ABSTRACT

Abstract Purpose: Robotics-assisted tilt-table (RTT) technology allows neurological rehabilitation therapy to be started early thus alleviating some secondary complications of prolonged bed rest. This study assessed the feasibility of a novel work-rate-guided RTT approach for cardiopulmonary training and assessment in patients with incomplete spinal cord injury (iSCI). Methods: Three representative subjects with iSCI at three distinct stages of primary rehabilitation completed an incremental exercise test (IET) and a constant load test (CLT) on a RTT augmented with integrated leg-force and position measurement and visual work rate feedback. Feasibility assessment focused on: (i) implementation, (ii) limited efficacy testing, (iii) acceptability. Results: (i) All subjects were able follow the work rate target profile by adapting their volitional leg effort. (ii) During the IETs, peak oxygen uptake above rest was 304, 467 and 1378 ml/min and peak heart rate (HR) was 46, 32 and 65 beats/min above rest (subjects A, B and C, respectively). During the CLTs, steady-state oxygen uptake increased by 42%, 38% and 162% and HR by 12%, 20% and 29%. (iii) All exercise tests were tolerated well. Conclusion: The novel work-rate guided RTT intervention is deemed feasible for cardiopulmonary training and assessment in patients with iSCI: substantial cardiopulmonary responses were observed and the approach was found to be tolerable and implementable. Implications for Rehabilitation Work-rate guided robotics-assisted tilt-table technology is deemed feasible for cardiopulmonary assessment and training in patients with incomplete spinal cord injury. Robotics-assisted tilt-tables might be a good way to start with an active rehabilitation as early as possible after a spinal cord injury. During training with robotics-assisted devices the active participation of the patients is crucial to strain the cardiopulmonary system and hence gain from the training.