

Feasibility of a New Robot-Assisted Therapy for Neuromuscular Training of Sub-Acute Stroke Patients

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INTRODUCTION

Stroke is a condition for which there is no universally accepted treatment. Loss of arm function after a stroke is one of its most devastating effects, as the affected limb may cause severe disablement in daily life.

The development of robotic treatments is motivated by the increasing public health burden associated with stroke-related disability, and by the current emphasis on health care cost reductions, which have resulted in shorter length of stay for inpatient rehabilitation.

The purpose of this study was to conduct a preliminary assessment of patient acceptance of the 'Reo™ Therapy System', a robot-assisted therapy that was developed specifically for motor training of the upper extremity in post-stroke patients in inpatient rehabilitation centers and outpatient clinics (see Fig. 1).

METHODS

SUBJECTS

Ten sub-acute stroke patients aged 30–60 years (mean ± SE, 50.4 ± 10.1 years; one of them female, all but one right-handed) participated in the study. All gave written informed consent according to the Declaration of Helsinki, and the Beit Loewenstein Institutional Review Board approved the study protocol. Patients started the treatment about 7 weeks after stroke onset (7 ± 1.8 weeks). All patients had single ischaemic subcortical stroke leading to severe to moderate upper arm motor paresis (MRC grade 2-4) at the beginning of the study.

INTERVENTION

Patients received 45 minutes/day of robot-assisted treatment in addition to the standard daily physiotherapy and occupational therapy sessions. The treatment was administered 5 days a week for 3 weeks.

The robotic assistance device used in this study was the Reo™ Therapy System (Motorika Medical (Israel) Ltd., Israel). In this robot-assisted therapy a robot manipulator applies forces to the more affected forearm during goal-directed movements. During the treatment the patient's affected hand is placed on or strapped onto the robotic arm and the patient is instructed to either actively reach pre-defined reach points, or to be guided while the robotic arm leads his/her arm towards these reach points (see Fig. 2).

Fig.1: The Reo Therapy System



Fig.2: Examples of the Reo Therapy exercises used in the study

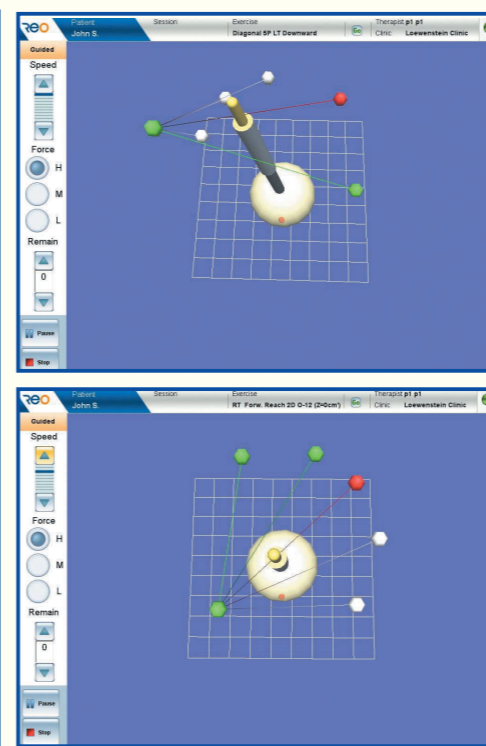
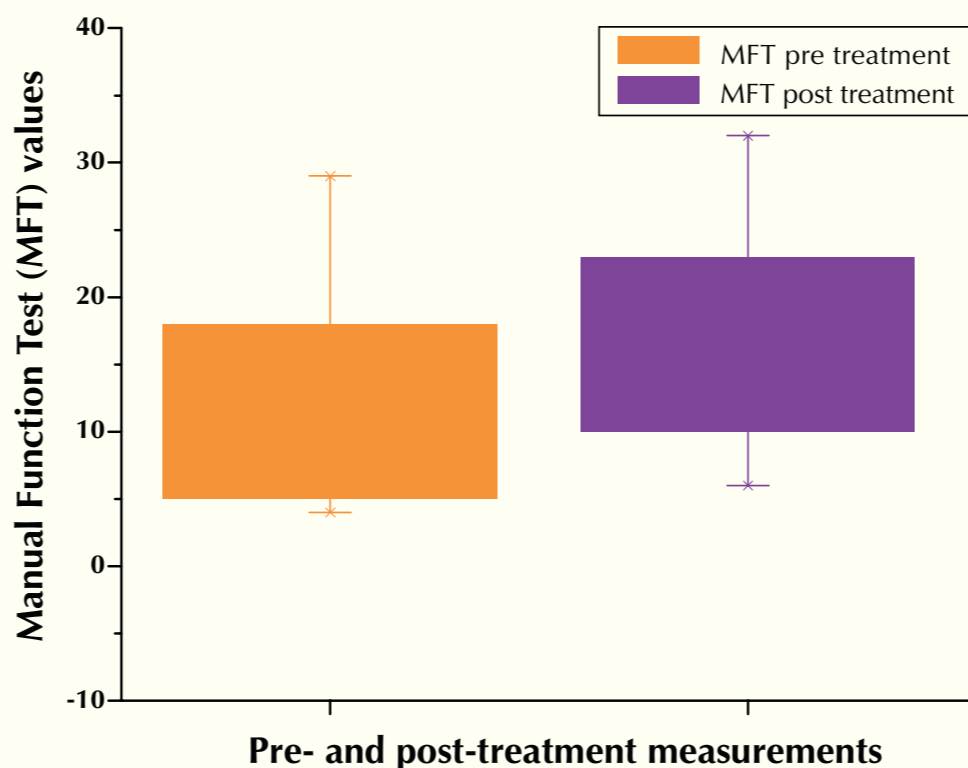


