Clinical use of Reo ™ Therapy System for the Rehabilitation of the Upper-Limb Motor Function after Stroke.

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Loss of arm function is one of the most devastating consequences of stroke, of traumatic brain injuries or of brain tumors and the affected limb may cause severe disability. In the USA around 700 000 people suffer from a Cerebro-Vascular Accident (CVA) and some 500 000 need therapy. Kinematic analysis shows that during the recovery process the initially fragmented movements become smoother and more coordinated. Training facilitates better coordination and accelerates functional recovery. However, upper extremity impairment yields to less functional improvement than lower extremity impairment during rehabilitation. Several investigators have addressed the challenges of upper limb rehabilitation with increased intensity of standard physical therapy (Lincoln et al. 1999), impairment oriented training (Platz et al. 2001), device-enhanced treatment (Feys et al. 1998), neuromuscular stimulation or “constrained induced movement therapy (Taub et al. 1993). Increasing evidence demonstrates that repetitive practice of movements has a profound effect on the recovery. Efforts toward developing robotic treatments are motivated by the increasing public health burden associated with stroke related disability, shorter inpatient rehabilitation and rising costs for the labor-intensive motor rehabilitation. Recent pilot and follow-up studies demonstrated beneficial effects of robot training on upper limb motor recovery (Volpe et al. 1999).
In this clinical study on 20 patients we used a robot-assisted movement training together with conventional physiotherapeutic techniques. The robot-assistance is provided by the Reo ™ Therapy System (Motorika Ltd. Caesarea, Israel), that interacts with the patient in real-timeand applies forces to the affected forearm during goal-directed movements. The Reo ™ Therapy System enables passive and active movements of the limb, which are carried out by a single spherical robotic guide. It incorporates sensors for accurate motion control of the robotic guide that also provide measures of patient performance. The robotic platform also incorporates a monitor, various fixtures, braces and harnesses. Software is used to manage interaction with the therapist and patient. The high level software also presents 3D-reaching tasks, skill tests and therapeutic games to the patient.

In this pilot study we wanted to quantify the presence and magnitude of therapeutic effects of the Reo ™ Therapy.
A double blinded, randomized controlled study in thirty (30) sub-acute stroke patients with a first ischemic stroke between 3 weeks and 3 months prior to study entry, and with a upper limb muscle strength grades between 2 to 4 on the Medical Research Council (MRC) motor

power scale. In addition to daily common physiotherapy and occupational therapy sessions patients received during 4 weeks of treatment 20 sessions of one hour each an upper extremity treatment with either the Reo Therapy System robotic device (group A) or an air splint therapy (group B) in two rehabilitation centers.

The exercises of 5 different tasks comprised: 1. reaching point to point (PtP) with flexion/extension of elbow in different horizontal planes 2. Reaching point to point (PtP) in various diagonal planes. 3. PtP in unaffected-affected-unaffected diagonal directions 4. Horizontal abduction reach (PtP). 5. Horizontal abduction/adduction reach (PtP).
The data evaluation was performed by a blinded researcher who did not know whether the patient received robotic therapy or air splint therapy.

The primary outcome measures were the blindly assessed Fugl-Meyer, Motor Power Score (MP), and the Motor status score for shoulder and elbow (MS-SE). As secondary endpoints we assessed the Action Research Arm Test (ARAT), the point-to-point (PtP) reach performance measured automatically by the Reo Therapy System, the Barthel Index, and the SF-12 version 2. Assessments were performed at baseline, one day after the 4 week training period and at follow up 3 months later. Adverse effects were continuously monitored.

Preliminary interim results and clinical observations are very promising. The final results of the study are currently still in progress and will be presented.

Literature

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