Application of lower limb exoskeletons rehabilitation robots in rehabilitation treatment of activity limited knee joint

Wan Da-qian[1], Xu Yi-ming[1], Bai Yue-hong[1], Yin Yue-hong[2]

Abstract

BACKGROUND: Limb exoskeletons rehabilitation robots can stimulate the natural resilience of body through simulated human movement to achieve tissue compensation based on its theoretical basis of continued combined active and passive activities.

OBJECTIVE: To dynamically observe and realize the rehabilitation effect of limb exoskeletons rehabilitation robots on functional exercise of patients with activity limited knee joint.

METHODS: Twenty early postoperative patients with activity limited knee joint were divided into experiment group and control group randomly. The functional exercise with limb exoskeletons rehabilitation robots was performed in the experiment group. The control group underwent functional exercise with passive training devices CPM. Psychological guide, low-frequency pulse electrotherapy and infrared physiotherapy were performed in both groups during the treatment.

RESULTS AND CONCLUSION: The active degree of retroflexion and protrusive movement of knee joint in all cases was improved. The muscle strength of the quadriceps femoris in experiment group was significantly improved after treatment ($P < 0.01$). The active degree of retroflexion and protrusive movement of knee joint in experiment group was further improved after 2 months follow-up treatment ($P < 0.01$). The indexes above did not change in control group. The results showed that the application of limb exoskeletons rehabilitation robots or passive training devices CPM combined with psychological guide, low-frequency pulse electrotherapy and infrared physiotherapy both could significantly improve the active degree of retroflexion and protrusive movement of knee joint in patients with activity limited knee joint, at the same time, the limb exoskeletons rehabilitation robots could recover the muscle strength of the quadriceps femoris.

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[1]Department of Rehabilitation Medicine, the Sixth People's Hospital Affiliated to Shanghai Jiao Tong University, Shanghai 200233, China; [2]the Human Centered Robotics & Automation, Shanghai Jiao Tong University, Shanghai 200233, China

Wan Da-qian★, Studying for master's degree, Department of Rehabilitation Medicine, the Sixth People's Hospital Affiliated to Shanghai Jiao Tong University, Shanghai 200233, China
wdqwdq1986@126.com

Correspondence to: Bai Yue-hong, Chief physician, Department of Rehabilitation Medicine, the Sixth People's Hospital Affiliated to Shanghai Jiao Tong University, Shanghai 200233, China
aibyhw@126.com

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Tables and figures

Table 1 Comparison of baseline information of experiment and control groups

Group	Male/Female	Age (yr)
Experiment	7/4	24−70
Control	6/3	28−69

Table 2 Changes of knee activity degree of both groups 2 mon after treatment ($x \pm s$, n=10, °)

Group	Retroflexion		*P*
	Before treatment	After treatment	
Experiment	31.57±19.96	102.17±25.81	< 0.01
Control	31.25±19.42	99.23±22.33	< 0.01
P	> 0.05	> 0.05	

Group	Protrusive movement		*P*
	Before treatment	After treatment	
Experiment	−5.17±5.33	0.00±0.13	< 0.01
Control	−5.22±5.62	0.00±0.18	< 0.01
P	> 0.05	> 0.05	

Table 3 The improvement of muscle strength of the quadriceps femoris in both groups 2 mon after treatment ($\bar{x}\pm s$)

Peak torque	Experiment group		*P*	Control group		*P*
	Before treatment	After treatment		Before treatment	After treatment	
60°	52±24	88±22	< 0.01	51±24	40±20	> 0.05
120°	46±16	67±25	< 0.01	47±15	39±16	> 0.05
180°	33±15	58±18	< 0.01	33±14	20±9	> 0.05

Ten cases had atrophy of quadriceps femoris in the control group and one in the experiment group, and the difference was significant ($P < 0.05$). The muscle strength recovery of the quadriceps femoris in the experiment group was better than that in the control group

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