

## **Specialized Programs**

### **Functional Electrical Stimulation (FES)**

Electrical current has been applied to the body for decades to stimulate muscles. Recently, FES has been used in the treatment of spinal cord injuries. Electrical stimulation is a technique that utilizes electrical current via the surface of the skin or through wires placed within the paralyzed muscle itself. Depending on the purpose of the stimulation and the type of current used, electrical stimulation may be used to improve or restore function in persons with incomplete spinal cord injury. FES may also be used to initiate and control movement in paralyzed muscles following neurologically complete spinal cord injury. The benefits of electrical stimulation have been shown at research and clinical centers throughout the U.S., and have formed the basis for an exciting new field within rehabilitation medicine. FES can also be used in conjunction with EMG Biofeedback to improve motor control.

FES may also be used in cochlear implants for the ear. This enables individuals with sensorineural deafness to hear certain kinds of sounds. Implanted phrenic nerve stimulators may help people breathe without a respirator. FES is also being used to induce ejaculation in men with SCI who experience sexual dysfunction. FES is also being utilized to assist paralyzed individuals in regaining control of bladder function.

FES has also been utilized to increase both strength and upper extremity function for persons with tetraplegia. In addition, the NeuroControl Freehand System is now available to assist with increasing arm and hand function by combining an implanted FES unit with conventional, reconstructive hand surgery. For additional information, contact: NeuroControl Corporation, Cleveland, Ohio, (888) 333-4918.

### **FES Bicycle Ergometry/ Stim Master Program**

Functional Electrical Stimulation (FES) is a form of neuromuscular stimulation in which the peripheral nerve system and muscle are stimulated. The brain and spinal cord network are bypassed. Therefore it can be utilized to directly stimulate the muscles of individuals paralyzed by spinal cord injury.

The Stim master is a large FES unit. The unit is a computerized closed loop system that stimulates the muscles in the legs in order to elicit reciprocal contractions in a proper sequence for bicycling. There are specific muscles stimulated to correctly and successfully be able to manipulate the bicycle. Twelve electrodes are applied, two to each muscle group on each side in proper placement to elicit a muscle contraction. The muscle groups include the quadriceps, hamstrings and the gluteal muscles. In addition, individuals can undergo leg training in a progressive resistance exercise program as a preliminary to riding a specially designed bicycle.

Criteria to initiate a Stim master program include:

- Cleared from a M.D.
- Medically stable/vitals stable
- Orthopedically stable/fractures sites stable
- No cervical or thoracic orthotics
- Motivated for activity
- Skin clear and intact
- Functional range of motion bilateral upper and lower extremities
- Sound judgment and a functional cognitive status.

FES applied in the specialized Stim master program may play a significant role in reversing the multisystem deterioration associated with spinal cord injury. Benefits may include:

- Improve cardiovascular status
- Increased respiratory capacity
- Increased muscle bulk of the legs
- Increased bone density
- Increased circulation
- Improved skin integrity
- Decreased spasticity
- Increased strength in incomplete spinal cord injuries
- Improved self image and self esteem
- Assist with stress management.

\*\*\* It is important to note that the benefits are maintained only through continued cycling on the Stim master unit. If training is discontinued, the benefits are not maintained. Therefore, the **STIM MASTER IS A LIFETIME COMMITMENT.**

There are currently a number of exercise systems and available clinically, in the community and for home use. It is important to be aware that such machines are potentially dangerous if not used correctly. Additionally, not all people are candidates for a FES exercise program. Individuals interested in exercising with FES equipment should be evaluated by a physician specializing in SCI and should undergo an exercise program under the supervision of a clinician with expertise in the area of FES and paralysis.

Many clinical settings currently use FES exercise systems with what they consider to be positive results. For information about FES programs in your area, contact the FES Information Center at 1-800-666-2353. Also, one can contact Electrologic of America, Inc., 3035 Dryden Rd., Dayton, OH 45439, 800-758-3460, <http://www.electrologic.com>, [info@electrologic.com](mailto:info@electrologic.com).