Fig.3: Manual Function Test (MFT) values



OUTCOME MEASURES

A feedback questionnaire, which measured the patients' satisfaction with the robot-assisted therapy, was administered after one week and three weeks of treatment. The feedback questionnaire included 15 items. It focused on the improvement in confidence in using the affected arm during and after robotic treatment, and on the increase in motivation to do the robotic treatment. Answer possibilities ranged from 1 for "Not agree at all", to 5 "Very much agree" (Max. value 75 points).

Arm functionality was assessed with the Manual Function Test at the beginning and end of treatment.

RESULTS

- Patient satisfaction with the robot-assisted therapy program and acceptance of working with Reo™ Therapy System increased significantly during the 3 weeks of the feasibility study period (see table 1).
- Patient compliance throughout the cycle of sessions was very good. All patients participated in all 15 sessions.
- No untoward effects were registered, and no patients reported pain or discomfort at any stage.
- Arm functionality as measured with the Manual Function Test (MFT) increased significantly after 15 sessions of working with the Reo™ Therapy System (see table 1 and Fig 3).

Table 1: Results of acceptance feedback questionnaire and MFT

	Mean values		P values
	After 1 week of treatment	At the end of 3 weeks of treatment	
Acceptance of Reo™ Therapy System Feedback Questionnaire (max. value = 75)	54	65	0.006*
	Pre-treatment	post-treatment	
Manual Function Test (proximal part only)	8.2	10.3	0.1
Manual Function Test (distal part only)	5.0	8.7	0.005*
Manual Function Test (overall)	13.2	19.0	0.002*

*sig.

CONCLUSION

In this feasibility study we demonstrated that the positive attitude of stroke patients toward robotic treatment increased during the treatment period. The Reo™ Therapy System was found to be valued by patients. This positive patient response led to excellent compliance, which led to the achievement of a high number of repetitions of functional movements per session. Moreover, and even though evaluating improvement of upper extremity motor functions was not the primary goal of this study, the results of the MFT clearly suggest that motor functionality was improved by robot-assisted upper arm therapy.

Further research is necessary in order to identify the most efficient balance of Reo Therapy and traditional therapy methods.