Stroke Rehabilitation and the AlterG Bionic Leg™

Introduction
Stroke is the third largest cause of death behind heart disease and cancer. It's a leading cause of serious, long-term disability in the developed world.

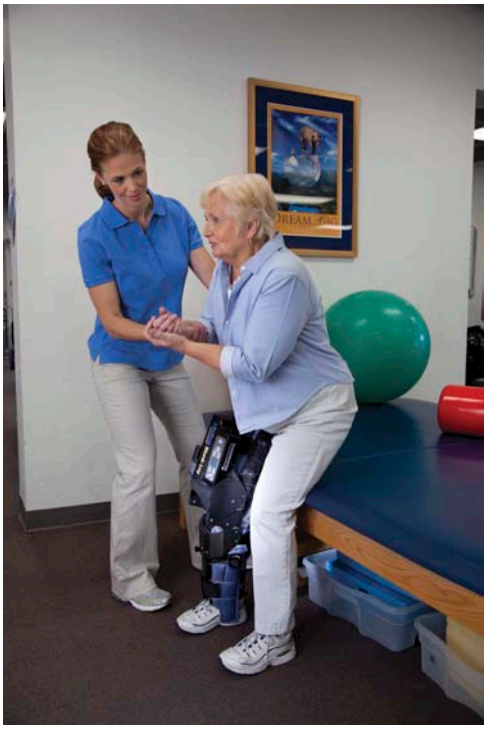
There are about 6.4 million stroke survivors alive today.[1] Many of them will suffer lasting financial, psychological, and physical consequences for the rest of their lives. As a result of the debilitating nature of their stroke, many survivors can develop other medical sequelae including: diabetes, cardiovascular disorders, pneumonia, seizures, and even fractures from falls. And each year, approximately 795,000 of these stroke survivors will suffer a new or recurrent stroke, which only adds to their disability.

Because stroke recurrence is a concern (patients who have had a stroke are five times more likely to have another stroke[2]), risk factors must be managed appropriately to prevent the cycle of further physical impairment and subsequent disability. One of the key ways to decrease risk factors such as hypertension, diabetes, and high cholesterol is with physical activity.

Economics of Stroke
The treatment for stroke is very expensive and accounts for a large percentage of health care budgets. On the average, it will cost individuals $140,048 in their lifetime for the necessary care of lasting deficits following stroke.

Calculations undertaken in the US suggest that stroke results in total costs of $38.6 billion a year. A little over one third of this cost is spent on providing health care to stroke sufferers (direct costs), and the rest is shared between informal care costs and productivity losses.

Stroke, Recovery, and Rehabilitation
A stroke happens when the blood supply to part of the brain is cut off and brain cells are damaged or die. Different parts of the brain control different parts of the body so stroke can affect people in lots of different ways depending on which part of the brain is affected. A person may become numb, weak, or paralyzed on one side of the body. They may slur their speech and have difficulty finding words or understanding speech. Some people lose their sight or have blurred vision, and others become confused or unsteady in standing or walking.



About a third of people who have a stroke make a significant recovery within a month. But most stroke survivors will have long-term problems. It may take a year or longer for them to make the best

possible recovery. Sadly, in the most severe cases, strokes can be fatal or cause long-term disability.

Rehabilitation helps stroke survivors to cope and adapt to their situation so they can become as independent as possible after stroke. They will normally be treated by a number of people who have specialized training and experience. Although recovery is linked to rehabilitation, the two are not the same thing. Recovery means getting better, rehabilitation means overcoming or adapting to the effects of the stroke.

