Gait characteristics in children and adolescents with cerebral palsy assessed with a trunk-worn accelerometer

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OBJECTIVE
In children and adolescents with cerebral palsy (CP), gait is usually assessed in the decision processes leading to orthopedic surgery, botulinum toxin injections and/or the application of orthoses. The main focus of these assessments has been on the movements of the lower limbs, rather than addressing functional components of gait, like progression and balance.

Despite the high prevalence of balance problems in children with CP relatively few studies have focused on balance during gait in this population.

The aim was to use a trunk worn accelerometer to investigate gait characteristics reflecting balance and progression in children and adolescents with CP, compared with typically developing children (TD).

STUDY DESIGN
Cross-sectional study

STUDY PARTICIPANTS
70 children, 41 children (24 males) with CP and a gross motor function corresponding to GMFCS levels I to III, and 29 TD children (13 males) between 5-18 years (mean 11.1 years) were included in the study.

METHODS
The children walked back and forth a five meter walkway with a tri-axial accelerometer worn on the lower back to assess their gait characteristics. Data were recorded along the anteroposterior (AP), mediolateral (ML), and vertical (V) axes. To assess the magnitude of potential differences in gait characteristics standard deviation scores (z-scores) were calculated, using TD children as reference.

RESULTS
- Gait parameters related to balance:
  - Accelerations (AP, ML and V) were higher in children with CP than TD children (z-scores between 0.4 and 0.7).
  - The differences increased with increasing GMFCS level and increasing gait speed.
  - Asymmetry in trunk accelerations differed significantly between the two groups in all three directions (z-scores between 0.8 and 1.8).
  - Regularity between strides differed only slightly between children with CP and TD children, and only in the AP direction.
  - Gait characteristics also differed between children with the spastic unilateral and bilateral CP subtypes for accelerations and asymmetry in the AP and ML directions.

- Gait parameters related to progression:
  - There were no differences between the children with CP and TD children.

CONCLUSION
Our results showed that differences in gait characteristics between children with CP and TD children may be more related to balance than progression, and that these problems increase with increasing gross motor impairment and with increasing speed.