Effects of an intensive therapy (HABIT-ILE) on the precision grip control while walking down a step in children with unilateral cerebral palsy

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Introduction

Grasping with precision depends on predictive and reactive mechanisms, both affected in children with unilateral cerebral palsy (UCP). To avoid slips and early fatigue, a good coordination between the perpendicular grip force (GF) and tangential load forces (LF) is required. In children with UCP, grip-load force coordination is present in the less-affected hand but altered in the more-affected hand in static sitting conditions, while walking and while performing a combined upper/lower extremity coordination task of going down a step holding an object.

New intensive motor-skill learning interventions such as Hand-Arm intensive Therapy-Including Lower Extremity (HABIT-ILE) have demonstrated improvements in functional abilities in children with CP. The effect of such therapies on the precision grip in tasks combining upper & lower extremities is still unknown. This is the aim of this study.

Methods

Participants: 24 unilateral CP children

- Gender (male/female): 6 / 18
- Age range (years/month): 6y,1m – 13y,0m
- Affected side (left/right): 11 / 13
- GMFCS level: I = 3, II = 19, III = 2

Intersegmental task: Standing on a step (17cm height), arms along the body and elbow at 90°, holding a Manipulandum (thumb-index grip), children go down the step spontaneously.

5 trials per hand, starting with the dominant (less affected) hand.

Instrument

- Manipulandum (Force/Torque sensors)
- Electronic pinch gauge (E-link system)

VARIABLE MEASURED

- Grip force [GF] (Newtons)
- Load force [LF] (Newtons)
- Delay between forces’ events (ms)
- Maximum Voluntary Contraction (MVC) (Newton)
- % of MVC for GF at each event (%)

Results

T1: baseline pre Conventional Therapy
T2: post Conventional Therapy pre HABIT-ILE
T3: post HABIT-ILE
T4: follow up

LESS AFFECTED HAND

MORE AFFECTED HAND

Conclusion

Although HABIT-ILE modified only transitarily the force scaling, this intervention induced long-term changes in force generation, which contributes, at least in part, to the functional improvements observed after HABIT-ILE in previous studies.

It remains to understand which specific features of HABIT-ILE should be transferred in daily activities or regular training to allow children maintain gains in force scaling further in time.