

Audio-motor and visual-motor synchronization in healthy children and children with cerebellum lesions

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The aim of the study was to reveal relations between cerebellum dysfunction and sensorimotor synchronization ability in children treated for posterior fossa tumor (PFT-group) and healthy children (control group).

Thirty-four children with a diagnosed medulloblastoma (mean age 12.44 ± 2.74) and 25 control children (mean age 12.32 ± 2.36) were given audio- and visual-motor synchronization tasks: tapping according to the metronome sounds or to the blinking square on the screen at 40 and 60 beats per minute for 30 sec. Rhythm maintenance (inter-tap-intervals variance) was defined as the ability to produce regular inter-tap-intervals (ITI): the less ITI variance, the better rhythm maintenance. Rhythm accuracy (relative error) was defined as the difference between the child's tap and stimulus onset (the less this difference, the more accurate synchronization is). It could be either negative (a child taps before the metronome sound) or positive (a child taps after the metronome sound). The negative relative error means anticipation of the beat by a child (Repp&Su, 2013).

The results show that for all children it is easier to synchronize their hand movements with an auditory cue, then with visual. Synchronization with slow rhythm (40 bpm) is more difficult than with 60 bpm. There is a significant difference between two groups of children in ITI variance ($F=8.88$, $p=0.004$ for visual-motor test and $F=4.04$, $p=0.046$ for audio-motor test), but only for 60 bpm: patients with medulloblastoma demonstrated more variable rhythm maintenance. Rhythm accuracy is better in audio-motor tasks. There is no anticipation in visual-motor tasks in both groups. Healthy children are able to anticipate the sound, but patients are not. Correlation analysis between auditory and visual tasks performance showed that there are some significant correlations in PFT-group, but not in the control group.

The results suggest that cerebellum dysfunction associated with poorer sensorimotor synchronization ability, more notable for visual stimuli.

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