

뇌신경재활

발표일시 및 장소: 10 월 18 일(금) 15:05-15:15 Room B(5F)

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Effects of training with an exoskeleton type robot on walking ability for chronic stroke patients

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OBJECTIVE

To investigate the effects of SUBAR[®]-assisted gait training for patients with chronic stroke.

METHODS

Design: This study was a single-blinded, prospective, randomized controlled trial that compared the effects of SUBAR[®]-assisted gait training with those of conventional physiotherapy.

Patients: We enrolled 30 patients from November 2018 to May 2019 at the Asan Medical Center. Inclusion criteria were as follow: age \geq 18 years old; the diagnosis of a stroke (either ischemic or hemorrhagic, confirmed by brain computed tomography or magnetic resonance imaging); after 6 months of onset; previously an independent walker, Functional Ambulatory Category score \geq 3; the ability to participate in SUBAR[®]-assisted gait training. Patients were excluded if they met any of the following criteria: severe cognitive disorder or aphasia that impeded communication; body weight \geq 100 kg; height $<$ 150 cm; severe medical disease affecting the gait; severe neurologic and musculoskeletal disease affecting the gait; other disabilities affecting the gait training.

Intervention: The patients were randomly assigned to one of two groups: 30 minutes of training with SUBAR[®] which is exoskeleton-typed robot (SUBAR[®] group; n = 15); or 30 minutes of conventional physiotherapy (control group; n = 15). All received 10 times treatment for three weeks.

Outcome measurements: The primary outcomes were walking ability, assessed using the Functional Ambulation Category scale(FAC), and lower limb function, assessed using the Motricity Index-Lower(MI), Modified Ashworth Scale(MAS), 10 Meter Walk Test(10MWT), Timed Up and Go(TUG), Rivermead Mobility Index(RMI), and Berg Balance Scale scores(BBS). Secondary outcomes were a gait analysis using the Optogait[®]. A gait analysis included step length, stride length, single support, double support, cadence, and gait speed. All patients were evaluated before and after 10 times rehabilitations.

RESULTS

We analyzed 30 patients and there were no lost of follow-up. In SUBAR[®] group, two patients finished nine times treatment. In SUBAR[®] group, MAS and step length are significantly improved after treatments. And SUBAR group showed greater improvement

in stride length, but not significantly (Table 2). In control group, there are significant improved after treatments in BBS, MAS and stride length (Table 2). In step length of the affected limb, the SUBAR[®] group showed greater improvement than the control group, but not differ significantly. BBS improved more in control group than the SUBAR[®] group. And there are no differences in other measurements between two groups (Table 3).

CONCLUSION

Our results suggest that SUBAR[®]-assisted gait training has a similar effect as conventional therapy. Step length is more improved with SUBAR[®]-assisted gait training compared with conventional physiotherapy in stroke patients. Between two groups, there are similar improvements in 10MWT, TUG, MAS, MI, RMI and gait analysis except BBS.

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Table 1. Baseline characteristics

	SUBAR [®] (n=15)	Control (n=15)
Age (years)	64.3 ± 4.6	62.9 ± 6.0
Height (cm)	161.2 ± 7.5	159.8 ± 8.0
Weight (kg)	68.5 ± 10.9	64.9 ± 9.9
Gender (n)		
Male	10	8
Female	5	7
Etiology		
Infarction	7	9
Hemorrhage	8	6
Duration from onset (Months)	168.3 ± 67.3	142.6 ± 59.2
Affected side		
Right	10	6
Left	5	9

Values are presented as mean ± SD or number.

