

Learning and retention of a temporal sequence in children with Developmental Coordination Disorder depend on the modality (auditory vs visual) of stimulations

Aim. To date, the question of whether motor learning is impaired in DCD remains open. This study investigates (1) a possible deficit in synchronization, learning and retention of a temporal sequence in DCD children (2) as a function of the sensory modality of the sequence and (3) the cortical correlates.

Background. Compared to visual stimulations, auditory stimulations induce spontaneous sensorimotor synchronization in healthy people, hence facilitating motor control and learning, in association with activations of frontal and parietal cortical regions. We hypothesize that motor synchronization and learning would benefit from auditory cues, but less in DCD children who present atypical fronto-parietal structures.

Method. 16 typically-developing (TD) and 11 DCD children during synchronization of auditory and visual regular temporal sequences, learning and retention of auditory and visual non-regular temporal sequences. Accuracy and stability of the produced sequence were tested. Correlations with the cortical thickness of 11 regions of interest (whole brain) acquired with Magnetic Resonance Imaging were also tested.

Results. Compared with TD children, DCD children present (1) less stable synchronization with regular rhythmic stimuli whatever the sensory modality, (2) less stabilization during learning and more increase of the number of errors during retention of the auditory non-regular temporal sequence. For all children, (3) the stability of synchronization with auditory sequence is correlated with the cortical thickness of (a) sensorimotor and (b) occipital cortices.

Discussion. Despite a general deficit in synchronization of a regular temporal sequence, DCD children present specific deficit in learning and retention of auditory (not visual) non-regular temporal sequence. For all children, higher stability of synchronization is linked with lower thickness of sensorimotor and visual cortical regions.

Conclusion. In accordance with our hypotheses, learning of non-regular temporal sequences was impaired in DCD children with the auditory modality: they failed to improve synchronization despite repeated exposition to the auditory sequence, especially when their cortical thickness of sensorimotor and occipital regions is high. This suggest a deficit or immaturity of audio-motor coupling in DCD.

Keywords: synchronization, cortical thickness, procedural learning