

Postural Control Characteristics in Children with Diplegic Cerebral Palsy: Cervical Joint Position Sense Error Perspective

Background: Children with spastic diplegic cerebral palsy (CP) have been reported to exhibit significantly impaired postural control in sitting compared with their typically developing peers (1). In addition, previous research has shown reduced activation of antigravity muscles responsible for maintaining postural stability in children with spastic diplegic CP when compared to typically developing children (2). Given the importance of sensory–motor integration for postural regulation, these findings suggest that factors beyond muscle weakness alone may contribute to postural control deficits in this population.

Objectives: Therefore, this study aimed to investigate relationship between postural control and cervical joint position sense error (CJPSE) in children with spastic diplegic CP.

Methods: Thirty-eight children with spastic diplegic CP (Gross Motor Function Classification System levels I–III), aged 5–12 years (mean age 7.94 ± 2.87), participated in study. CJPSE was evaluated using Cervical Range of Motion (CROM) device in flexion, extension, right/left rotation, and right/left lateral flexion directions (3). Postural control was assessed with Trunk Control Measurement Scale (TCMS) (4), and gross motor function was measured by Gross Motor Function Measure-66 (GMFM-66) (5). Correlations between variables were analyzed using Spearman's rank correlation test.

Results: Cervical joint position error was negatively correlated with postural control for flexion ($r = -0.533$, $p = 0.001$), extension ($r = -0.413$, $p = 0.011$), left rotation ($r = -0.702$, $p < 0.001$), and lateral flexion ($r = -0.660/-0.736$, $p < 0.001$), while right rotation showed small positive correlation ($r = 0.350$, $p = 0.034$). Strongest relationships appeared in dynamic sitting subscale of TCMS. Gross motor function was inversely associated with CJPSE error in flexion, left rotation, and lateral flexion movements, particularly in GMFM-C and GMFM-E dimensions.

Conclusion: In this study, cervical joint position sense error was observed to be associated with both postural control and gross motor function in children with spastic diplegic CP. The finding that CJPSE was more pronounced during rotation and lateral flexion, and that associations with postural control and gross motor function were relatively stronger in these directions, suggests that interaction may be more evident in transverse and frontal planes. These results may be related to possible challenges in head–trunk coordination during sitting and limitations in mediolateral balance strategies. From a clinical perspective, considering CJPSE assessments that include rotation and lateral flexion may be useful. In addition, when planning rehabilitation approaches, it may be appropriate to take into account potential relationships between postural control, gross motor function, and cervical joint position sense error.

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