재활보조기구

게시일시 및 장소 : 10 월 18 일(금) 08:30-12:20 Room G(3F)

질의응답 일시 및 장소 : 10 월 18 일(금) 10:12-10:16 Room G(3F)

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Wearable Ankle-assist Robot Improves Gait Parameters in Patients after Stroke

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Objective

Hemiparesis after stroke results in a unilateral primary impairment of the paretic leg that results in a disrupted walking pattern. Reduced descending neural drive to the paretic ankle joint causes muscle weakness and spasticity, often accompanied with foot drop which is characterized by the foot pointing downward and dragging on the ground during walking. The purpose of this study was to investigate the effect of the Gait Enhancing and Motivating System-Ankle (GEMS-A, Samsung Advanced Institute of Technology, Samsung Electronics Co., Ltd., Korea), on spatial-temporal, kinematic, and kinetic gait parameters in hemiplegic patients.

Methods

A total of 45 eligible subjects (mean age; 54.11±13.94, 34 males) were recruited for the study. The participants were asked to walk at a self-selected normal speed along a 8-m walkway under the following three conditions in random order using a table of random numbers: free gait without robot assistance [FG], a 8-m walk without wearing the exoskeleton in order to measure baseline spatiotemporal, kinematic, and kinetic gait parameters; robot-assisted gait with zero torque [RAG-Z], a 8-m walk wearing the exoskeleton, but the desired torque was set to zero to verify the effect of wearing the exoskeleton on spatiotemporal, kinematic, and kinetic gait parameters; robot-assisted gait [RAG], a 8-m walk while wearing the exoskeleton and using the assist torque. Eight-camera motion capture system (Motion Analysis Corporation, USA) was used for three-dimensional motion analysis and kinetic parameters were obtained using two force plates (TF-4060-B, Tec Gihan, Japan) embedded midway on a straight 8-m walkway.

Results

The RAG condition demonstrated significantly greater gait speed, cadence, and stride length than the FG and RAG-Z conditions ($p<0.05$). In addition, we observed that at initial contact, the affected foot had positive tilting angle from the ground (heel strike the ground with foot pointing upwards) than the FG and RAG-Z ($p<0.05$), and toe clearance during swing phase was successfully achieved in RAG condition. The RAG condition had higher propulsive forces by altering their peak ankle power generation compared with FG and RAG-Z ($p<0.05$).

Conclusion

The finding in this study indicates that the GEMS-A is a useful robotic device for enhancing walking performance by providing positive tilting angle at initial contact for heel strike and toe clearance during swing, and improving push-off intensity.

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