

Feasibility of Robot-assisted Gait Training with End-effector Type in Children with Cerebral palsy

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Introduction

One of the most disabling mobility problems in CP is gait impairment, clinically characterized by reduced speed and endurance, as well as reduced step, stride length, and toe clearance during gait. Robotic-assisted gait training (RAGT) has become an increasingly common rehabilitation tool over the last decade to improve the gait pattern of people with neurological impairment. While there is a growing body of evidence on the effectiveness of RAGT in adults, evidence for pediatric population is not so clear. There are two main categories of automated gait machines: exoskeletons and end-effectors. Morning Walk[®] is the only end-effector commercially available in Korea. It has two foot plates that simulate locomotor activity with saddle support for body weight. The purpose of this study is to investigate the feasibility of Morning Walk[®] in Children with Cerebral palsy.

Materials and Methods

This study is fulfilled from April 2014 to May 2018. Children under 120 cm of height and over 120 kg of weight were excluded considering specification of the device. Two sizes of saddles were applied according to the heights of the patients. RAGT was done for 30 minutes per each session and 1 or 2 times per week. Completed therapy consisted of 24 consecutive sessions. If weight support greater than 70% and ground reaction force less than 20% of the body weight remained unchanged, the patient was excluded from RAGT. A session of RAGT was stopped in the following cases: 1) if an experienced therapist judged there would be a potential musculoskeletal injury; 2) if there was a request to stop from the patient; or 3) if the patient was not cooperative to the treatment.

Results

Total 31 children with cerebral palsy were included in this study (mean age 13.5 ± 3.54 yrs), and the distribution of CP was diverse (Table 1). 15 of them performed the GMFM test and 28 children performed occupational evaluation (Table 2). Among these population, Twenty-five patients had cognitive dysfunction and 10 children could not complete RAGT therapy, because of poor cooperation and hip joint pain (Table 3).

Conclusion

The present study demonstrated that automated gait machine with end-effector is feasible and safe for children with cerebral palsy. Further research, such as a randomized controlled trial including the follow-up periods after the training, is needed to provide

conclusive evidence of the efficacy of Morning Walk[®] compared with conventional rehabilitation or intervention with other devices.

table1. Type and Distribution of Cerebral Palsy

Type of Cerebral Palsy		
Quadriplegia	11	(35.48 %)
Hemiplegia	3	(9.68%)
Triplegia	3	(9.68%)
Diplegia	14	(45.16%)
GMFCS level		
I	4	(12.90%)
II	10	(32.26%)
III	7	(22.58%)
IV	9	(29.03%)
V	1	(3.23%)

table2. Physical and occupational evaluation of Cerebral Palsy

	Number of Patient (% of total patient)	Result
MBI total	15 (48.39 %)	48.80 ± 29.20
MBI stair climbing		3.00 ± 3.55
MBI ambulation		4.33 ± 5.08
GMFM	15 (48.39 %)	
GMFM C (Crawling & Kneeling)		67.62 ± 31.50
GMFM D (Standing)		43.58 ± 30.81
GMFM E (Walking, Running, Jumping)		35.63 ± 31.62

table3. Reasons of Discontinuation of Cerebral Palsy

Reasons of Discontinuation		Number of Patient (% of total patient)
Severe cognitive dysfunction	GMFCS I	2 (6.45 %)
	GMFCS IV	6 (19.35 %)
Severe motor dysfunction	GMFCS V	1 (3.23 %)
Pain at hip joint	GMFCS I	1 (3.23 %)