CO21-002-e

Efficacy of robotic walk training in the early recovery period in patients after total joint replacement of the lower extremities

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Keywords: Total joint replacement; Distance robotic reconstruction

Objective.– Study was aimed to determine the effectiveness of distance robotic reconstruction (RRH) training in patients after total joint replacement (TJR) of the lower extremities.

Methods.– In total, 162 patients with knee and 48 with hip TJR were included in the first 5 postoperative days. Then, 130 patients received RRH (study group) and 80 received only physiotherapy sessions with an instructor (control group). RRH training started on the second day after surgery and continued daily for 2–3 days. Podography, podometrics and 10-m walk test were conducted at inclusion and at the end of the treatment.

Results.– At podography, the study group compared with the control had a decrease of asymmetry of locomotion, increased smooth rolling of the foot, normalization of depreciation function, physiological load increase and participation of foot support structures in the dynamics of ongoing training, decrease in pathological inner arch overload. Analysis of pressure center migration showed: preoperatively 702.89 vs 591.54 g/cm; postoperatively 1206.51 vs 978.02 g/cm, P = 0.009. Results of 10-m walk test were: 38.65 vs 63.12 sec preoperatively, 17 control patients.

Conclusion.– RRH training in the early recovery period after TJR of the lower extremities is a highly effective method of walk recovery.

http://dx.doi.org/10.1016/j.rehab.2014.03.032

CO21-003-e

SAM, an assistive robot for persons with quadriplegia: Usability study

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Keywords: Robotics; Tetraplegia; Usability; Acceptability

Objective.– To study the usability of the JACO robotic arm mounted on an automated mobile base across a population of 17 persons with quadriplegia vs 17 control patients.

Methods.– Usability parameters were assessed during 3 scenarios segmented into 5 steps, identifying the room, moving the robot, identifying the object, grasping the object, moving the robot back and dropping the object.

Results.– The mean success rate for each of the three scenarios varied between 98% to 100% for step 1 and 2 for both groups. Results were less consistent for step 3, 4 and 5, depending on the type of scenario. The number of user errors was predominant in the control group. The panoramic camera was almost systematically used during the 5 steps. The task of grasping object was deemed simple for all subjects included. In both groups, at least 75% of the subjects judged the robot relevant at home, for a daily use in order to reduce caregiver time or reassigning that time to other tasks.

Discussion.– This study showed a good level of acceptability and enables a targeted study on user indications.

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http://dx.doi.org/10.1016/j.rehab.2014.03.033

CO21-004-e

Retrospective analysis of upper limb motor recovery after prolonged robot-assisted training in subacute stroke

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Keywords: Hemiparesis; Upper limb; Subacute stroke; Prolonged robot-assisted training

Background.– High intensity of rehabilitation has been demonstrated to enhance motor recovery after stroke. The evolution of upper limb motor kinematics during prolonged robot-assisted training is yet to be determined.

Methods.– This retrospective study in 10 patients with subacute hemiparesis (age 48 ± 20; time since stroke 54 ± 16 days; stroke type 8 ischemic, 2 hemorrhagic; paresis side 5 L) analyzed hand kinematics recorded by the robot before onset and following 6, 12 and 18 weeks (W1, 6, 12, 18) of robot-assisted upper limb training. In addition, the Fugl–Meyer score (FM) and Motor Status Score (MMS) were assessed at W1, 6 and 12 in 8 patients.

Results.– While improvements in hand kinematics occurred only during the first third of the training period (W6; task success index, +97%, P = 0.024; trajectory RMS, –45%, P = 0.044; hand velocity, +335%, P = 0.0028; hand trajectory reversals, –38%, P = 0.034), motor impairment scores increased at W6 (FM, +48%, P = 0.018; MMS, +64%, P = 0.012) and W12 (vs W6, FM + 23%, P = 0.012; MSS, +30%, P = 0.017).

Conclusion.– This retrospective study suggests that prolonged robot-assisted training in subacute stroke is associated with continued reduction of motor impairment up to 12 weeks after treatment onset.

http://dx.doi.org/10.1016/j.rehab.2014.03.034

CO21-005-e

Walking robotic assistance: Assessment of the hip and knee range of motion among post-stroke patients

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Keywords: Gait; Stroke; Evaluation; Robotic assistance; Range of motion

Objective.– To study the ranges of motion developed during walking by post-stroke patients on an electromechanical gait trainer, the Lokohelp®

Method.– Ten patients were equipped with electronic goniometers. Data were collected at the 2nd minute (M2), the 5th minute (M5) and the 8th minute (M8).

Hip and knee extension and flexion on the paretic and the healthy sides were analyzed.

Results.– On the paretic side, insufficient joint extension was observed; only 37% of patients had a physiologic hip extension, 30% had normal knee extension, 23% had normal hip flexion. The amplitudes of the healthy side were more physiological, 57% of patients had hip extension within norms and 53% had normal knee extension. Knee recurvature was observed only on the healthy side. Reproducibility was good except for the healthy knee.

Discussion/conclusion.– These results can be explained by insufficient body weight support, lack of active participation by the patient (especially for the paretic side), uncontrolled pelvis movements and two characteristics of this device: the ankle immobilization in the orthoses and the fixed length step. Nevertheless, these results call into question the relationship between the efficacy of this kind of assistive walking devices and the ranges of motion actually induced.

http://dx.doi.org/10.1016/j.rehab.2014.03.035