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Robotic ArmeoSpring Program (RAP) for Improvement of Upper Limb Function in Chronic Stroke Patients

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Introduction

Research evidence supports the use of robot-assisted therapy in motor relearning of stroke patients as an additional intervention in combination with conventional physiotherapy. High-dosage and high-intensity of meaningful motor training can be achieved through the application of robot-assisted therapy. ArmeoSpring provides a virtual-reality training environment allowing patients to participate in interactive and task orientated rehabilitation games. Most previous studies were targeted on the delivery of robotic therapy to sub-acute stroke patients. The sustainability of robot therapy remains uncertain. Robotic ArmeoSpring Program (RAP) has been established at Physiotherapy Department of Tseung Kwan O Hospital to facilitate upper limb neuromuscular control and function of chronic stroke patients.

Objectives

To evaluate the efficacy and sustainability of RAP in promoting upper limbs motor recovery of chronic stroke patients.

Methodology

From March to December 2016, 12 participants from Physiotherapy outpatient with unilateral stroke were recruited into RAP. Their average months since stroke were 32.8 months. A total number of 8 RAP sessions were offered. In each session, 4 to 6 motivational virtual-reality games were selected based on participant's performance and ability. All subjects were tested by physiotherapists before receiving RAP, at the 8th training session and 4-month follow up sessions. Fugl-Meyer Assessment (FMA) was used to assess upper limbs function and Modified Ashworth Scale (MAS) for assessing spasticity. Friedman and Multiple Wilcoxon Signed Ranks Tests were used for data analyses. Patient Satisfaction Survey (PSS) was conducted.

Result

10 males and 2 females participated and completed RAP. Significant improvement was found in several aspects of FMA after 8 sessions of training: upper extremity function ($p= 0.001$), wrist function ($p= 0.014$), total motor function ($p=0.001$). The FMA scores in these aspects after 8 sessions of training were sustained at 4-month follow up. MAS over shoulder, elbow and wrist was not significantly improved. There was no drop-out and adverse effect noted. All patients reported increase in awareness and confidence in using their hemiplegic arms.

RAP is an effective program for enhancing upper limbs motor recovery of chronic stroke patients by improving their upper extremity, wrist and total motor function. Sustainability of RAP was noted in follow up session.