Researchers are developing devices that can help restore bodily movement

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Grasping a cup of coffee and raising it to the mouth is a daily ritual most people take for granted. Yet, for those who have suffered a stroke or injury to the spinal cord, the task can be impossible to perform—until now.

Researchers and clinicians at Case Western Reserve University and partnering medical centers are developing devices that can restore movements such as grasping, standing, and even bladder control in some patients. The devices retrieve information from sensors implanted in muscles a patient can still move and indicate what type of movement the patient would like to perform.

The computer then sends out electrical signals to paralyzed muscles, instructing them to contract at the right moment.

"The objective is to extract information from a part of the nervous system that is working and use that to control parts that have lost control," says Case Western Reserve researcher P. Hunter Peckham, Ph.D., a professor in the Department of Biomedical Engineering.

The technology takes its cues from natural movements, which start with electrical signals produced in the brain or spinal cord. The signals are then transmitted through hundreds of thousands of nerve cells that, like wires, travel to every muscle fiber in the body. When injuries occur, they can interfere with these signals. For example, spinal cord injuries can result in paralysis below the site of injury. Similarly, a stroke can

damage parts of the brain responsible for specific movements, preventing signals from ever being sent.

Researchers have found, however, that signals can be replaced by small electrical currents delivered through electrodes.

"The muscle says 'I see information that says contract.' It does not care whether the information came from electrodes rather than naturally through the nerves," says Peckham.

To deliver electrical stimuli to paralyzed muscles in a way that mimics the body's own nervous system, Peckham and colleagues at the Cleveland Functional Electrical Stimulation Center are developing small computer devices called neuroprostheses.

The devices are not a perfect match for the nervous system.

"We only have one or a maximum of two stimulation electrodes for any one muscle," explains Peckham. "In the normal nervous system you would have hundreds of nerve cells going to any one muscle."

Nonetheless, neuroprostheses have helped at least 300 patients regain some independence.

"Just having the ability to take notes in school or eat on your own, these things have a huge impact on quality of life," says Peckham.

And the devices may also someday provide insight into how to repair a damaged nervous system, not just address its symptoms.

"The reason injuries to the brain or spinal cord are so devastating is that nerve cells and connections that are lost after an injury do not fully regenerate," says Peckham. "But we've observed that electrical

stimulation may help enhance recovery."

This possibility, although based on anecdotal evidence, caught the interest of Case Western Reserve neuroscientist Robert Miller, Ph.D., who plans to investigate how electrical stimulation might be able to boost the body's innate repair mechanisms.

"If the mechanism is understood we could find ways to augment that and use those in patients," says Miller.

For now, however, prospects for regenerating the nervous system have far to go. Peckham and his colleagues are focusing on a next step for neuroprostheses: obtaining approval from the U.S. Food and Drug Administration.

"Our top priority is to make them widely available to patients," he says. "We really hope to do it in the next two to three years."

Source: Case Western Reserve University (news : web)