Comparative study on the developmental characteristics of mathematical cognitive between ADHD and normal children

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Abstract

Objective
To compare the differences of the development of mathematical cognitive characteristics between ADHD children and normal children aged from 7 to 12 years old with the event-related potentials (ERP) in the mathematical tasks, and to explore the neural mechanisms and characteristics.

Methods
ERP and behavioural data of 72 ADHD children and 88 normal children in three groups (7?8 years old, 9?10 years old, 11?12 years old) were recorded and analysed. N1, P2 and N2 components' amplitude and latency of Fz by judging the answers to simple calculation within 20.

Results
(1) Vertical comparative analysis (the three age groups were compared): the differences of N1, P2 and N2 amplitudes in normal groups were considered to be statistically significant (right answer: N1 (-3.8±2.1) μV, (-4.3±3.4) μV, (-2.2±2.4) μV; P2 (10.6±4.3) μV, (12.6±5.1) μV, (8.5±2.4) μV; N2 (-6.5±3.1) μV, (-10.2±4.2) μV, (-6.8±3.4) μV; error answer: N1 (-2.8±2.7) μV, (-4.5±3.0) μV, (-2.9±2.5) μV; P2 (9.3±5.9) μV, (12.1±5.0) μV, (8.2±3.6) μV; N2 (-7.4±3.7) μV, (-11.4±5.5) μV, (-7.7±3.7) μV; all P<0.05), while was not significant in ADHD group (all P>0.05).
(2) Horizontal comparative analysis (ADHD group and normal group were compared): N1 amplitude of ADHD group aged from 7 to 8 years old was higher than normal groups while judging the right answer (right answer: P2 (9.6±4.4) μV, (12.6±5.1) μV; N2 (-8.0±4.3) μV, (-10.2±4.2) μV; error answer: P2 (9.6±4.4) μV, (12.1±5.0) μV; N2 (-7.9±4.6) μV, (-11.4±5.5) μV; all P<0.05). (3) Comparison of different tasks (the judgement of right and wrong answer): There was no statistically significant difference between ADHD and normal group in amplitude (P>0.05). The latent period of the wrong answers was longer than that of the right ones among normal groups aged from 11?12 while the difference of ADHD group had no statistical significance ((312.9±42.3) ms, (292.2±21.2) ms, P<0.05).

Conclusion
The development trend of mathematical ERP component in ADHD children is different from normal ones, and it is closely related to the maldevelopment of the frontal lobe. The characteristics of cognitive deficit differ from ages. ADHD children in the low and intermediate level were damaged primarily with inhibition function, while the senior were damaged mainly in collision detection function.