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Correlation of Vestibulo-ocular Reflex with Motor Skills and Functional Performance in Children with Cerebral Palsy: A Literature Review

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ABSTRACT

The present review aimed to examine the relationship between prefrontal cortex connectivity, Vestibulo-Ocular Reflex (VOR) function, and motor as well as functional performance in children with cerebral palsy. The review also explored how altered cortical activity and vestibular dysfunction contribute to impaired balance, motor coordination, gait, and reduced functional independence in cerebral palsy. A narrative literature review was conducted using electronic databases, including PubMed, Google Scholar, and Scopus. Articles published between 2014 and 2025 were searched using keywords related to cerebral palsy, EEG, fNIRS, vestibulo-ocular reflex, vestibular function, cortical connectivity, and motor performance. A total of 13 articles were selected based on predefined inclusion and exclusion criteria. Studies assessing cortical activity, vestibular function, balance, gait, motor skills, and functional performance in children with cerebral palsy were included. The reviewed studies showed that children with cerebral palsy have altered cortical connectivity and vestibulo-ocular dysfunction compared to typically developing children. EEG and fNIRS findings indicated reduced prefrontal activation, decreased alpha/beta activity, and increased delta/theta activity, reflecting impaired sensorimotor integration. Functional connectivity studies found disrupted interhemispheric and sensorimotor connections linked to poorer motor control. Vestibular assessments revealed abnormal eye movement responses, reduced VOR gain, and poor fixation stability, contributing to impaired balance, gaze stabilisation, and coordination. Some studies also reported increased cognitive load and compensatory cortical activation during motor tasks. The review highlights that cerebral palsy involves significant alterations in cortical connectivity and vestibulo-ocular control beyond primary motor impairment. Understanding these mechanisms may support the development of targeted rehabilitation approaches focusing on cortical activation, vestibular rehabilitation, and cognitive-motor integration.

Keywords: Cortical connectivity, Motor performance, Ocular motor control, Prefrontal cortex, Vestibular function.

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