

SUMMARY

ON THE DEVELOPMENT OF POSTURAL ADJUSTMENTS IN SITTING AND STANDING

Created by Åsa Hedberg

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Description :

Postural control constitutes an inseparable part of any posture or movement and is organized to ensure the maintenance of equilibrium (Massion 1994). Within the first two years of life the infant masters to control equilibrium well enough to be able to sit, stand and walk independently. We studied postural adjustments, i.e., muscle activity elicited by external perturbations in typically developing infants during the periods in life when independent sitting and standing emerge. We also studied two types of motor control (voluntary and automatic) in children with cerebral palsy (CP), and in a group of age-matched, typically developing children.

Already at the age of one month, the infants were able to produce direction specific postural muscle activity, during unsupported sitting. Translations in the bw direction, evoked direction specific postural adjustments in 85% of the trials, and translations in the fw direction, in 72% of the trials. The postural adjustments were noted in all recorded muscles and particularly, direction specific postural adjustments were found in the neck muscles. The 'complete' pattern, i.e., when all direction specific muscles were activated during the same trial, became more frequent with age. However, the development of postural adjustments was not linear. We found that at 3 months the infants, used the 'complete' pattern less often than at 1 and 2 months, during both fw and bw translations. From 3 and 4 months onwards the activation rate gradually rose.

Infants aged 8 and 10 months, who are not yet able to stand independently exhibited direction specific postural adjustments during standing both with and without support. Therefore, we argue that direction specificity might constitute a prerequisite for the development of independent standing. We also found that the development of postural control in standing resembles that of sitting, i.e., great variation in the postural adjustments at early age, and fine-tuning to the situation with increasing age and experience. This strengthens the proposal that postural control develops through a selection process of the most suitable postural adjustments for the situation from a repertoire of direction specific postural adjustments (Forssberg 1999, Hadders-Algra 2000). Additionally, differences in response rates were noted between the two standing positions, indicating that already before independent standing is established, sophisticated sensorimotor integration enables task specific postural adjustments.

We also examined two types of motor control, i.e., voluntary ankle dorsiflexion and automatic postural adjustments (during external perturbations in standing without support) in nine children aged 9-15 years with hemiplegic CP. The ability to dorsiflex the ankle was investigated using the Selective Motor Control scale

and by recording muscle activity during dorsiflexion. During both voluntary dorsiflexion and automatic control of the leg muscles the children with CP activated more muscles than the typically developing children, both synergistic and antagonistic muscles. In the group of CP, there was a significant correlation ($\rho=-0.71$, $p<0.05$) between the number of muscles activated during dorsiflexion (1-7 muscles) and the SMC scores (1-4). A trend for positive correlation between the numbers of muscles activated during the two tasks was noted.

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Contact Person :

Astrid Chrisafi (mutiaraadinda@yahoo.com)

Thank You,

Astrid (astrid.chrisafi@esaunggul.ac.id)

Supervisor