Intelligent Robots
as the Backbone of Rehabilitation

Text / Hana You

The neurological rehabilitation team of Hualien Tzu Chi Hospital which embraces a fusion of Chinese and Western medicine concepts is actively committed to the major policy direction of restoring the ability of patients to get up and walk. The Department of Neurosurgery strives to help patients who are paralyzed or have lost their mobility as a result of severe strokes, brain injuries, and spinal cord damage to stand up and walk again by relying on stem cells, chips, and interdepartmental medical teams. The ultimate goal to assist them in walking practice, help them rediscover their dignity and regain control of their own lives, and thereby ease the burden of their caregivers.

The Department of Rehabilitation at Hualien Tzu Chi Hospital adopted Walking Rehabilitation Robots for its therapies in July 2018 (Director Liang Chung-Chao on the left).

Endogenous Stem Cell Therapy (G-CSF), which has been promoted by Superintendent Lin Shinn-Zong for more than ten years, increases bone marrow stem cell proliferation tenfold through the injection of granulocyte colony-stimulating factor (G-CSF) based on stem cell proliferation principles. The goal is to attract stem cells to the brain for the repair of injured spots by maximizing the magnetic effect. Since these cells autonomously differentiate into cranial nerve and blood vessel cells, which is highly conducive to the rapid recovery of brain injury patients, protection of nerves, and prevention of cranial nerve necrosis due to ischemia as a direct result of a stroke. These cells also have anti-inflammatory properties and are capable of inhibiting inflammation of tissue and cells at stroke locations.

The same principles apply to the utilization of Endogenous Stem Cell Therapy in patients afflicted with spinal cord injuries. In these patients, the therapy stimulates the proliferation and activation of their own cells and repairs damaged and ruptured spinal nerves. Nervous tissue functions are rapidly restored through Chinese herbal medicine and acupuncture which promote blood circulation and transforms stasis. The Department of Neurosurgery further adopted spinal cord stimulator implantation surgery in June 2019. This surgery not only facilitates the rehabilitation process in patients with disabled lower extremities due to spinal cord damage but can also be utilized for brain stimulation in comatose patients and pain treatment.

With a view to helping patients stand up and walk again, the Department of Rehabilitation at Hualien Tzu Chi University adopted the highly innovative Walking Rehabilitation Robot technology fused with smart healthcare concepts in July 2018. Clinical results clearly prove that the earlier bedfast patients leave their beds and start standing and walking again the lower is the loss of bone density, muscle strength, and muscle memory. Walking Rehabilitation Robots represent a perfect aid in this process.

In August 2019, the Department further adopted Upper Limb Rehabilitation Robots. In addition to the “Hand of Hope”, which is a valuable aid in the remote rehabilitation of the upper limb joints, the Department has acquired the first “Smart Board” nationwide which is applied in the local rehabilitation of upper limb joints. Mechanical aids and AI are valuable tools that help speed up the patient recovery process.

Exoskeleton robot technology was adopted in 2020. This technology is highly conducive to the rehabilitation process after spinal cord stimulator surgery in patients with spinal cord damage. Dr. Tsai Sheng-Tzung, Director of the Department

of Neurosurgery, describes how a young patient who was a paraplegic due to a traffic accident gradually regained his trunk control and the ability to stand up and walk for a short time with the aid of a walker after a four-month hospital stay during which he underwent spinal cord stimulator implantation surgery and a rehabilitation program consisting of a series of rehabilitation training exercises with the aid of an exoskeleton robot. These results were extremely heartening for the patient and the medical team.

By relying on mild electronic stimulation delivered by the stimulator to muscle groups controlled by nerves along the spinal column through electrodes, this young patient attempted to control

Lower Limb Exoskeleton Robots can assist patients afflicted with spinal cord injuries in repeated, high-intensity training of routine movements required for standing and walking. They are also valuable aids in the process of neural remodeling, acceleration of functional recovery, and restoration of a sense of normal pace and walking speed in patients.

leg lifting and lowering movements under guidance of a physical therapist. He gradually learned how to control his legs with electrostimulation through leg lifting and lowering and muscle strength training exercises. The training program with this exoskeleton robot enabled the patient to gradually regain his trunk control and his sense of coordination and balance. He relearned how to support his upper body while walking, slightly straighten his back which was hunched due to lack of muscle strength, and raise his head and look ahead. Director Tsai points out that despite the challenges posed by the operation of this robot, this rehabilitation training program can restore the patient's sense of rhythm required for the swinging movements during walking.

Dr. Liang Chung-Chao, Director of the Department of Rehabilitation, states that repeated high-intensity training, active participation, and true action orientation represent the key prerequisites for restoration of the ability to walk. " The rehabilitation team therefore designs a series of rehabilitation training exercises upon further assessment of patients with spinal cord damage who have undergone spinal cord stimulator implantation surgery. Smart robots are incorporated into muscle coordination, standing, and walking training as required according to the patient's needs. Hualien Tzu Chi Hospital has achieved very positive results in the field of rehabilitation therapies based on a fusion of Chinese and Western medicine concepts over the past two years. These results were presented to the public during the Healthcare+ Expo on December 4, 2022, and the annual conference of Taiwan Neurosurgical society.

After implantation of a spinal cord stimulator, a training program with an exoskeleton robot enables this young patient to gradually regain his trunk control and sense of coordination and balance and relearn how to support his upper body while walking under guidance of a physical therapist.