

R&D Funding
Life Sciences

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New hope for severe-stroke survivors



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Every year, 17 million people worldwide suffer strokes – a third of them are left severely paralysed. The rehabilitation therapies available today can offer only little help. Now a CTI-funded project carried out by the EPFL and its spin-off Intento is giving new hope to people with brain injuries.

Professor José del R. Millán does research into brain-computer interfaces at the Swiss Federal Institute of Technology Lausanne (École polytechnique fédérale de Lausanne, EPFL). Together with his team, this neuroscientist decodes brain signal patterns and translates them into commands for rehabilitation systems. The goal is to help stroke patients suffering from paralysis or limited mobility.

Effective system for stroke rehabilitation

In 2009, Millán and Andrea Biasiucci, his doctoral student at the time, began using brain-computer interfaces in stroke rehabilitation. Doctors still disagree on the effectiveness of Functional Electrical Stimulation (FES), which is used in today's standard rehabilitation therapies. However, there is growing scientific evidence – including clinical data by professor Millán – showing that patients who can control their own movements with FES experience high levels of functional recovery.

Based on these findings, devices can be developed to increase the scope of today's rehabilitation therapies, for instance Constraint-Induced Movement Therapy (CIMT). In CIMT, the patient's healthy arm is restrained, which forces them to use their paralysed arm when performing everyday tasks. However, as CIMT is only possible for patients who have retained at least some mobility in their affected limb, this form of therapy is an option for only six to ten per cent of all stroke patients.



Controlling movement of the paralysed hand: controlling muscle and nerve stimulation improves functional recovery.



Research into activating stroke patients: José del R. Millán of the EPFL's Biotech Campus with Andrea Maesani and Andrea Biasiucci of Intento (from left to right).

Intento SA – an EPFL spin-off founded by Drs Andrea Biasiucci and Andrea Maesani – is developing user-friendly devices that open up CIMT to the majority of stroke patients. Intento's system consists of tablet software and a motion-control device that is connected to an electrical stimulator. Using the tablet, the therapist selects one of several programmed movements, for instance "grasp a glass and put it to the mouth". This command is sent to the motion-control device. Electrodes connect the stimulator to the patient. Turning a dial on the device controls the electrical stimulation of the muscles and nerves – and thereby the degree of movement of the paralysed arm

according to the programmed movement selected. "Even a totally paralysed patient can perform physical exercises with his or her therapist and relearn motion processes," says Dr Andrea Maesani.

Successful clinical trial

In a CTI project in 2015, the team and Dr Stefano Carda conducted a clinical trial at the Centre hospitalier universitaire vaudois (CHUV), in which they compared the effectiveness of their own therapy with that of the most effective therapy offered at the CHUV. After two weeks, 80 per cent of patients using the new programme showed a clinically relevant improvement – compared to only 30 per cent of patients undergoing conventional intensive therapy.

Intento plans on launching two versions of their product: one for use in hospital and another for at-home physical therapy. Together with the National Centre of Competence in Research Robotics – which is funded by the Swiss National Science Foundation – Intento is now developing technology to more easily attach electrodes to patients' bodies.

"Even a totally paralysed patient can perform physical exercises with his or her therapist and relearn motion processes."

Andrea Maesani, CEO of Intento

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