Changes in Trunk and Head Stability in Children with Cerebral Palsy after Hippotherapy: a Pilot Study

Source: Shurtleff TL, Engsberg JR.2010. Changes in trunk and head stability in children with cerebral palsy after hippotherapy: a pilot study. *Phys Occup Ther Pedi*. 2010;30(2):150-163.

Purpose:
Can changes in head and trunk control of individuals with cerebral palsy be objectively quantified in the sagittal plane following hippotherapy (HPOT) intervention?

Design/Methods:
This pilot study included six children with a diagnosis of spastic cerebral palsy (CP) and six individuals without disability. Children with CP included four boys and two girls ranging in age from 5 to 17 years and gross motor function levels (GMFCS) ranging from I-IV. Two males and four females without disability (age range 7 -56 years of age) were included in this study to provide a normative baseline for comparison of study results. Hippotherapy intervention consisted of 45 minute weekly sessions for 12 weeks with two testing sessions, one session two weeks prior to beginning HPOT intervention and one session two weeks after the end of the intervention period. Each participant was screened by a physical or occupational therapist for precautions and contraindications for participation and to develop a treatment plan to meet the unique needs of each child. Hippotherapy sessions were conducted at two adaptive riding/hippotherapy centers. Treatment sessions were directed by licensed occupation therapists, physical therapists, or occupational therapist assistants who were experienced with HPOT intervention. Changes in trunk and head movement patterns were measured using a 6 camera video motion capture (VMC) system (Eva RealTime V. 4,3,32, Motion Analysis Corp. 2004) while the participants were seated on a motorized barrel. The motorized testing barrel provided precisely replicable rhythmic perturbations at the pelvis to challenge head and trunk control in anterior-posterior (AP) translations. Designed and constructed by the researchers, the motorized barrel provided one translational degree of freedom at an amplitude of 16 centimeters (cm).

Results:
Movement variability of angular excursion of the head decreased to 9.0° at post-test from 18.8° at pre-test ($p < .03$) in the children with CP after HPOT intervention. Although improvements were seen in mean AP head rotation ROM (44° at pre-test and 29° at post-test; $p < .05$) the mean ROM and SD remained significantly different between individuals without disability and children with disability following the intervention period.

Conclusion:
Stability of the head and trunk in response to rhythmical perturbations to the pelvis were objectively quantified in the sagittal plane in children with spastic diplegia using VMC. Following 12 weeks of HPOT intervention, children with CP demonstrated decreased head and neck ROM, decreased AP trunk translations, and decreased head angle variability resulting in improved head/trunk stability. These findings further support the efficacy of HPOT intervention at improving head and trunk control in response to rhythmic movement.

Strengths:
The strengths of this study included the use of objective measurement tools in VMC and a motorized barrel when assessing for head and trunk control changes and the consistency of treatment session length.

Limitations:
The limitations of this study included a small sample size, varying disciplines directing HPOT intervention sessions, motorized barrel developed for this study without normative values, small comparison group, and length of intervention period.

Practical Application:
Improvements in head and trunk control can be objectively quantified using a motorized barrel to provide perturbations to the pelvis with VMC for 3D motion analysis. This more objective measurement tool could supplement clinical rating scales and measures when assessing head and trunk control in children with CP. More research is needed for normative values using a motorized barrel and to determine minimal detectable change.

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