Computers may help patients restore movement after stroke

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(Medical Xpress) -- New research suggests that patients whose mobility has been limited by stroke may one day use their imagination and a computer link to move their hands.

In patients, scientists at Washington University School of Medicine in St. Louis have shown they can detect the brain simply thinking about moving a partially or completely paralyzed hand. The half of the brain that normally thinks such thoughts and moves the hand can no longer do so because of stroke damage. Instead, the signal comes from the undamaged half of the brain.

The new study suggests it may be possible to harness these signals to restore a fuller range of movement in the patient's limbs.

"We've known for some time that the brain can reroute or otherwise adapt its circuits to cope with an injury," says senior author Eric Leuthardt, MD, associate professor of neurosurgery, of biomedical engineering and of neurobiology. "Now we have proof-of-principle that we can use technology to aid that process."

To demonstrate the potential to help restore movement, scientists connected brain signals detected by an electrode-studded cap to the movements of a cursor on a computer screen. In 30 minutes or less, patients learned to control the movement of the cursor with thoughts of moving their impaired hand. Researchers are now working on a motorized glove that will make the imagined movements a reality.

The results are available online in *The Journal of Neural Engineering*.

Leuthardt, who is director of Washington University's Center for Innovation in Neuroscience and Technology, is a pioneer in the field of brain-computer interfaces, or devices that allow the brain to communicate directly with computers to restore abilities lost to injury or disease.

Much of Leuthardt's research has focused on patients with epilepsy who are undergoing surgery to remove the part of the brain where their seizures originate. He uses the electrode grids temporarily implanted on the surface of the brain to pinpoint areas where the seizures begin. With the patients' permissions, Leuthardt also uses the implants to gather and analyze detailed information on brain activity for future use in brain-computer interfaces. This approach laid the foundations for the technique now being applied to the stroke population.

In the new research, first author David Bundy, a graduate student, worked with four patients who had suffered strokes that caused extensive damage on one side of the brain. All were experiencing paralysis or significant difficulty moving the hand on the opposite side of the body.

The brain signals that control movement are low-frequency signals, which makes them relatively easy to detect with electrodes on the outside of the skull. Researchers fitted patients with an electrode-studded cap connected to a computer, and asked them to perform a finger-tapping activity. Depending on a cue flashed on a screen in front of them, the patients either tapped the fingers of their unimpaired hand or imagined tapping the fingers of the impaired hand. Scientists used the cap to identify signals in healthy part of the brain that accompanied the imaginary movements.

The researchers are now developing motorized braces that can be controlled by similar signals, with the goal of restoring full movement in weak or paralyzed limbs.

“This is an exciting development that opens up new opportunities to help even more patients overcome limitations imposed by brain damage or degeneration,” Leuthardt says.

More information: Bundy DT, Wronkiewicz M, Sharma M, Moran DW, Corbetta M, Leuthardt EC. Using ipsilateral motor signals in the unaffected cerebral hemisphere as a signal platform for brain-computer interfaces in hemiplegic stroke. *The Journal of Neural Engineering*, June 2012 doi:10.1088/1741-2560/9/3/036011