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Effects of Robot-assisted Gait Training (RAGT) in Patients Focused on Body Composition and Balance : Case Series

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Introduction

- Sarcopenia is a syndrome characterized by reduction of muscle mass, low muscle strength and low physical performance.
- Improvement of sarcopenia is associated with functional and discharge outcomes in patients with brain injury.
- RAGT (Morning Walk®) is an end-effector type robot which is used for lower limb rehabilitation.
  - ✓ End-effector type robot requires more patient participation than the exoskeletal type robot.
  - ✓ Patient uses more lower extremity muscle strength.
- This case study aims to show the change of body composition and improvement of balance function after RAGT using Dual energy X ray absorptiometry (DEXA) and functional evaluation.

Figure 1. End-effector Type Robot (Morning Walk®)-assisted Gait Training (RAGT)

Methods

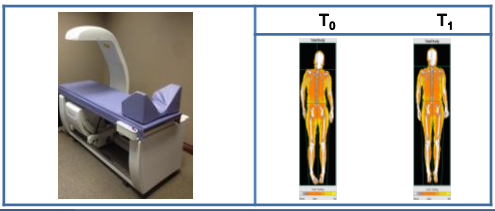
Study Participants

- This is case series report on patients (2 stroke patients, 1 tumor patient) who performed RAGT treatment with conventional physical therapy.
- Each patients underwent RAGT for 30 minutes per session in combination with 1 hour of conventional physiotherapy included core strengthening exercises and dynamic sitting/standing balance training.

Measurement Method

- Clinical assessments were conducted at baseline (within 1 week of admission) and at the time of discharge.
- Functional outcomes were assessed using scores of Berg Balance Scale (BBS), Rivermead Mobility Index (RMI), Trunk Instability Scale (TIS), and Functional Ambulation Category (FAC).
- Body composition change was measured using DEXA.
- Appendicular lean mass (ALM) was defined as the sum of the muscle mass of the 4 limbs and ALM was adjusted using height squared (ALM/Ht^2, Appendicular Lean Mass/Height^2).

Figure 2. Representative Data of Body Composition Change Before (T_0) and After (T_1) the Treatment Using Dual-energy X-ray Absorptiometry



Case Reports

- Patients characteristics at baseline were reported in **Table 1.**
- The balance assessment were presented in **Table 2** and outcomes revealed that BBS and RMI scores were improved at the end of RAGT.
- Total ALM scores and muscle of lower limb were increased after receiving RAGT rehabilitation (**Table 3**).
- Satisfaction survey results were reported in **Table 4**.

Table 1. Baseline Characteristics

	Patient A	Patient B	Patient C
Age (yr)	45	59	67
Sex	Female	Female	Female
Diagnosis	Basal ganglia intracranial hemorrhage, left	Subarachnoid hemorrhage	Temporal meningioma, left
From onset (month)	4	2	5
The number of RAGT	8	26	12

Table 2. Changes in the Balance Assessment Factors Before (T_0) and After (T_1) the Treatment

	Patient A		Patient B		Patient C	
	T_0	T_1	T_0	T_1	T_0	T_1
FAC	1	2	2	2	1	1
BBS	31	40	9	40	15	29
RMI	6	7	3	7	4	6
TIS	17	17	12	15	8	10

T_0, Pre-RAGT rehabilitation; T_1, Post-RAGT rehabilitation; FAC, Functional ambulation scale; BBS, Berg balance scale; RMI, Rivermead Mobility Index; TIS, Trunk Instability Scale.

Table 3. Body Composition Change Before (T_0) and After (T_1) the Treatment Using Dual-energy X-ray Absorptiometry

	Patient A			Patient B			Patient C		
	T_0	T_1		T_0	T_1		T_0	T1	
ALM/Ht^2 (kg/m^2)	6.35	7.19		4.4	4.83		3.29	3.83	
Δ ALM/Ht^2 (%)	**113 %**			**110 %**			**116 %**		
Lean mass of legs (g)	12,443	13,265		8,922	9,791		11,408	12,040	
Δ Lean mass of legs (%)	**107 %**			**110 %**			**106 %**		
Lean mass of trunk (g)	19,169	19,662		15,693	17,405		18,843	17,916	
Δ Lean mass of trunk (%)	103 %			111 %			95 %		

T_0, Pre-RAGT rehabilitation; T_1, Post-RAGT rehabilitation; ALM/Ht^2, appendicular lean mass/height^2.
Δ ALM/Ht^2 (%) : T_1/T_0 *100; Δ Lean mass of legs (%) : T_1/T_0 *100; Δ Lean mass of trunk (%) : T_1/T_0 *1000

Table 4. Survey Results on RAGT Treatment

Category	Subcategory	Patient A	Patient B
Efficacy	(1) Treatment preparations	65 %	80 %
	(2) Informativeness	35 %	65 %
	(3) Learnability	45 %	80 %
	Total	48 %	75 %
Satisfaction	(1) Psychological stability	62 %	97 %
	(2) Reliability	47 %	93 %
	Total	53 %	91 %
Safety	(1) Physical fitness	80 %	90 %
	(2) Device stability	90 %	94 %
	Total	86 %	93 %

Conclusion

- RAGT treatment with conventional physiotherapy improved body muscle mass in patients with brain injury. Also, all patients showed improvement body balance, especially in BBS score.
- RAGT rehabilitation can be an effective treatment for patients with brain injury.
- In the further study, a larger number of patients with control groups would be conducted to show RAGT treatment with conventional therapy effectiveness in terms of body lean mass and body balance.