MIND your BODY

Feature

Robotic limbs help stroke patients

Using a bionic leg or an arm rehabilitation system helps patients regain mobility. **Ng Wan Ching** reports

For the past couple of weeks, retiree Yee Kow Hoi has been looking forward to physiotherapy.

Instead of doing his usual physiotherapy sessions at a community hospital, where he would walk on a treadmill and do simple hand exercises, he now wears a bionic leg to help him walk up and down stairs and plays computer games to improve the mobility of his left arm.

For the first time since Mr Yee, 53, suffered a stroke 17 months ago, physiotherapy was fun, he said.

He is among five patients at private physiotherapy clinic Kinesis Physio & Rehab who are using the bionic leg and the hand and arm rehabilitation system.

These devices are meant to help stroke patients regain movement in their limbs.

The Tibion Bionic Leg may also benefit those with other brain injuries, partial spinal cord injuries, multiple sclerosis and Parkinson's disease.

The ReJoyce Hand and Arm Rehabilitation system may be used to treat those with spinal cord and brain injuries.

Both devices have emerged as a result of the global push to incorporate robotic technologies to aid in the recovery of mobility.

They both leverage on the neuroplasticity of the brain – the ability of the brain to rewire itself in response to the stimulation from learning and experience, resulting in restored mobility.

The use of these devices is meant to complement conventional therapy, which gets patients to practise moving their limbs using everyday objects. For instance, they may practise lifting motions using a cup or practise fine motor movements by picking up buttons.

Kinesis Physio & Rehab launched the devices here two weeks ago. It is the only clinic in Singapore to offer the use of both devices.

Changi General Hospital said it is planning to get the devices in the near future. Khoo Teck Puat Hospital said it does not use robotics for stroke rehabilitation, but will consider doing so for its community hospital in the future.

After five sessions with the bionic leg, Mr Doh Syn Siang can climb stairs without using his hands to pull himself up. Here, he is helped by physiotherapist Helen Cooke from Kinesis Physio & Rehab.

A LEG UP

The Tibion Bionic Leg was launched in the United States in 2010.

Its maker, a US-based company called Tibion, has called it the world's first wearable robotic device for stroke rehabilitation

It is a battery-powered exoskeleton for the leg, which the patient wears when he is undergoing physiotherapy.

It enables the patient to do exercises in a natural environment, for example, walk up and down stairs.

This is not possible with other machines, such as treadmills, where the patient can do his exercises only at a fixed area, said Mr Philippe Steiner, chief executive and senior physiotherapist at Kinesis Physio & Rehab.

The bionic leg is a portable device and can be brought to a patient's bedside to allow him to take his first steps with it.

"This can have a positive psychological effect on patients, giving them renewed hope to walk again," said Mr Steiner.

Another advantage is that the bionic leg is a form of patient-initiated therapy, where the patient takes a more active role in the exercise, as opposed to the device or the physiotherapist doing more of the work, he said.

Conventional physiotherapy for stroke patients involves the physiotherapist and patient working together to build strength, flexibility and endurance on the patient's weakened side.

This can involve the physiotherapist and assistants providing physical support on the patient's weakened side, while the patient repeats movements such as going from a sitting position to a standing position, climbing stairs and drinking from a cup.

The physiotherapist will provide instructions and correct the patient's movements.

This can be both physically and emotionally draining, for both the physiotherapist and patient.

With the bionic leg, the physiotherapist does not need to physically support the patient as much, as the device does it.

To make the patient use his weakened leg, the therapist will place a piece of spongy foam under the patient's good foot. This will force the patient to rely on his weakened foot and leg when he tries to stand up.

Mr Steiner believes that when the therapy is patient-initiated, it will better train the brain to carry out the movements.

HELPING HAND

The other device, the ReJoyce Hand and Arm Rehabilitation system, was released last year by a Canadian-based company called Rehabtronics.

The system, which is also a form of patient-initiated therapy, comprises a laptop and a big joystick called the ReJoyce Manipulandum. The joystick has doorknobs, handles, plastic keys to turn and buttons.

Patients need to manipulate the joystick in specific ways to complete computer games, such as target practice, driving and pick-and-drop games.

"This makes the patient look forward to the therapy, motivating him to do better," said Mr Steiner.

The joystick has a number of unique features to train the patient's strength, flexibility and fine motor control.

For instance, it has a twisting motion, which a patient uses to catch falling objects with a cup in a computer game. This will improve his fine motor movement.

There is also a hand function test to provide an objective measurement and track the patient's progress.

Patients can opt to undergo the therapy through tele-rehabilitation.

This allows the patient to bring the device home and practise on a daily basis.

The patient and physiotherapist have to log on at the same time.

"The physiotherapist can monitor the patient through a camera and guide the patient over the Internet. This makes it more convenient for the patient, who would not have to travel to the clinic so often," said Mr Steiner.

Typically, patients are asked to wear the Tibion Bionic Leg or use the Rejoyce Hand and Arm Rehabilitation system twice a week for an hour each time for six weeks.

An hour-long session with the bionic leg costs $275.

Each hour-long session using the hand and arm rehabilitation system costs $200 at the clinic or $150 over the Internet. But patients who do tele-rehabilitation have to rent the laptop and joystick at $350 for six weeks.

A conventional physiotherapy session at Kinesis Physio & Rehab costs $150 for 45 minutes.

At Khoo Teck Puat Hospital, costs range from $60 to $90 per session, which lasts between 45 and 90 minutes. For more complex cases, it could cost more.

PHOTOS: KINESIS PHYSIO AND REHAB

Mr Philippe Steiner, chief executive and senior physiotherapist at Kinesis Physio & Rehab, watches Mr Doh use the hand and arm rehabilitation system to exercise his weakened left arm.

REGAINING MOBILITY

After one-hour, twice-weekly sessions for six weeks, those wearing the bionic leg will usually see an improvement in gait speed, balance, strength and endurance levels in their affected leg, Mr Steiner said.

Those using the hand and arm rehabilitation system will be able to see an improvement in their muscle coordination grip strength, arm flexibility and fine motor skills of the affected arm, he said.

These improvements should be lasting, especially if the patients continue to do exercises at home, he added.

These devices should increase their confidence in using their weakened limbs and the more they use them, the better they will get, he said.

Mr Doh Syn Siang, 57, who suffered a stroke in 1999, had walked with a pronounced limp as his left leg was stiff.

During the therapy sessions, he used the bionic leg to help him move from a sitting position to a standing position, to walk up and down steps and to do wall squats with an exercise ball.

After just five sessions, he can now go up the stairs using just his leg muscles and no longer needs to use the arm unaffected by the stroke to pull himself up.

He owns a carpentry business and hopes that the bionic leg will help him improve his mobility, gait and balance, so he can carry on working in better physical shape.

Similarly, Mr Yee can also walk up and down stairs more smoothly now without having to use his good hand to haul himself up or down, or having to place both legs on the same step before climbing another step.

The former driver, who has retired because of his condition, said his left leg felt stronger and lighter after wearing and using the bionic leg.

"Because of the stroke, my left leg became very weak. I would depend on my right leg more. But with the bionic leg, I feel that my two legs are becoming more balanced now," he said.

Now he can also lift a mug to his lips with his left hand – something he could not do before using the hand and arm rehabilitation system.

"I'm much more confident of using my weaker left limbs now," he said.

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