Table 2. Between SUBAR® and Control groups before and after treatment programs

	SUBAR® (n = 15)			Control (n = 15)			
	Pre	Post	p-value*	Pre	Post	p-value*	
FAC	4.4 ± 0.5	4.4 ± 0.5	1.00	4.7 ± 0.7	4.7 ± 0.7	1.00	
10MWT (SSV) (m/s)	9.4 ± 4.9	9.2 ± 5.7	.609	9.1 ± 2.5	8.3 ± 2.8	.173	
10MWT (FV) (m/s)	7.8 ± 4.0	7.6 ± 4.9	.256	7.0 ± 2.2	6.7 ± 2.6	.609	
TUG (sec)	17.1 ± 6.9	17.3 ± 9.7	.532	17.3 ± 4.9	15.1 ± 4.3	.065	
BBS	48.3 ± 2.7	48.5 ± 2.8	.599	47.3 ± 4.9	50.8 ± 2.5	.004	
MAS	3.1 ± 2.1	2.0 ± 1.1	.019	2.2 ± 2.0	1.4 ± 1.4	.031	
MI	49.0 ± 7.5	48.8 ± 7.4	.859	50.1 ± 9.5	54.7 ± 6.6	.114	
RMI	11.2 ± 0.4	11.3 ± 0.4	.317	11.1 ± 0.5	11.2 ± 0.6	.317	
Gait analysis	Step Length (cm)	42.0 ± 7.7	47.4 ± 10.6	.016	43.6 ± 9.8	44.9 ± 12.1	.379
	Stride Length (cm)	82.6 ± 15.0	87.7 ± 15.1	.088	80.8 ± 16.2	87.2 ± 19.6	.035
	Single support (%)	31.5 ± 10.0	31.4 ± 9.2	.900	28.1 ± 6.1	31.2 ± 6.5	.140
	Double Support (%)	33.4 ± 8.7	32.5 ± 6.1	.363	38.3 ± 9.9	33.5 ± 6.4	.065
	Cadence (step/min)	103.0 ± 18.4	107.1 ± 27.9	.363	97.6 ± 19.8	101.1 ± 15.8	.256
	Speed (m/s)	0.7 ± 0.2	0.8 ± 0.2	.396	0.7 ± 0.3	0.8 ± 0.3	.061

Values are presented as mean ± SD.

FAC, Functional Ambulation Category; 10MWT, 10 Meter Walking Test; TUG, Timed Up and Go; BBS, Berg Balance Scale; MAS, Modified Ashworth Scale; MI, Motricity Index; RMI, Rivermead Mobility Index.
* p-value were calculated using Wilcoxon signed rank test, for pretreatment versus posttreatment

Table 3. Differences between SUBAR® and Control groups

	SUBAR®	Control	p-value*	
ΔFAC	0	0	1.00	
Δ10MWT (SSV)	-0.2 ± 1.4	-0.9 ± 2.1	.486	
Δ10MWT (FV)	-0.1 ± 1.2	-0.3 ± 1.5	.775	
ΔTUG	0.2 ± 3.2	-2.1 ± 3.9	.250	
ΔBBS	0.1 ± 1.3	3.5 ± 4.6	.004	
ΔMAS	-1.1 ± 1.6	-0.8 ± 1.5	.436	
ΔMI	-0.1 ± 6.5	4.6 ± 9.4	.187	
ΔRMI	0.1 ± 0.3	0.1 ± 0.3	1.00	
Gait analysis	ΔStep Length	5.5 ± 7.6	1.3 ± 8.0	.098
	ΔStride Length	5.1 ± 10.7	6.5 ± 9.5	.595
	ΔSingle support	-0.1 ± 7.6	3.1 ± 7.1	.285
	ΔDouble Support	-0.9 ± 7.7	-4.8 ± 9.4	.412
	ΔCadence	4.1 ± 17.2	3.5 ± 13.1	.653
	ΔSpeed	0.04 ± 0.2	0.07 ± 0.1	1.00

Values are presented as mean ± SD.

FAC, Functional Ambulation Category; 10MWT, 10 Meter Walking Test; TUG, Timed Up and Go; BBS, Berg Balance Scale; MAS, Modified Ashworth Scale; MI, Motricity Index; RMI, Rivermead Mobility Index.

Δ = Difference of "posttreatment - pretreatment."

* p-value were calculated using Mann-Whitney test, for the difference of the SUBAR group versus control group.