

## Effects of robot-assisted therapy on upper-limb function of acute stroke patients

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### Abstract

**BACKGROUND:** Recently studies showed that robot-assisted therapy can improve recovery of upper-limb in subacute and chronic stroke patients, but the studies on robot-assisted therapy in acute stroke patients are few.

**OBJECTIVE:** To study the effects of robot-assisted therapy on upper-limb in acute stroke patients.

**METHODS:** A total of 30 acute stroke patients were divided into two groups according to the wish. The patients in conventional therapy group received a conventional rehabilitative program including usual facilitation techniques, neuromuscular electrical stimulation, acupuncture therapy and so on. The patients in robot-assisted therapy group received robot-assisted therapy on the basis of conventional rehabilitative program. This kind of robot consists of adaptive upper-limb weight support, intelligence feedback and three-dimension training systems. A single or multiple joint training can be carried out in the virtual reality environment.

**RESULTS AND CONCLUSION:** ①After treatment Fugl-Meyer Score of the upper extremity assessment (FMA) and the functional independence measure (FIM) were better than the scores before treatment both in the two groups significantly. ②At 3 weeks after treatment, there was no statistical difference in the FMA Scores in the two groups ( $P=0.075$ ), but at 3 months the patients in robot-assisted therapy group gained better scores than conventional therapy group significantly ( $P < 0.01$ ). ③The differences were not significant in the FIM Scores between the two groups both at 3 weeks or 3 months after treatment ( $P > 0.05$ ). ④The changes of scores both on FMA and FIM compared with before treatment in robot-assisted therapy group were better than conventional therapy group statistically ( $P < 0.05$ ). It could be concluded that robot-assisted therapy gained better motor function of upper limb in acute stroke patients on the basis of conventional therapy. Robot-assisted therapy also could change much more motor function and activities of daily living.

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### Tables and figures



Figure 1 A patient undergoing robot-assisted therapy

Table 1 Baseline characteristics of the patients (n=15)

Item	Robot-assisted therapy group	Conventional therapy group	P
Sex (Female/male)	7/8	6/9	0.713
Age ( $\bar{x}\pm s$ , yr)	61.67 $\pm$ 11.72	59.73 $\pm$ 12.30	0.663
Time after stroke ( $\bar{x}\pm s$ , d)	15 $\pm$ 7	15 $\pm$ 6	0.660
Comorbidity (n)			
Hypertension	15	13	
Diabetes	5	4	
Coronary heart disease	3	5	
Hyperlipemia	14	12	
COPD	2	1	
Score on FMA ( $\bar{x}\pm s$ )	28.87 $\pm$ 6.71	27.73 $\pm$ 6.89	0.652
Score on FIM ( $\bar{x}\pm s$ )	38.13 $\pm$ 15.18	38.87 $\pm$ 15.99	0.898

COPD: chronic obstructive pulmonary disease; FMA: Fugl-Meyer score of the upper extremity assessment; FIM: functional independence measure

Table 2 Scores on FMA and FIM at 3 wk and 3 mon after treatment ( $\bar{x}\pm s$ ,  $n=15$ )

Time	Robot-assisted therapy group	Conventional therapy group	P
FMA at 3 wk	38.20±11.48	31.40±8.41	0.075
FMA at 3 mon	47.53±10.65	34.73±8.14	0.001
FIM at 3 wk	63.27±18.18	58.33±17.43	0.454
FIM at 3 mon	83.80±19.73	72.73±18.14	0.121

FMA: Fugl-Meyer score of the upper extremity assessment; FIM: functional independence measure

Table 3 Changes in scores on FMA and FIM at 3 wk and 3 mon after treatment compared with scores before treatment ( $\bar{x}\pm s$ ,  $n=15$ )

Time	Robot-assisted therapy group	Conventional therapy group	P
△FMA at 3 wk	9.33±5.19	3.67±2.35	0.001
△FMA at 3 mon	18.67±6.02	7.00±2.70	0.001
△FIM at 3 wk	25.13±7.13	19.47±6.55	0.031
△FIM at 3 mon	45.67±10.91	33.87±10.78	0.006

△FMA: changes in scores on FMA; △FIM: changes in scores on FIM; FMA: Fugl-Meyer score of the upper extremity assessment; FIM: functional independence measure

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