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Diminished lateralised motor cortex activation in children with ADHD

Background / Objective

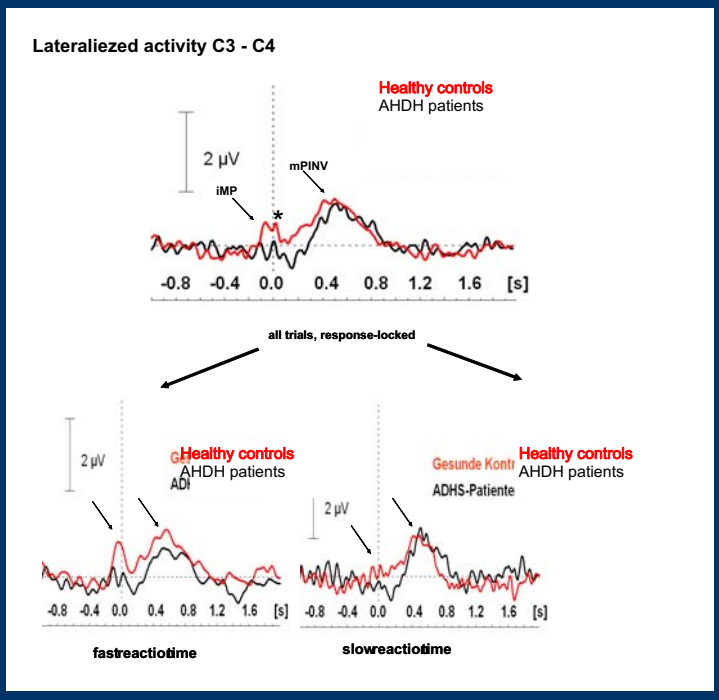
Inhibition deficits have been described for children with attention deficit/hyperactivity disorder (ADHD) by various groups. Only a few studies addressed movement-related potentials directly, because the readiness potential is not developed in children yet. Thus the role of higher executive control areas (prefrontal and cingulate cortex) could not be well seaprated from deficits directly in the motor system. Structural and functional studies point towards a motor cortex inhibition deficit. We analyzed lateralized movement-related potentials,l which reflect the programming of a specific movment (initial motor potential peak, iMP) and its post-processing / evaluation (motor postimperative negative variation). Deficits with respect to movement-related potentials could point towards genuinemotor system deficits.

Methods

Sample: 16 children with ADHD, 20 healthy age-matched control children (Seifert et al, 2003).

Elektrophysiology: A Continuous Performance Test (CPT) was analyzed by multi-channel-DC-EEG (with and without stimulant medication; MPH)
Analysis: We separated responses below and above the median reaction time in order to investigate the influence of „concentration“ on movement-related potentials. Response-locked lateralized movement-related potentials (C3-C4) allowed to reduce stimulus-related evoked activity. An ANOVA with the factors diagnosis, T1/T2 (ADHD: with/without medication), reaction time (fast versus slow responses) and component (iMP/mPINV) was performed.

Results



Results

ADHD patients showed an overall diminished motor cortex activation (p=0.008). However, this effect mainly relied on trials with fast reaction times (p=0.035). Only healthy controls showed higher amplitudes with faster reaction times compared to slower responses (p=0.02). As a consequence, ADHD patients showed reduced amplitudes in trials with fast reaction times (p=0.03). The iMP-interval was affected more strongly. Stimulant medication did not affect the lateralization of movement-related potentials.

Background / Objective

Our finding of diminished lateralized movement-related potentials especially with fast reaction times points towards a reduced recruitment of exact focal motor activation by higher executive areas in ADHD even when a better concentraction is achieved. While motor post-processing (mPINV) was also present with distracted (slow) responses, movement-preparation and execution only evoked a significant iMP in healthy children during good concentration. Our data contradict a simple maturational delay in ADHD because we did not find a combination of a decreased iMP and an increased mPINV. That these deficits were not restored by stimulant medication indicate that they might not be part of a general inhibition deficit which normalizes when it is sufficiently treated. Cortical maturation processes might interact with ADHD pathophysiology. Further studies are needed to characterize the exact motor abnormalities in ADHD.