

New therapy device enables stroke victims to recover further

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Patients whose progress plateaued after undergoing conventional treatment showed new peaks in recovery under new system.

Scientists from Nanyang Technological University (NTU) have developed a new stroke rehabilitation device which greatly improves recovery in stroke patients.

Thanks to this invention, [stroke patients](#) who had undergone conventional rehabilitation for a year or more and had hit a plateau in

their recovery, managed to make significant progress in their ability to carry out [everyday tasks](#).

Some of these long-term [stroke sufferers](#) have recovered up to 70 per cent of motor function clinical scores in just a month during the trial.

The new [stroke therapy](#) system, known as Synergistic Physio-Neuro Platform (SynPhNe), is currently undergoing thorough clinical investigations and more feasibility trials at local hospitals.

In use for 150 therapy hours, it has not had any side effects so far. Patients who tried SynPhNe also said they experienced little fatigue while using this easy-to-use system.

Developed by Dr John Heng, a senior research fellow at NTU's School of Mechanical and [Aerospace Engineering](#) and his PhD student, Mr Banerji Subhasis, this system gives hope to frustrated patients who want to see more progress after completing conventional rehabilitation therapies.

The NTU research team of four has published over 11 scientific papers since 2008 on the principles of the system, its effectiveness and ease of use.

"While current rehabilitation systems do benefit many patients, there are also other patients who still have difficulties performing [everyday activities](#) like holding a fork or drinking from a cup, despite the usual rehab sessions," said Dr Heng.

"SynPhNe works by giving real-time feedback to the patients on what is happening in their mind and in their muscles. Patients using SynPhNe know where their problems lie and can slowly work towards overcoming each problem, instead of feeling frustrated and going through a painful,

expensive and prolonged trial-and-error process when their improvements are not visible."

How it works

SynPhNe consists of patented computer software connected to a specially designed headset with neural sensors and a sensor arm glove. The device is designed to be worn easily by stroke patients who usually have control of only one arm.

These sensors provide feedback on the stress, attention, and relaxation levels of the mind and which muscles are being activated or inhibited by the patient. The software contains instructional videos for limb movements which the patient can mimic to improve his/her performance of various tasks.

Sensor information is displayed in real time via the computer screen so that the patient is aware of what is happening in his mind and body while undergoing the rehabilitation exercises.

Dr Heng said that while multi-model associative learning is known to be useful in the development of babies and in education, it is the first time that their research team is adapting it for stroke therapy. Tested on 10 patients so far, it has shown to be very effective in accelerating the recovery in stroke patients.

In associative learning, a patient will find out the link between cause and effect, or intent and physical result. The patient learns what he/she wants to do and what is actually happening with their limbs. This helps the patient to self-correct movements to match intended actions.

"For example, if a patient wants to move his wrist, but his wrist is not moving, SynPhNe will be able to show him that his mind had sent out a

signal, his muscles have received it, but because supporting and opposing muscles are clenched, he will need to relax the opposing muscle in order to move his wrist," Mr Subhasis explained.

"Another common problem is that the patient may feel stressed while undergoing therapy, which affects his muscle control. So by showing the stress level on the screen, SynPhNe will teach the patient how to control his breathing and posture to regain his balance and composure so that he can continue with the exercises.

"In short, SynPhNe makes patients aware of what is happening with their bodies so they learn how to relax their mind and muscles. This helps them to re-learn simple actions like holding a pen or a cup which may be arduous tasks for stroke victims."

Ramping up patient trials

Patient trials are still on-going and 10 patients have undergone the trial for 12 sessions, each lasting 90 minutes. Over a four-week period, they have all shown some improvement on the clinical scales. It was found that patients with hand control and hand weakness problems improved the most, in several cases, up to 70 per cent.

The scientists started the patient trials in October 2012 at Tan Tock Seng Hospital and are embarking on another similar trial at the National University Hospital. Talks are underway to start another trial at Singapore General Hospital and in India.

SynPhNe, which took over five years to develop, have also won successive grants from the National Medical Research Council, the National Research Foundation's Proof-of-Concept grant and Singapore-MIT Alliance for Research and Technology (SMART)'s Innovation Grant.

Start-up to look into commercialisation

Apart from conducting further trials involving 50 more patients, the next step for the scientists is to form a start-up company to turn the SynPhNe prototype into a portable stroke therapy kit for home use. This kit is expected to be cheaper than most robotic rehabilitation systems in the market which may cost over tens of thousands of dollars.

"This reduction in cost will allow for perhaps a rental or subsidy scheme for patients who wish to practise in the convenience of their own home instead of having to go to rehabilitation centres. It has the added advantage of providing constant updates of instructional videos and exercises to match the patient's improvement and can even send their reports to their therapists via the device's Wi-Fi capabilities," Prof Heng added.

The idea to develop SynPhNe was inspired by the mind-and-body-as-one philosophy preached in traditional practices such as Taichi, Aikido and Yoga, and the health benefits they bring.

Mr Subhasis, a martial arts and yoga practitioner for more than 30 years had sought to bring this health benefit to people through modern yet simple, affordable technology. In the latest study, the patients who synergised their minds and bodies best (based on the brain and muscles signals recorded by SynPhNe) made the most dramatic improvements.

"Training the [patients](#) to self-regulate their mind and body increases their confidence to make positive changes in their lives. It also helps therapists better customize rehabilitation routines based on the individual patient's capabilities and perceptions," Mr Subhasis added.

Provided by Nanyang Technological University

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