

## Working Memory and Audio-Motor Synchronization in Children with Different Degrees of Central Nervous System's Lesions

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**Abstract :** Background: The most simple form of entrainment to a sensory (typically auditory) rhythmic stimulus involves perceiving and synchronizing movements with an isochronous beat with one level of periodicity, such as that produced by a metronome. Children with pediatric cancer usually treated with chemo- and radiotherapy. Because of such treatment, psychologists and health professionals declare cognitive and motor abilities decline in cancer patients. The purpose of our study was to measure working memory characteristics with association with audio-motor synchronization tasks, also involved some memory resources, in children with different degrees of central nervous system lesions: posterior fossa tumors, acute lymphoblastic leukemia, and healthy controls. Methods: Our sample consisted of three groups of children: children treated for posterior fossa tumors (PFT-group, n=42, mean age 12.23), children treated for acute lymphoblastic leukemia (ALL-group, n=11, mean age 11.57) and neurologically healthy children (control group, n=36, mean age 11.67). Participants were tested for working memory characteristics with Cambridge Neuropsychological Test Automated Battery (CANTAB). Pattern recognition memory (PRM) and spatial working memory (SWM) tests were applied. Outcome measures of PRM test include the number and percentage of correct trials and latency (speed of participant's response), and measures of SWM include errors, strategy, and latency. In the synchronization tests, the instruction was to tap out a regular beat (40, 60, 90 and 120 beats per minute) in synchrony with the rhythmic sequences that were played. This meant that for the sequences with an isochronous beat, participants were required to tap into every auditory event. Variations of inter-tap-intervals and deviations of children's taps from the metronome were assessed. Results: Analysis of variance revealed the significant effect of group (ALL, PFT and control) on such parameters as short-term PRM, SWM strategy and errors. Healthy controls demonstrated more correctly retained elements, better working memory strategy, compared to cancer patients. Interestingly that ALL patients chose the bad strategy, but committed significantly less errors in SWM test than PFT and controls did. As to rhythmic ability, significant associations of working memory were found out only with 40 bpm rhythm: the less variable were inter-tap-intervals of the child, the more elements in memory he/she could retain. The ability to audio-motor synchronization may be related to working memory processes mediated by the prefrontal cortex whereby each sensory event is actively retrieved and monitored during rhythmic sequencing. Conclusion: Our results suggest that working memory, tested with appropriate cognitive methods, is associated with the ability to synchronize movements with rhythmic sounds, especially in sub-second intervals (40 per minute).

**Keywords :** acute lymphoblastic leukemia (ALL), audio-motor synchronization, posterior fossa tumor, working memory

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