

Project Title: *Gait Restoration in Hemiparetic Stroke Patients using Goal-Directed, Robotic-Assisted Treadmill Training*

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Project Description

The overall goal of this study is to determine whether goal-directed, robotic-assisted gait training is more effective than conventional gait training for facilitating the recovery of stable walking patterns in hemiparetic stroke patients. The subject sample will consist of 100 patients in the sub-acute stage following stroke (less than 6 months post stroke), randomly assigned to one of 2 experimental groups. The first (control) group will receive one hour of conventional gait training, with appropriate physical assistance and feedback as necessary. The second group will receive body-weight supported treadmill training (BWSTT) with robotic-assistance using the Lokomat® System (Fig. 1, Hocoma, Inc., Zurich, Switzerland). The Lokomat® is an exo-skeletal robotic orthosis that attaches to a person's legs and assists the subject in achieving normal gait patterns while walking on a treadmill. During training sessions with the Lokomat®, patients will receive bio-feedback of their performance, allowing for goal-directed therapy. Both groups will be trained for 24 sessions over a 10 week period, 3 times per week, with 1 hr allocated for all training paradigms. All subjects will be trained at the National Rehabilitation Hospital (NRH) in Washington DC and the Rehabilitation Institute of Chicago (RIC) in Chicago, IL.

The re-acquisition of natural gait patterns and lower limb motor function will be evaluated at weeks 0, 4, and 8 of the intervention, as well as during a follow-up exam 3 months after study completion. Outcome measures include the speed and variability of unassisted walking, step lengths and cadence, postural balance, assessment of spasticity, and strength measures. Using these criteria, we will determine whether there are differences between conventional gait training and Lokomat® therapy for promoting the restoration of walking capabilities and reducing functional impairments in patients with hemiparesis following stroke.

Progress To Date

NRH has enrolled a total of 25 subjects where 20 have completed the study, 2 have dropped out, and 3 are currently being trained. RIC has enrolled a total of 19 subjects where 12 have completed the study, 6 have dropped out, and 1 is currently being trained. Of the 37 subjects who have completed the study, 11 have been assigned to the fast walker group (initial walking speed 0.4 – 0.6 m/s) while 26 have been assigned to the slow walker group (initial walking speed 0.1 – 0.4 m/s).

We are currently analyzing the data collected from the first 37 subjects to determine how many subjects we will need to train in order to see statistical differences between groups (e.g. Lokomat vs. Conventional), using an effect size of 0.5. If we will need more subjects than originally estimated (50 per group), we will consider focusing the remainder of the study only on slow walkers since we have trained more than twice as many in that group as we have fast walkers.

Presentations and Publications

1. "Introduction: An overview of robotic technologies", American Congress on Rehabilitation Medicine, Chicago, IL, 2005
2. "Robotic-assisted arm therapy in hemiparetic stroke", American Congress on Rehabilitation Medicine, Chicago, IL, 2005.
3. J. M. Hidler, D. Nichols, M. Pelliccio, and K. Brady, "Advances in the understanding and treatment of stroke impairment using robotic devices." *Top Stroke Rehabil*, vol. 12(2): 21-33, 2005.



Fig. 1 – Lokomat robotic gait-orthosis