

Lokomat

Background

Around 75% of post-stroke patients suffer from cardiac disease. Most of these have low exercise endurance due to the cerebrovascular event, and as secondary reaction to immobility. Previous studies have shown the beneficial effects of aerobic exercise in chronic stroke. Less is known about the impact of cardiovascular exercise early after stroke. Methods for assessment of aerobic capacity in severely affected stroke patients are lacking.

Aims

The aim of the project is to evaluate the feasibility of using feedback-controlled robotics-assisted treadmill exercise (RATE) to influence and assess aerobic capacity early after stroke. We are interested in gaining preliminary evidence on the clinical efficacy of the method and focus on retention rates, suitability of inclusion/exclusion criteria, data processing, and ability to process subjects with available resources.

Methods

In-patients after stroke undergo constant load and incremental exercise testing using a human-in-the-loop feedback system in automated robotic gait orthoses integrated with a treadmill and a dynamic body-weight unloading system (Lokomat, Hocoma AG, CH). Inclusion criteria are stable medical condition, appropriate cognitive function and moderate control of the lower limbs to voluntarily produce forces within the exoskeleton. Exercise capacity is measured using breath-by-breath pulmonary gas exchange monitoring and heart rate telemetry. Outcome measures are oxygen uptake kinetics, peak oxygen uptake, peak work rate, peak heart rate, gas exchange threshold, and work rate variability. Additionally, adherence and data processing will be evaluated.

Future directions

Following completion of a two-phase pilot study, we are now proceeding with a randomised controlled trial in the clinical setting. This work is carried out at our clinical partner Reha Rheinfelden and involves patients at an early stage of rehabilitation following stroke.

Publications

[1] M. Schindelholz and K. J. Hunt, "Feedback control of heart rate during robotics-assisted treadmill exercise," *Technology and Health Care*, 2012. In press.

[2] O. Stoller, E. D. de Bruin, R. H. Knols, and K. J. Hunt, "Effects of cardiovascular exercise early after stroke: systematic review and meta-analysis." *BMC Neurology*, 2012. 12(45). doi:10.1186/1471-2377-12-45.

[3] K. J. Hunt and A. Bugmann, "Feedback control of human metabolic work rate during robotics assisted treadmill exercise," *Biomed. Signal Process. Control*, vol. 7, pp. 537–541, September 2012. doi:10.1016/j.bspc.2011.11.001.