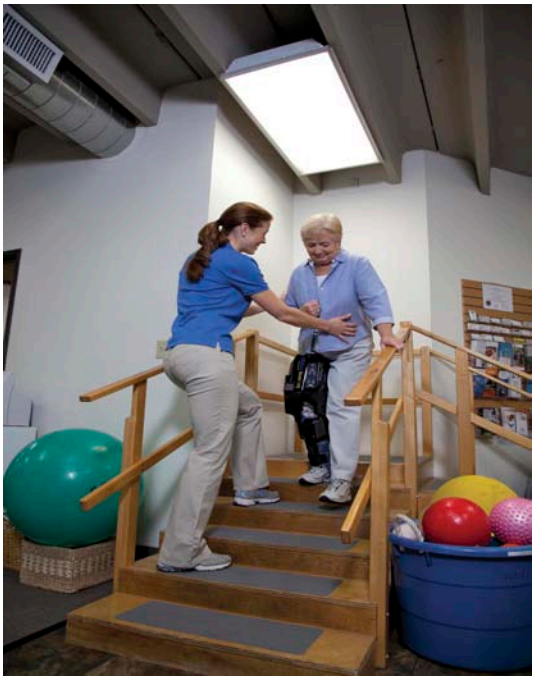
Effect of Stroke on Gait
The loss or deviation from the normal state and function of the body following stroke can lead to lower levels of ambulation in many stroke survivors. A stroke imparts numerous physical, psychological, and cognitive impairments, which combine to manifest as gait disability.

Some of the documented features of gait disability after stroke are attributed to:

- Motor deficit
- Cognitive deficit
- Sensory deficit

Stroke Recovery and Gait Training
In general, recovery of motor function can occur either through neural reorganization, which involves finding alternative means to activate the same muscles used for a task prior to injury, or using alternative muscles in compensatory strategies.

One of the most important features of gait training in stroke rehabilitation is that the patient should be as active as possible. This can not only affect the possible gains in motor learning but could also potentially help reduce the severity of the secondary complications of stroke such as cardiovascular disease and osteoporosis.



Motor Learning and Neuroplasticity
In motor learning theory, the assumption is that patients can improve with practice. By practicing task specific and goal-oriented activities, scientists and researchers hypothesize that patients can possibly encourage cortical change through volitional movement. This brain plasticity, or ability to change and adapt is what ultimately leads to “healing” in neurologic patients.

Stroke Rehabilitation and Robotics
In neurological rehabilitation of the lower extremities, one way to encourage use and practice is through the use of robotic-assistive devices. Robot-driven gait therapy can provide assistance to post-stroke patients during training and offers a number of advantages. Active patient participation in robot-driven gait therapy is vital to many of the potential recovery pathways and is therefore an important feature of robotic gait training (Pennycott et al. 2012).

Why the AlterG Bionic Leg?
The AlterG Bionic Leg is a wearable single leg robotic trainer that is activated by the patient’s intent to move. The intuitive technology accurately assists knee extension and helps to control

knee flexion in a range of patient presentations.

Byl (2012) found that lower extremity training integrating the AlterG Bionic Leg may improve gait speed, endurance and community levels of participation in select patients in a post-stroke chronic state. It was concluded that the wearable, mobile assistive robotic device safely supplemented supervised physical therapy including mobility and balance skill training.

In a case series Wong et al. (2012) reviewed the effect of AlterG Bionic Leg use during a 6-week physical therapy program. Subjects were assessed with a variety of balance, gait, and functional tests including the Berg Balance Scale (BBS); six-minute walk test (6MWT); and Emory Functional Ambulation Profile (EFAP) at pre-treatment, post-treatment, one-month and three-month follow-up. It was found that all subjects improved balance, gait and functional performances with no adverse events.

Conclusion

Physical therapists may find a wearable robotic knee orthosis useful for providing patient-initiated assisted movement for ambulatory chronic stroke survivors during functional task-specific balance and mobility training.

References:

1. Byl, N. 2012. Mobility training using a bionic knee orthosis in patients in a post-stroke chronic state: a case series. *Journal of Medical Case Reports.* 6: 216.

2. Pennycott, A., Wyss, D., Vallery, H., Klamroth-Marganska, V., and Riener, R. 2012. Towards more effective robotic gait training for stroke rehabilitation: a review. *Journal of Neuro-Engineering and Rehabilitation.* 9: 65

3. Wong, C., Bishop, L. and Stein, J. 2012. A wearable robotic knee orthosis for gait training: a case-series of hemiparetic stroke survivors. *Prosthetics and Orthotics International.* 0(0): 1–8

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For specific recommendations regarding use of the AlterG Bionic Leg with neurologically impaired patients, please feel free to check out the clinical section of our website at www.alterg.com.