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Applying the Eye Tracking Technique for the Evaluation of Oculomotor System in Patients Survived after Cerebellar Tumors

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Abstract : Background: The cerebellar lesions inevitably provoke oculomotor impairments in patients of different age. Symptoms of subtentorial tumors, particularly medulloblastomas, include static and dynamic coordination disorders (ataxia, asynergia, imbalance), hypo-muscle tonus, disruption of the cranial nerves, and within the oculomotor system - nystagmus (fine or gross). Subtentorial tumors can also affect the areas of cerebellum that control the oculomotor system. The noninvasive eye-tracking technology allows obtaining multiple oculomotor characteristics such as the number of fixations and their duration, amplitude, latency and velocity of saccades, trajectory and scan path of gaze during the process of the visual field navigation. Eye tracking could be very useful in clinical studies serving as convenient and effective tool for diagnostics. The aim: We studied the dynamics of oculomotor system functioning in patients undergoing remission from cerebellar tumors removal surgeries and following neurocognitive rehabilitation. Methods: 38 children (23 boys, 15 girls, 9-17 years old) that have recovered from the cerebellar tumor-removal surgeries, radiation therapy and chemotherapy and were undergoing course of neurocognitive rehabilitation participated in the study. Two tests were carried out to evaluate oculomotor performance - gaze stability test and counting test. The monocular eye movements were recorded with eye tracker ArringtonResearch (60 Hz). Two experimental sessions with both tests were conducted before and after rehabilitation courses. Results: Within the final session of both tests we observed remarkable improvement in oculomotor performance: 1) in the gaze stability test the spread of gaze positions significantly declined compared to the first session, and 2) the visual path in counting test significantly shortened both compared to the first session. Thus, neurocognitive rehabilitation improved the functioning of the oculomotor system in patients following the cerebellar tumor removal surgeries and subsequent therapy. Conclusions: The experimental data support the effectiveness of the utilization of the eye tracking technique as diagnostic tool in the field of neurooncology.

Keywords : eye tracking, rehabilitation, cerebellar tumors, oculomotor system
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