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Evaluation of Robotic- Assisted Locomotion Training in Spinal Cord Injury Patients – Patients and Physiotherapists' Perspectives

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Introduction

Gait training was of vital importance in restoration of daily function and improving quality of life for patients after spinal cord injury (SCI). However, the process was labour-intensive and physically demanding in SCI patients with severe gait dysfunction. Physiotherapists often encountered difficulties in providing efficient and sufficient training to Robot-assisted gait training system could help to alleviate these difficulties.

Objectives

To evaluate the feasibility of using robotic-assisted gait training device for locomotion training in SCI patients with severe gait dysfunction with respect to the training effects on SCI patients and therapists' physical efforts.

Methodology

Patients suffered from SCI due to trauma, haematoma or tumors were recruited from Tuen Mun Hospital from July 2013 to January 2014. In addition to concurrent physiotherapy sessions, all patients attended one-hour robotic-assisted gait training session once per week including set-up time with actual training time of 30-45 minutes. Treadmill speed ranged from 1.5mph to 2.0mph. The amount of body weight support was minimized to allow maximum lower-extremity loading (30% 7.1%). Primary outcome measures included the Lower-Extremity Motor Scores (LEMS), Mobility Subscale of Spinal Cord Independence Measure III (SCIM III) and Walking Index for Spinal Cord Injury II (WISCI II) to assess patients' improvement in locomotor function after training. Secondary outcome measures consisted of the Medical Outcome Study Short Form (SF-36) to assess patients' quality of life and a self-reported form to assess physical demand of therapists on conducting robotic-assisted gait training.

Result

8 SCI patients (6 female, 2 male) with a neurologic level of injury at L1 or higher were recruited (age 19-59 years). The total number of training sessions was 16±12. At baseline, the numbers of patients classified according to the American Spinal Injury Association (ASIA) classification were1A, 4B and 3C. After training, the number became 1A, 1B, 4C and 2D The robotic-assisted gait training tolerance significantly increased from 15±7 minutes to 31±16 minutes ($Z=-2.240$, $p=0.025$).LEMS (11±9 to 24±14), Mobility Subscale of SCIM III (10±7 to 16±8) and WISCII (2±1 to 6±5) showed improvement progress after training but it is statistically insignificant ($p>0.05$). Both physical component score (27±3.0 to 31±6.2) and mental components core (35±15 to 40±16) of SF-36 increased after training with no statistical significance ($p>0.05$). However, the item of “Self-reported Health Transition” in SF-36 showed significant improvement from 2.3±1.4 to 4.1±0.7 ($Z=-2.32$, $P=0.04$). All therapists reported less physical strain to conduct a 30-minute of robotic-assisted gait training for 7 patients and moderate physical strain level for 1 patient with obesity. Conclusion The use of task-specific robotic-assisted gait training to improve locomotor function for SCI patients and their training tolerance was promising. Though enhancement of patients’ quality of life could not be proved in our study, their subjective health status was improved after training. In addition, physical stress on therapists to conduct gait training was reduced by this new system. A larger-scale of study will be conducted to explore the effect of robotic-assisted locomotion training on patients’ quality of life.