

## The Effects of End-Effector Type Robot-Assisted Gait Training in Ataxia Patient with Brain Lesion

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### OBJECTIVE

Robot-assisted gait training has been in the spotlight and its effectiveness of regaining ability to walk has been proven in patients with traumatic brain injury, stroke and spinal cord injury. Ataxia, caused by stroke or meningoencephalitis, lowers the balance of body and induces gait disturbance. The aim of study is to investigate the improvements of gait and balance in patients with ataxia caused by brain lesion after the end-effector type (Morning Walk<sup>®</sup>) robot-assisted gait training.

### METHODS

Among the patients who admitted in rehabilitation department, patients with ataxia caused by brain lesion, such as infarction, hemorrhagic stroke, or meningoencephalitis, within the preceding year were included. Subjects were randomly assigned to two groups: 30 min of Morning Walk<sup>®</sup> training with 1 hr of conventional physiotherapy; or 1.5 hr of conventional physiotherapy for 3 weeks. Primary outcomes of walking ability and balance were assessed using Functional Ambulatory Category (FAC) and Berg balance scale (BBS). 10m Walk Test (10mWT), Rivermead Mobility Index (RMI), Motricity Index (MI) and Modified Barthel Index (MBI) were used for measurements of secondary outcomes.

### RESULTS

At baseline, there was no statistically significant difference between two groups except for MBI (Table 1, 2). After 3 weeks of treatment, Morning Walk<sup>®</sup> group showed statistically significant improvements of FAC, 10mWT, MBI, RMI and BBS. Control group showed statistically significant improvements of MBI, MI, BBS. Inter-group comparison of changes of outcome measures demonstrated that  $\Delta$ FAC and  $\Delta$ RMI of Morning Walk<sup>®</sup> group were higher than control group with statistical significance ( $\Delta$ FAC<sub>case</sub>=1.88±0.35,  $\Delta$ FAC<sub>control</sub>=0.57±0.30, p-value=0.029,  $\Delta$ RMI<sub>case</sub>=3.50±0.50,  $\Delta$ RMI<sub>control</sub>=2.00±0.38, p-value=0.040). Notably however, a higher degree improvement of  $\Delta$ BBS was observed in Morning Walk<sup>®</sup> group without statistical significance (Table 2).

### CONCLUSIONS

In the aspects of gait function of ataxia patients, End-effector type (Morning Walk<sup>®</sup>) robot-assisted gait training group demonstrated more significant improvements than conventional physiotherapy alone group.

**Table 1 Baseline characteristics of case and control group**

	Morning Walk <sup>®</sup> group (N=8)	Control group (N=7)	<i>p</i> -value
Age (years)	62.1±5.5	66.3±3.1	0.613 <sup>b</sup>
Sex (female : male)	4 : 4	3 : 4	1.000 <sup>a</sup>
Weight (kg)	62.8±3.5	60.0±5.2	0.613 <sup>b</sup>
Height (cm)	162.3±2.1	163.2±4.5	0.867 <sup>b</sup>
Time from onset to enrollment (months)	3.4±2.6	2.6±1.8	0.955 <sup>b</sup>
Etiology			
Hemorrhage	1	1	1.000 <sup>a</sup>
Infarction	6	6	
Infection	1		

<sup>a</sup> Analysis was done by Fisher's exact test.

<sup>b</sup> Analysis was done by Mann-Whitney test.

**Table 2 Outcome measurements of case and control groups, at baseline, post- treatment and changes ( $\Delta$ Post-Pre) after treatment**

	Morning Walk <sup>®</sup> group (N=8)			Control group(N=7)			<i>p</i> -value <sup>a</sup>
	Pre-treatment	Post-treatment	$\Delta$ Post-Pre	Pre-treatment	Post-treatment	$\Delta$ Post-Pre	
FAC	2.88±0.30	4.75±0.53*	1.88±0.35	2.29±0.29	2.86±0.55	0.57±0.30	0.029
BBS	30.38±6.19	43.5±6.31*	13.13±3.70	20.29±5.00	26.1±6.41*	5.85±1.77	0.152
10mWT	17.57±4.34	9.71±3.80*	7.87±2.03	25.00±4.91	18.44±4.74	6.56±1.25	0.927
RMI	6.75±1.00	10.25±1.10*	3.50±0.50	4.43±0.92	6.43±1.19	2.00±0.38	0.040
MI	79.00±3.00	87.00±4.25	8.00±4.00	78.57±3.67	88.57±4.57*	10.00±4.72	0.867
MBI <sup>b</sup>	67.75±8.67	88.13±6.56*	20.38±6.92	43.14±8.01	59.14±8.75*	16.00±5.06	0.779

Values are expressed as Mean  $\pm$  SD.

*FAC*, Functional Ambulatory Category, *BBS*, Berg Balance Scale, *10mWT*, 10m Walk Test, *RMI*, Rivermead Mobility Index, *MI*, Motricity Index (Lower extremity, severe side), *MBI*, Modified Barthel Index,

<sup>a</sup>  $\Delta$ Post-Pre values between two groups were analyzed by Mann-Whitney test. *p* –value < 0.05 was considered as statistically significant.

<sup>b</sup> At baseline (pre-treatment), there were no variables showing statistically significant differences other than MBI. Baseline comparison of inter-group was done by Mann-Whitney test.

\* Treatment effects of each group were evaluated by Wilcoxon signed rank test. Statistically significant changes between pre- and post- treatment were indicated in post-treatment column; \* *p* –value < 0.05