Service Priorities and Programmes

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Convention ID: 247
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Robot-assisted physiotherapy training on treadmill reduces muscle stiffness at the hips and knees in a thoracic level complete paraplegia: a case report

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Keywords:
spinal cord injury
spasticity
muscle stiffness
robotic
physiotherapy training

Introduction

Person with complete spinal cord injury at thoracic level usually presented with marked spasticity below the injury level. This increase in muscle stiffness may cause pain, sleep disruption, fatigue, movement difficulty, and muscle/bone/joint distortion. Several therapies are available to manage spasticity including medication, surgical intervention and rehabilitation therapy. Medications alone are usually not enough. Robot-assisted treadmill training has been suggested to have beneficial effects on managing spasticity in individuals with spinal cord injury. The robot-gait-orthosis provides stretching to the lower extremity muscles during repetitive gait cycle in a weight loaded position.

Objectives

To investigate the effect on muscle stiffness of hips and knees of a complete thoracic pareplegic patient who underwent a single and multiple sessions of robot-assisted physiotherapy training on treadmill.

Methodology

A complete paraplegia (“the patient”) at low thoracic lesion (T11-12) was recruited. The patient underwent eight sessions of robot-assisted physiotherapy training on treadmill (“the training”) with a computerized robot-assisted gait training system (“the system”). The training included treadmill walking at variable speed (1.5 to 2.0 km/h) for 30 minutes with a partial body weight support and assistance from the computerized gait orthosis. The resistive torques (stiffness in Nm/ degrees) over the hips and knees to passive leg movement with varying angular velocities at 30°, 60°, and 120° per second were measured by the system immediately before and after a single session and upon completion of 8 sessions of the training.

Result

The passive torque on average significantly reduced by 37.5% and 10.9% over the hips and knees, respectively, immediately after a single session of the training.

Following 8 sessions of the training, the passive torque reduced by 22.0% over the hips and 40.9% over the knees. The effect was more obvious at lower velocities in contrast with higher velocities. Injuries to low-thoracic spinal cord may cause significant spasticity to lower extremities. The computerized robot-assisted physiotherapy training on treadmill for the aforesaid patient was effective in reducing muscle stiffness at both the hips and knees in both immediate short-term and cumulative long-term effect. It is foreseeable that more similar patients can promisingly benefit further in muscle stiffness if the conventional physiotherapy training can be incorporated with robot-assisted gait training on treadmill.