

December, 2007 update from Jack R. Engsborg, PhD, & Tim L. Shurtleff, OTD, OTR/L, HHRF Grant Recipients

The Human Performance Laboratory at the Program in Occupational Therapy of Washington University School of Medicine (St. Louis, MO) is in the final phases of data gathering for the study funded by the Horses and Humans Research Foundation's 2006 research grant. The study recruited 11 children with spastic diplegia cerebral Palsy ranging in age from 5 years to 13 years old. The purpose of the study is to measure the trunk and head stability changes in children with CP after 12 weeks of 45 min hippotherapy (HPOT) treatments. We defined stability as the ability to keep the head and upper trunk relatively still while the pelvis was in motion. Another variable measured is upper extremity reaching and targeting. We hypothesized that if trunk stability improved, then functional use of the arms and hands might also show improvement because the foundation (the trunk) and the visual and vestibular (balance and movement) sensory systems are more stable. Both systems are resident in the head and provide sensory feedback for functional use of the hands. We used a motorized barrel and Video Motion Capture (VMC) to challenge and measure the changes in motor control of the trunk that might have been learned on a horse. Our VMC system is the same technology that is used to animate movies and video games. It uses six cameras that "see" small reflective markers on anatomical landmarks of the head, trunk, arms and hands. The system measures the position of the markers in 3D space to an accuracy of 0.5mm, 60 times per second over several timed tests (15 sec). Subjects were tested on the motorized barrel, and while sitting on a stool and reaching to touch a target. VMC enables very precise and objective measurement of the movement of the body and its parts. The testing challenge, from the barrel, is precisely replicable before and after our 11 kids participated in hippotherapy for 45 minutes per week for 12 weeks. In addition, we measure their control of their bodies again after another three months of not riding horses. We are also comparing them to a group of age matched children with no disabilities.

So far, we have had all 11 children complete their pre and post hippotherapy testing. They have shown very significant differences in their control of their trunks and heads. On average they have reduced movement at the head and upper trunk by 1/3 of their pre-HPOT movement while being challenged by the reciprocating movement of the barrel. We can also show that their control of their heads has improved significantly. The range of motion of the head (highest and lowest head angles compared to the horizontal) and their movement variability (standard deviation of all angles through the timed test) decreased significantly. They also do not drop their heads as much forward, another significant result. So far, 8 of the children have come back for their last test. Preliminary results show that all these changes have persisted and remain statistically significant after the three month washout period after they stopped riding horses. We will be able to confirm this after the final children complete their third measurements in late December. The take home message is that we think we will be able to show with objective measures that HPOT improves motor control of the head and trunk and that the improvement sticks with them.

We are in the middle of analyzing the upper extremity targeting data. VMC, with markers added to the arms and hands, is also used to objectively measure the reaching task. The test of upper extremity targeting asks them to reach to touch a target from a resting position with their hand on their thigh while sitting on a stool. They reach with both hands both forward and out to the side. The target is set at an easy reach and also at a stretch position (10-15 cm further than they can reach without moving the trunk). A very early preliminary result seems to be that upper extremity reaching efficiency, measured by the reach/path ratio (a comparison between a straight line and their actual path) has improved significantly after HPOT, and the improvement continues after they stop riding. We do not yet have all of the data collected and we still have much still to do to analyze these data, but these early results are promising.

We are very grateful to the HHRF for funding this project and believe that the results will provide valuable objective evidence for the efficacy of hippotherapy as well as validating this measurement methodology for future studies.