Abstract #676.doc

EFFICACY OF VOLUNTARY DRIVEN EXOSKELETON HYBRID ASSISTIVE LIMB (HAL) IN PATIENTS WITH CHRONIC CERVICAL SPINAL CORD INJURY

Introduction
Hybrid assistive limb (HAL) is a wearable robot suit to assist voluntary control of knee and hip joint motion by detecting bioelectric signals on the surface of the skin with high sensitivity. HAL has been reported to be effective for functional recovery in motor impairments. The purpose of this study is to investigate the efficacy of HAL training in chronic spinal cord injury (SCI) cases.
Materials and Methods
We analyzed 6 patients (4 men, 2 women, mean age 59.0 years old) with chronic incomplete cervical SCI. All of the patients were volunteers recruited through local newspaper advertisements or outpatients at our Hospital. Patients received 90-minutes HAL training twice per week for 8 weeks (16 sessions). 10-m walk test (consists of speed, steps, and cadence), timed-up and go (TUG) test, and Berg balance scale (BBS) at the baseline and after training without wearing HAL were assessed. Additionally, ASIA classification and the walking index for SCI II (WISCI II) before initial training and after last training were also assessed. Wilcoxon signed-rank test was used for statistical analyses. A p value less than 0.05 was considered to be significant.
Results
There were significant improvements in speed (0.42 ± 0.41 m/s to 0.50 ± 0.48 m/s), cadence (67.5 ± 36.9 steps/min to 75.5 ± 40.1 steps/min), while there were no significant changes in steps (42.8 ± 21.1 steps to 39.6 ± 20.2 steps, p = 0.07), TUG test (64.2 ± 48.1 s to 55.2 ± 42.1 s, p = 0.23), BBS (35.7 ± 9.8 to 38.2 ± 12.2, p = 0.34). ASIA classification and WISCI II remained constant in all cases. No adverse events were observed during the training.
Discussion
HAL training improved the cadence rather than the stride. This tendency is similar to previously reported robotic training. We expect that HAL-induced motion can induce favorable feedback effect between the central and the peripheral nervous system. Furthermore, it is conjectured that appropriate sensory inputs such as maximum weight loading, facilitating proper trunk posture, are essential for functional recovery.
Conclusion
HAL training improved functional ambulation in patients with chronic incomplete cervical SCI.