Virtual Physiotherapist Based On A Haptic System For Training Of Reaching And Grasping

M. Mihelj [1], J. Podobnik [1], M. Munih [1]
1. Faculty of Electrical Engineering, University of Ljubljana,

Introduction:

Task-oriented repetitive movements can improve motor recovery in patients with neurological or orthopaedic lesions [1, 2]. HEnRiE (Haptic Environment for Reaching and Grasping Exercise) is a robot based haptic environment for simultaneous training of reaching and grasping movements. It consists of a robot with three active and two passive degrees of freedom and a grasping device with one degree of freedom. A training scenario that includes a virtual physiotherapist is introduced and presented are expected performance values for reaching and grasping movements.

Methods and Subjects:

A patient sits in front of a 3D screen and his hand is attached to the robot end-effector. A computer generated virtual physiotherapist (VPT) is shown on the screen and her hand virtually holds the patient's hand. The robot produces haptic and tactile feedback simulating forces produced by the VPT. Training scenarios resemble real therapy (passive movements, active resistance, disturbances, guidance). The VPT introduces a social component into the robot based rehabilitation, since VPT responds also in visual (gesture and mimics) and acoustic way (commands, encouraging statements).

Discussion:

The expected performance values are expressed as biomechanical and physiological reactions (speed of a movement, range of motion, force direction and magnitude, grasp and arm movement coordination precision of movement), cognitive behavior (coordination and accuracy, planning of movements), and psychological reactions (joy/relaxation when successfully accomplishing the task, annoyance when tasks are too difficult or challenging, enthusiasm when VPT gives praising and encouraging statements, stress/anger when the VPT is ignorant).

Conclusion:

HEnRiE allows training of complex reaching and grasping movements, while the VPT scenario provides a suitable platform for upper limb rehabilitation.

References:

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