In addition, the following organizations have the Stim Master bicycles available to the public.

Hospital for Special Care  
2150 Corbin Ave  
New Britain, CT  
860-832-6258

New Horizons  
37 Bliss Road  
Unionville, CT  
203-284-1045  
Contact Person: Jim Quick

Gaylord Hospital  
PO Box 400, Gaylord Farm Rd.  
Wallingford, CT 06492  
203-284-2800

Uconn Medical Center  
Storrs, CT  
860-486-1773

Several research groups in the U.S. and other countries have begun developing systems designed to help people with paralysis walk again. By using electrical stimulation in combination with computerized feedback system, scientists have been able to mimic the correct sequence of muscle activation used in walking. Feedback is a very important component of this process. The challenge lies in using FES to develop a practical, safe, workable system for an individual's daily use. To date, it still requires considerably more energy to walk using FES than to propel a wheelchair.

It is important to recognize that all FES programs may not be appropriate for all people with SCI. Researchers and clinicians currently working on FES systems are attempting to develop criteria to determine for whom FES will be most successful. In addition, an important consideration in the use of FES for motor control is getting one's muscles back in shape after months or years of disuse. Once a SCI has occurred, the muscles below the level of injury generally atrophy and circulation becomes impaired due to inactivity. Many people also have problems with osteoporosis, or brittle bones. If one intends to use FES to stand or walk on paralyzed limbs, it is necessary to recondition the body and get it accustomed to the use of external stimulation.

### **Electromyographic (EMG) Biofeedback**

Electromyographic (EMG) Biofeedback is technique that utilizes a learning procedure known as operant conditioning. The EMG attempts to teach the brain to more efficiently use existing neural cells in the brain and spinal cord. The goal is to restore function to people with

physical disabilities resulting from spinal cord injury, head trauma, stroke, cerebral palsy, and orthopedic injuries.

In spinal cord injury, EMG is used in two areas. Computerized EMG biofeedback can be used to increase the voluntary motor signal to and from the brain and the injured part of the spinal cord to the muscles. In order to accomplish this task, motor signals from muscles below the level of the injury are identified and displayed on a video screen. A learning procedure incorporating this feedback is then applied to teach the brain to find and use existing neural tracks in the spinal cord. This technique has been found to significantly improve motor signals and control in incomplete spinal cord injuries.

The other area of work in spinal cord injury is with establishing learned voluntary control of blood pressure in people suffering from postural hypotension. Changes in blood pressure and related physiological responses are measured and one learns utilizing the EMG to voluntarily control their blood pressure.

## **Aquatic Programs**

It has always been recommended that persons with spinal cord injuries attempt to remain active and healthy. One of the ways to accomplish this goal is to perform a regular exercise

program. You may go to an accessible fitness center and/or gym. However, another option is to perform exercises in a pool or an aquatic environment. The various properties of water enable individuals to exercise in a comfortable, fun and gravity free environment. Some people find that because of the buoyancy property of water that it is so much easier to move, walk, sit upright and exercise. There are two types of “pools”. One pool is considered a “fitness” pool. The temperature of the water can vary from 75 to 85 degrees. This is an excellent place to challenge the cardiovascular system by performing various exercises and/or swimming activities. The other type of pool is the “therapeutic” pool. The temperature of the water can vary from 89 to 93 degrees. You will need permission from a medical doctor to ensure that you are medically safe to perform exercises in the warmer temperatures. This is an excellent place to address a variety of issues, like complaints of pain, stiffness and weakness. Both pools may dramatically help one to move better and become more independent. Furthermore, at some facilities there are therapists trained in aquatic therapy that can help to establish an aquatic exercise program for you. Some of the available and accessible pools include the following:

Hospital for Special Care  
Aquatic and Fitness Community Center  
2150 Corbin Ave  
New Britain, CT 06053  
860  
Contact Person: Dorothy Villiano,

Gaylord Hospital  
PO Box 400  
Gaylord Farm Road  
Wallingford, CT 06492  
203-284-2800

In addition, one may contact any and all of your local YMCA's.