).

Correlations between WISC-III & P3: (Table2, Fig 2)

- P3a latency and amplitude: n.s.
- P3b latency: n.s.
- P3b amplitude: Negative correlation with FIQ, VIQ, and VCI
 - Vocabulary task score was decreasing as P3b amp. in difficult condition.
 - Picture arrangement task score was decreasing in the both conditions

- Boucher (2010) reported correlation between
 - P3b latency and Digit span forward score
 - P3b amplitudes and recognition score of CVLT, Stroop interference completion time

This inconsistency might be due to difference in

- Sensory modality (visual v.s. auditory)
- Difficulty of tasks (3 v.s. 2-stimulus)
- Age of participants (13 v.s. 11 years old)

These results indicated P3b could reflect verbal ability and ability to anticipate and interpret social situations by visual cues, depend on experimental situations.

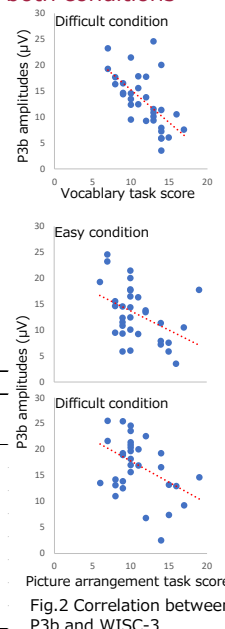


Fig.2 Correlation between P3b and WISC-3

Conclusion

Amplitude of P3b was correlated with lower ability of Vocabulary and Picture arrangement task.

Table2 Correlation between WISC-III score P3.

		VIQ (Verbal IQ)					IQ (Performance IQ)							
		Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit span	Picture Completion	Picture arrangement	Block Design	Object assembly	Symbol search	Mazes	
Mean amplitude	P3b easy	0.12	-0.21	0.02	-0.27	-0.01	-0.01	-0.12	0.22	-0.41	-0.14	0.10	0.09	-0.19
	difficult	-0.33	-0.08	-0.19	-0.61	-0.28	0.06	-0.18	0.09	-0.43	-0.25	0.22	0.17	-0.02
Peak latency	P3a easy	-0.03	-0.14	-0.04	-0.25	-0.13	-0.04	-0.09	0.14	-0.18	0.04	0.10	0.26	0.06
	difficult	-0.21	-0.02	-0.05	-0.30	-0.19	0.02	-0.07	0.16	-0.13	0.07	0.25	0.26	0.17
	P3a easy	-0.11	0.04	-0.11	0.14	0.22	-0.15	-0.08	-0.24	0.19	0.03	-0.04	-0.09	-0.14
	difficult	0.15	0.14	0.03	-0.04	0.22	0.23	-0.08	-0.05	-0.02	0.06	-0.10	0.06	0.13
	P3b easy	-0.26	-0.19	-0.14	0.00	-0.15	-0.20	-0.33	-0.17	-0.01	0.04	-0.18	0.04	0.15
	difficult	-0.28	-0.02	-0.22	-0.06	-0.11	-0.13	-0.23	-0.15	-0.05	0.21	-0.16	-0.02	0.13

IQ: Intelligence quotient, Red value means significance (p < 0.05).