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Man walks again after years of paralysis

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The ability to walk has been restored following a spinal cord injury, using one's own brain power, according to research published in the open access *Journal of NeuroEngineering and Rehabilitation*. The preliminary proof-of-concept study shows that it is possible to use direct brain control to get a person's legs to walk again.

This is the first time that a person with complete paralysis in both legs (paraplegia) due to spinal cord injury was able to walk without relying on manually controlled robotic limbs, as with previous walking aid devices.

The participant, who had been paralyzed for five years, walked along a 3.66m long course using an electroencephalogram (EEG) based system. The system takes electrical signals from the participant's brain, which then travel down to electrodes placed around his knees to create movement.

Dr. An Do, one of the lead researchers involved in the study, from University of California, Irvine, USA, says: "Even after years of paralysis the brain can still generate robust brain waves that can be harnessed to enable basic walking. We showed that you can restore intuitive, brain-controlled walking after a complete spinal cord injury. This noninvasive system for leg muscle stimulation is a promising method and is an advance of our current brain-controlled systems that use virtual reality or a robotic exoskeleton."

Mental training was initially needed to reactivate the brain's walking ability. Seated and wearing an EEG cap to read his brainwaves, the

participant trained to control an avatar in a virtual reality environment. He also required physical training to recondition and strengthen his leg muscles.

The participant later practiced walking while suspended 5cm above ground, so he could freely move his legs without having to support himself. On his 20th visit, he translated these skills to walk on the ground and wore a body-weight support system for aid and to prevent falls. Over the 19 week testing period, he gained more control and performed more tests per visit.

This proof-of-concept study involved a single patient so further studies are needed to establish whether these results are true for a larger population of individuals with paraplegia.

Dr. Zoran Nenadic, the senior lead researcher of the study, from University of California, Irvine, USA, says: "Once we've confirmed the usability of this noninvasive system, we can look into invasive means, such as brain implants. We hope that an implant could achieve an even greater level of prosthesis control because brain waves are recorded with higher quality. In addition, such an implant could deliver sensation back to the brain, enabling the user to feel their legs."

More information: The Feasibility of a Brain-Computer Interface Functional Electrical Stimulation System for the Restoration of Overground Walking after Paraplegia, Christine E King, Po T Wang, Colin M McCrimmon, Cathy CY Chou, An H Do, Zoran Nenadic, *Journal of NeuroEngineering and Rehabilitation* 2015, DOI: 10.1186/s12984-015-0068-7

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