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Title
Development of Wearable Powered Gait Orthosis Using Geared Motor

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Summary
This study of the paraplegic to walk on a walker to assist will be wearable.
90W motor on RGO at the hip and the knee was attached to control the gait.
Using EMG signals, walking speed and stride are controlled.
As a results, gait for paraplegic patients were possible stably.

Introduction
Apart from disorders in physical and sensory functions, most of the paraplegics have problems in the function of the autonomic nerves that control the bladder and the colon [1, 2]. The rehabilitation treatment for paraplegics consists of walk training using orthosis devices appropriate for the level of paralysis. The training is effective in preventing contracture in joints, decreasing rigidity, and protecting patients from complications [3]. However, as walking with orthosis requires a lot of energy and is not difficult, there have been many cases where its use was discontinued after the termination of the physical therapeutic walking [4]. Therefore there needs to be an orthosis effective for functional walking after therapeutic walking.
The objective of this study is to development of regular walking of the paraplegic using a RGO with motor.

Methods
The WPGO(Wearable Powered Gait Orthosis) with motor developed for this study adopted an Isocentric RGO (IRGO) structure in order to insure the stability of the balancing posture. The structure of the RGO was modified to accommodate geared motors as developed by Kang and Kim et al. [5] and was made in titanium alloy for rigidity [6]. Geared motor (90W, Hyundae, Korea) were installed from the points above and below therotating axes of the hip joint to enable flexion .Each geared motors the rotation of the body that rotates the pelvic
band which brings corresponding leg forward alternately through a link mechanism. Therefore the patient consumes less energy. The control system is composed of a motor controller (24V, eleparts, Korea), battery (Li-ion, Samsung, Korea), and real-time controller (AVR, USA). The signals for gait are an EMG signal emitted from the electromyography sensor attached to both arms, and signal from foot sensor the insoles of both foot.

**Results**

In order to analyze the kinematic and clinical effects of the paraplegic wearing a WPGO under study, three participants were selected. In this study, parameters measured for the analysis were the gait speed, number of steps per minute, and the length of each step for Group (subjects A, B, and C). The measurements were done at the onset of, two months after and four months after the gait training. The number of steps for each participant was different, but it can be seen that they were all improved as the training sessions continued. Subject B especially, showed improvement of about 59% at the end of training. Subject A showed improvement of by about 26%, and Subject C by about 56%.

Fig. 5. Comparison of gait parameters change in moveable joint knee for PGO: (A) Cadence (steps/min), (B) Velocity (cm/s), (C) Step length (cm). The gait speed also showed improvements over the course of training. Subject A was confirmed with about 82% improvement at the end of training compared to the initial stage. In the case of Subject C, there was no significant difference in the gait speed during the two months of training. These differences show that the training effects could vary according to personal traits such as age, physical condition or activeness.

The lengths of each step showed an increase among the participants as training progressed. Subject A improved by about 54% at the end, and Subject C by about 35%. On the other hand, while Subject B showed no big difference up to the t

**Conclusion**

In this study, to validate the effect of gait training from sustained functional training after training to acclimate to it.

A RGO with geared motors for paraplegics has greater kinematic effects than RGO, and showed improvements in gait speed, cadence, and step length after a long training period.
References


