Bionics Institute

Media release
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From science fiction to reality: New bionic limb research redefines possibilities for people with amputations

In a world-first, a patient with an amputation above the elbow has been able to control a bionic hand as if it was his own thanks to new surgical and engineering advancements merging humans with machine.

The ground-breaking study, published today in *Science Translational Medicine*, details the first documented case of an individual whose body was surgically modified to incorporate implanted sensors connected to a bionic hand via a skeletal implant.

This new technique allows the patient to have intuitive movement of each and every finger and sensory awareness.

Leading this research is Professor Max Ortiz Catalan, Head of Neural Prosthetic Research at the Bionics Institute in Melbourne (Australia) and Founding Director of the Center for Bionics and Pain Research in Gothenburg (Sweden).

Professor Ortiz Catalan says this research offers new hope and possibilities for people with amputations worldwide.

"Prosthetic limb options are commonly attached to the body by a socket that compresses the residual limb – a process which is mechanically unstable and can cause discomfort," he says.

"Our work uses osseointegration, where a titanium implant is placed within the residual bone and becomes strongly anchored to the patient's skeleton. Such skeletal attachment allows for comfortable and more efficient mechanical connection of the prosthesis to the body."

Until now, osseointegration has been limited to providing mechanical attachment to the prosthesis.

"A major problem in patients with higher amputation levels, such as above the elbow, is that not many muscles remain to command the many robotic joints needed to truly restore the function of an arm and hand," Professor Ortiz Catalan explains.

"In this study, we enhanced the nerve and muscle connections that would normally be found in the arm by taking the patient's peripheral nerves that were severed by the amputation, splitting them, and then reconnecting them to different muscle targets in which we also placed implanted electrodes."

This bionic reconstruction integrating biological and artificial components allows the artificial intelligence (AI) decoder in the prosthesis to gain access to the neural information related to motor control.

When the patient tries to move their hand, the signal is recorded and AI algorithms tell the bionic limb what to do, like a biological one would.

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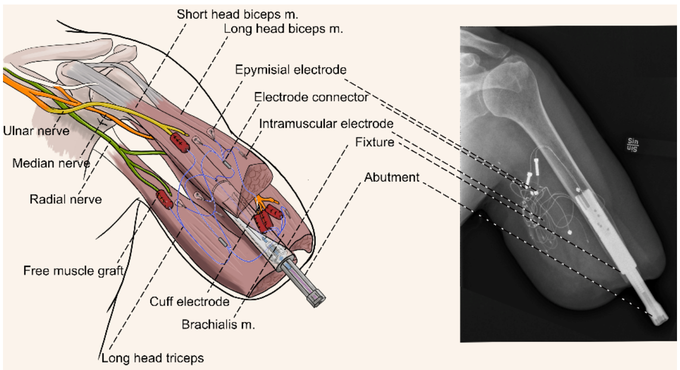
Bionics Institute CEO Robert Klupacs says this research paves the way for people across the world with an amputation to regain quality of life.

“This is an incredible step forward for people with amputations. The clinical study is evidence that combining sophisticated implanted electrodes, new microsurgical techniques and machine learning can provide a patient with a highly functioning bionic limb that they can control at will.”

“We at the Bionics Institute are excited by what Professor Ortiz Catalan and his team of collaborators have achieved to date, and by their ongoing development of next generation bionic limb technology to provide people with amputations improved control and dexterity,” he adds.

Resources
Pictures and videos available [via this link].

File name: Zbinden2023_STM_4



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Available for interview

- Professor Max Ortiz Catalan – Head of Neural Prosthetic Research at the Bionics Institute, Melbourne; and director of the Center for Bionics and Pain Research (CBPR), Sweden
- Mr Robert Klupacs – CEO of the Bionics Institute

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About the research

Led by Professor Max Ortiz Catalan, the work was conducted by researchers at the Center for Bionics and Pain Research (CBPR), a multidisciplinary collaboration between Chalmers University of Technology, Sahlgrenska University Hospital, and the Sahlgrenska Academy at the University of Gothenburg, all in Gothenburg, Sweden; the Bionics Institute in Melbourne, Australia; the Istituto Ortopedico Rizzoli, Bologna, Italy; the Scuola Superiore Sant'Anna, Pisa, Italy; the University of Colorado, Aurora, USA; the Massachusetts Institute of Technology, Cambridge, USA; and the medical device company Integrum AB, Sweden.

The research was financed by the Promobilia Foundation, the IngaBritt and Arne Lundbergs Foundation, and the Swedish Research Council (Vetenskapsrådet).

About the surgery

The surgery took place at the Sahlgrenska University Hospital, where CBPR is located. The neuromuscular reconstruction procedure was conducted by Dr. Paolo Sassu, who also led the first hand transplantation performed in Scandinavia. The osseointegration surgery was conducted by Dr. Rickard Brånemark at MIT, University of Gothenburg, and Integrum AB.

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