According to the World Health Organization, 15 million people worldwide suffer a stroke each year, five million of whom are left permanently disabled. Strokes are the biggest cause of permanent disability and lasting impairment. Most stroke patients have yet to reach their full potential by the time they are discharged from rehabilitation programs. Philips is currently researching new ways to increase the effectiveness of rehabilitation. The Stroke Rehabilitation Exerciser prototype helps patients and therapists to design and execute personalized neurological motor exercise plans that can be carried out at home.

The most common disabilities resulting from stroke include hemiparesis and hemiplegia, which distort the face, weaken or paralyze a limb or an entire side of the body, making it difficult to walk or grasp objects. Although tissue damage in the brain as a result of a stroke is irreversible, survivors can achieve a better quality of life by relearning skills and learning to compensate for their impairments. In addition, the use of impaired limbs promotes the brain’s ability to relearn and helps reduce the effect of disabilities. Rehabilitative therapy often begins within 48 hours of the stroke and includes passive or active range-of-motion exercises. Physical therapists often establish extensive exercise programs and, for some stroke survivors, rehabilitation will be an ongoing process lasting several months or even years, requiring repetitive practice and a high degree of self-discipline. Conventional rehabilitation requires the immediate presence of a therapist, contributing to the high costs of this recovery phase. Today, many stroke patients do not receive the rehabilitation they need in order to recover to their maximum potential, because they lack the necessary exposure to rehabilitation, careful instruction and the motivation to continue exercising at home once the therapy has ended.

Wireless motion sensors
Philips is researching new ways to offer remote therapy by coaching and supervising upper limb training. Through small, unobtrusive motion-sensing devices for home use, the Philips approach focuses on exercises that are compatible with existing motor therapies in order to improve arm-hand movements.

With the Stroke Rehabilitation Exerciser prototype by Philips Research, patients can train in a comfortable home setting. Lifting a cup from a table is a typical training exercise to improve a stroke patient’s arm-hand movements.

“With guided home rehabilitation, a stroke patient can train more often, leading to better results and faster progress.” Gerd Lanfermann, Senior Scientist

“Wireless motion sensors” Richard Willmann, Research Scientist

“For better ease of use, we developed light-weight, matchbox-sized inertial sensors which record the patient’s movements.”

Reaching Higher

Stroke Rehabilitation Exerciser helps patients along the road to recovery

Research
These sensors can now be put on by the patients themselves. Philips Research has developed lightweight, matchbox-sized wireless inertial sensor systems that wirelessly communicate with a computer. These systems are either attached to the athlete or lack the required accuracy. To make things easier, a special movement target and provides immediate feedback to the patient. Commercially available sensor systems are either too heavy or offer only a single perspective of the patient. Quantitative and objective data on the patient’s progress have hitherto not been possible in a laboratory scenario, while this new approach even enables the therapist to access data in the patient’s home environment.

Immediate feedback

Stroke patients may suffer from cognitive disabilities. Depending on the patient’s situation, there are a variety of feedback methods. Correct exercises can, for instance, be rewarded by visual or auditory cues. Data are transferred to the therapist’s station via the internet and the therapist can access historical data, watch an animated figure on screen or read charts and graphs on range of motion, jerk or velocity. The therapist can review the last few sessions within a matter of minutes. Because all patient movements are shown in 3D, the therapist can watch the patient’s movement or posture from the perspective which gives him the best view. This is a clear advantage over video camera-based systems, which offer only a single perspective of the patient. Quantitative feedback methods. Correct exercises can, for instance, be rewarded by visual or auditory cues. Data are transferred to the therapist’s station via the internet and the therapist can access historical data, watch an animated figure on screen or read charts and graphs on range of motion, jerk or velocity, illustrating the patient’s progress. The therapist can review the angle data of the joints in severable movement planes. Measurement accuracy meets the standards set by the physiotherapist in a visual inspection.

Greater patient motivation

The physiotherapist plays a crucial role in the adequate rehabilitation of a stroke patient but rehabilitation is often interrupted once the patient has left the clinic. The Stroke Rehab Exerciser extends the therapist’s reach by enabling further rehabilitation at home. In contrast to other innovative solutions emerging in this field, the Stroke Rehabilitation Exerciser can easily be integrated into a therapist’s existing therapy scheme.

Most importantly, the new approach increases a patient’s motivation to keep exercising, as feedback is immediate. Exercising on a daily basis, a patient may have the impression that he didn’t lift the cup faster than before, while the feedback will show him that he has actually made significant progress compared with the previous week’s exercises.

This new approach can greatly complement conventional therapy, increasing the effectiveness of unsupervised therapy through accurate information on patient progress. Therapists can view the results, enabling them to better plan face-to-face sessions. Rather than walking around the patient in order to assess current functions, the therapist simply reviews the last few sessions within a matter of minutes. Because all patient movements are shown in 3D, the therapist can watch the patient’s movement or posture from the perspective which gives him the best view. This is a clear advantage over video camera-based systems, which offer only a single perspective of the patient. Quantitative and objective data on the patient’s progress have hitherto only been possible in a laboratory scenario, while this new approach even enables the therapist to access data in the patient’s home environment.

Open innovation

A pilot trial on usability and accuracy with 15 patients was completed at a rehabilitation clinic in The Netherlands. Philips has also teamed up with a second clinic in The Netherlands as well as with a British rehabilitation research consortium, encompassing three university hospitals in the UK. A randomized controlled trial will take place at the end of next year to establish the medical effectiveness and cost-efficiency of the system.

Enabling novel approaches in home motor therapy, the Stroke Rehabilitation Exerciser may have a number of therapeutic applications and is also potentially beneficial for patients with musculoskeletal diseases.

Philips used its presence at the Sundance independent film festival in January, to raise funds for the American Heart Association – and raise awareness of the symptoms of sudden cardiac arrest (SCA), and the importance of cardiopulmonary resuscitation (CPR).

Celebrities learnt about SCA, CPR and defibrillation, and raise funds for the American Heart Association – and raise awareness of the symptoms of sudden cardiac arrest (SCA), and the importance of cardiopulmonary resuscitation (CPR). The Philips Simplicity Lounge at the film festival is a haven for celebrities, VIPs and media to take time out from hectic festival schedules to rest and relax. While at the lounge, visitors interact with a full array of technologies from domestic appliances, to semiconductors. This year, the lounge also offered celebrities the opportunity to learn how to save a life with an automated external defibrillator (AED).

Philips then put the signed “Matt” up for auction on eBay Giving Works, eBay’s dedicated program for charity listings. The money raised was also given to the American Heart Association’s Bystander CPR Training Programs. The funds will help the organization train citizens to recognize the symptoms of SCA and to perform CPR.

“Saving ‘Matt’ is a novel and eye-catching way for influential celebrities to learn about SCA,” said Vinay Nadkarni, M.D., American Heart Association volunteer and past chair of the association’s Emergency Cardiovascular Care committee: “Through efforts like this, Philips and celebrities are helping to demonstrate that using AEDs and performing CPR are simple, necessary skills to learn. Immediate, effective CPR and AED programs can save thousands of lives each year.”

Philips raises money for the American Heart Association by teaching celebrities about SCA and how to use AEDs.