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Cable Driven Robot Assists Patients With Neurological Disorders

Co-inventor Melissa Morris, an FAU engineering graduate student, designed and built the device pictured above to aid physical therapists and their patients to retrain injured muscles. The device will assist patients with neurological disorders such as Parkinson's disease and stroke. (Credit: Image courtesy of Florida Atlantic University)

ScienceDaily (May 9, 2008) — Florida Atlantic University has filed a provisional patent for a unique robotic device to assist with the physical rehabilitation process of patients suffering from neurological damages to their upper extremities such as those due to stroke or Parkinson's disease. Inventors, Dr. Oren Masory, chair and professor of mechanical engineering in the College of Engineering and Computer Science, and Melissa Morris, FAU engineering graduate student, designed and built the device to aid physical therapists and their patients to retrain injured muscles.

The invention is composed of moving parts, including motors, cables and spools, enclosed within an acrylic case with a handle [joystick] that is indirectly connected to the system through magnetic attraction. This device is the first-known cable driven robot to utilize a barrier between the operator and the moving mechanisms of the system. The system does not contain any rigid parts that could suddenly harm or injure the user, and the device can be used in a physical therapy office or at home without supervision. In addition, the system has a safety button embedded in the handle and if released during operation, a signal is sent to the controller that the patient has lost contact with the handle and the system immediately shuts down.

The device is designed to operate in various modes which guide the patient through a series of routine exercises. One mode enables the patient to begin his/her training by following a preprogrammed path which corresponds to "repetitions" done in traditional physical therapy. Another mode assists the patient as he/she attempts to follow the path, and the robot corrects them if they move outside of the path in much the same way a therapist would do by providing gentle resistance.

It also offers varying resistance at all points within the platform to simulate contact with objects and increase muscle strength. An additional mode offers a significant advantage over traditional physical therapy by providing absolutely no resistance to the patient, allowing movement anywhere within the platform for the purpose of diagnostic measurements. Furthermore, this device allows the physical therapist to make changes or modify the program to create new paths or change the level of resistance. The device also assists physical therapists by taking over the tedious work of repeated training.

The system is capable of supporting quantitative measurements of the user's progress and performance as well as feedback. The robot tracks the patient's progress and records data such as position and speed. This data can later be analyzed by the physical therapist so that adjustments in the treatment can be made as needed to help the patient progress in their treatment.

"Right now, physical therapists have no way of collecting empirical data that can measure the path, force or progress of any patient," said Morris. "This device can help alleviate that problem."

As medical science progresses, more individuals survive previously catastrophic conditions which leave them with some type of physical impairment. As a result, patients who have had a stroke or have Parkinson's disease or multiple sclerosis require physical therapy or rehabilitation programs to assist them to recover some, if not all, use of the affected limbs.

"Unfortunately, rehabilitation is not covered by insurance programs for long periods of time," said Masory. "Because this device is much lower in cost and less intimidating than existing systems, therapists will be able to track and manage the progress of multiple patients remotely with fewer office visits. The reduction in costs will enable patients to receive longer sessions of therapy which are still covered by insurance."

The robot will utilize communication technologies, such as phone lines, to send and receive data from a therapist's computer.

Adapted from materials provided by Florida Atlantic University, via Newswise.