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ARIZONA STATE UNIVERSITY ASU'S NEWS AND INFORMATION CENTER

August 22, 2006

Research helps people with spinal cord injuries

A collaboration between ASU's Biodesign Institute and the Clinical Neurobiology & Bioengineering Research Center (CNBRC) at Banner Good Samaritan Medical Center aims to assist people with spinal cord injuries to exercise, stand and possibly prevent the onset of chronic disease, such as diabetes, because of inactivity.

James Abbas, a researcher with the CNBRC and co-director of the Biodesign Institute's Center for Adaptive Neural Systems, is beginning four projects, each with a different focus for people living with spinal cord injury (SCI).

"We're trying to find means to assist people with SCI, either by providing some with a means to regain limited mobility, helping them to stand, or helping them to exercise," Abbas says.

The first study to open will use an external electronic stimulator designed to give participants exercise in their legs. Twenty subjects, 10 with complete spinal cord injuries and 10 with incomplete injuries, will be recruited to participate in a 12-week exercise protocol with the device.

"People who cannot use their legs are at a higher risk of becoming obese and developing chronic diseases, such as diabetes," Abbas says. "This device, which can be used at home, will provide wheelchair-reliant participants with a means to exercise their legs. We're interested to see how the muscle activity and circulatory flow can benefit these participants."

This project is related to a second one that will study how the body responds to exercise after trauma such as SCI.

"We're interested in looking at the metabolic and immune systems change after an injury," Abbas says. "Hopefully, this knowledge will then enable us to develop new therapies that can reduce or prevent these changes from occurring."

In this study, participants will perform different types of exercise as the researchers monitor heart rate, breathing patterns and concentrations of hormones circulating in the blood.

Two studies will open later in the fall. They are:

• An implanted stimulation device that will enable people to stand.

• An external stimulation system to help retrain people to walk.

The implanted neuroprosthesis (electrical stimulation system) will use a pacemaker-style device that sends stimulation to eight muscle groups that will extend the knees, hips and lower back on the left and right sides. When the device is activated, it causes all the muscle groups to contract, making it easier for the person to stand.

“They will still have to have to use their hands for some balance and support, either a walker or a tabletop,” Abbas says. “These participants do not have complete feeling in their legs and can easily lose their balance without holding onto something. However, the ability to stand will allow them to reach items in cupboards, or to transfer more easily from a wheelchair to another surface.”

This study involves a long-term commitment of the participants, and it will require that they undergo surgery to get the implanted device.

The walking study will use an external stimulator during therapy sessions for people with incomplete SCI. The idea behind this study is based on “practice makes perfect.” It uses electrical stimulation to help the person step on the treadmill, and the project is intended to help the participants gradually regain greater the ability to step on their own. The electrodes for the devices are externally placed on the major leg muscle groups and connected to a small stimulator and battery pack.

One of the new features in the design of the Biodesign Institute system is an adaptive program that automatically learns how much stimulation to provide.

“In Stage 1 of the study, we will ask for assistance from people with complete SCI,” Abbas says. “They will help us determine if our adaptive system can work well enough to control the stepping movement on the treadmill. In Stage 2, we will seek assistance from people with incomplete SCI to determine if the adaptive system can accommodate the voluntary actions of the participant.”

The team hopes to demonstrate that this system can be used as an effective form of therapy in the clinic.

These studies will take place at both the CNBRC, located in the Banner Good Samaritan Rehabilitation Institute and at the Center for Adaptive Neural Systems within the Biodesign Institute.

For more details about these research projects, call Russ Brandt at CNBRC at (602) 239-4048.

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