Effectiveness of Occupational Therapy Robotic Training Program in improving hemiplegic upper limb function for stroke patients in UCH: A Randomised Controlled Trial

Andy Chan(1), Peggy Hui (1), Maurice Wan (1), Dr. Cheung Ka Yin (2), Dr. Ng Ping Wing (2)
Occupational Therapy Department (2) Department of Medicine and Geriatrics, United Christian Hospital

Stroke is a leading cause of death and a major source of disability in Hong Kong and worldwide (Ng PW,2007)

The persistence of upper limb (UL) weakness after stroke has led to the development of novel rehabilitation techniques to improve functional motor recovery (Rabadi, 2008)

Andy Chan
Occupational Therapist I
United Christian Hospital

Robotic therapy timeline

~1990-2000

Theory

Intensive and repetitive task specific active upper limb treatment is one of the most effective approaches to restore arm and hand function

Treatment Interventions for the Paretic Upper Limb of Stroke Survivors: A Critical Review

Susan Barreca, Steven L. Wolf, Susan Fasoli, and Richard Bohannon

~2000-

Robotic

In recent years, new Robotic-assisted training strategies
to improve arm function have been developed for patients after stroke.

- the Mirror Image Motion Enabler, MIME (Burgar 2000);
- the InMotion robot (Massachusets Institute of Technology, MIT-Manus) (Krebs 1998);
- the Assisted Rehabilitation and Measurement (ARM) Guide (Reinkensmeyer 2000b);
- the Robotic Rehabilitation System for upper limb motion therapy for the disabled, REHAROB (Fazekas 2007);
- the Neuro-Rehabilitation-Robot, NeReBot (Fazekas 2007);
- the Bi-Manu-Track (Hesse 2003);
- the robot-mediated therapy system, GENTLE/S (Coote 2003); and
- the Arm robot, ARMin (Riener 2005).

2006 -

Systematic reviews

Systematic reviews and meta-analysis support robotic therapy improving motor control of the hemiplegic upper limb functions but no significant difference with conventional treatment

JRRD Journal of Rehabilitation Research & Development

Systematic review of the effect of robot-aided therapy on recovery of the hemiparetic arm after stroke

Gerdienke B. Prange, MSc;[1*] Michiel J. A. Jannink, PhD;[1] Catharina G. M. Groothuis-Oudshoorn, PhD;[1] Hermie J. Hermens, PhD;[1,2] Maarten J. IJzerman, PhD, PT[1,3]

[1]Roessingh Research and Development, Enschede, the Netherlands; [2]Department of Biosignals and Systems, University of Twente, Enschede, the Netherlands; [3]Biomedical Technological Institute, University of Twente, Enschede, the Netherlands

Electromechanical and robot-assisted arm training for improving generic activities of daily living, arm function, and arm muscle strength after stroke (Review)

Mehrholz J, Hädrich A, Platz T, Kugler J, Pohl M

~2010 -

In HK…

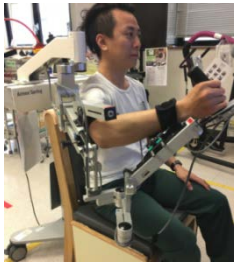
HA hospitals started to apply robotic therapy for stroke rehabilitation

2015 -17

Applied in UCH

Collaboration study by OT dept and M&G dept

ArmeoSpring



Self-initiated repetitive arm and hand therapy in an extensive 3D workspace.

Study Process

Objectives

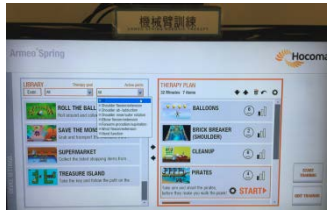
To compare the effectiveness of the Robotic Training Program with conventional OT upper limb training on acute and sub-acute stroke upper limb rehabilitation.

Pre-assessment

Outcome evaluation includes muscle tone (Modified Ashworth Scale), active range of motion, functional upper limb assessment (Fugl Meyer assessment, Functional Test of Hemiplegic Upper Limb) and hand grip

Post assessment

Outcome evaluation includes muscle tone (Modified Ashworth Scale), active and passive range of motion, functional upper limb assessment (Fugl Meyer assessment, Functional Test of Hemiplegic Upper Limb) and hand grip



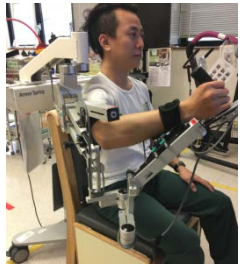
1 2 3 4

Cases recruitment 15-17

48 newly diagnosed acute and sub-acute stroke cases recruited and randomly allocated into Robotic training program (RTP) and conventional training program (CTP)

Training

For RTP, subjects received 10-session of 1 hour robotic therapy training. These subjects did not receive any other OT UL interventions within the study period. For CTP, subjects received the same duration of conventional training (eg. repetitive, task specific training and neurofacilitation techniques).



Study Results

A total of 48 cases acute and sub-acute stroke patients were recruited in the study. Data was analyzed by SPSS.

	RTP (N=24) Mean	CTP (N=24) Mean	RTP vs CTP
Age	59.83 (9.187)	64.71 (13.080)	p=0.142
AROM shoulder flexion	86.88 → 125.00 (p<0.01)	95.21 → 125.42 (p<0.01)	p=0.289
AROM shoulder abduction	79.17 → 103.75 (p<0.01)	82.08 → 106.88 (p<0.01)	p=0.974
AROM elbow flexion & extension	85.63 → 115.63 (p<0.01)	97.71 → 117.29 (p<0.01)	p=0.102
AROM pronation	30.00 → 52.29 (p<0.01)	45.83 → 55.63 (p<0.01)	p=0.029
AROM supination	40.50 → 66.46 (p<0.01)	57.08 → 69.58 (p=0.013)	p=0.056
Fugl-Meyer assessment: UL score	20.08 → 29.00 (p<0.01)	22.38 → 30.63 (p<0.01)	p=0.678
Fugl-Meyer assessment: Hand score	10.17 → 17.71 (p<0.01)	10.54 → 19.92 (p<0.01)	p=0.270
Fugl-Meyer assessment: Total score	30.25 → 46.71 (p<0.01)	32.92 → 50.54 (p<0.01)	p=0.799
Hand grip (kgf)	4.79 → 7.83 (p<0.01)	4.38 → 9.08 (p<0.01)	p=0.131
Functional Test of Hemiparetic Upper Extremity (level)	Z=-3.789 (p<0.01)	Z=-4.054 (p<0.01)	p=0.069
Modified Ashworth Scale	Z=-1.732 (p=0.83)	Z=0.000 (p=1)	p=0.179



Conclusion, Implication & Future

- both the robotic therapy and conventional OT UL intervention did significantly improve in post stroke upper limb rehabilitation individually

- similar in previous literatures, there is no superiority or inferiority when comparing RTP to CTP in outcome measures.

✓ Clinically, robotic therapy provides safe and intensive evidence-based rehabilitation with less supervision from a therapist, it can deliver cost-effective care in local hospital settings with limited therapists' manpower

➢ Combined robotic therapy with conventional OT UL interventions with larger sample size in different hospitals and settings will provide more insight for clinical utilization of robotic therapy

ALONE, WE CAN
DO SO LITTLE.
TOGETHER,
WE CAN
DO SO MUCH.

Thank you!