

## **FUNCTIONAL ELECTRICAL STIMULATION FOR THE LOWER EXTREMITY**

### **Information for Patients and Families**

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### **What is Functional Electrical Stimulation (FES)?**

Functional electrical stimulation (FES) is a technique that causes a muscle to contract through the use of an electrical current. This might sound strange, but in fact, the body naturally uses electrical currents to make muscles move. Normally, when a part of the body needs to move, the brain sends electrical signals through the nervous system. The nerves, acting like electrical wires, relay these signals to the muscles, directing them to contract. This contraction causes the body part - for example, the ankle, wrist or elbow - to move in a controlled, deliberate fashion.

After a stroke, some of these electrical signals do not function as well as they should. This causes patients to have difficulty walking and coordinating movements. It can also cause pain and stiffness.

When using FES as an intervention after a stroke, the therapist applies an electrical current to either the skin over the nerve, or over the bulk of the muscle, and this will cause a muscle contraction.



FES allows muscles that have been paralyzed or partially paralyzed by stroke to move again. The electrical stimulation applied to the muscle is controlled, so that the movement will be useful rather than random. FES devices translate input controlled by the patient into patterns that produce a desired motion in the paralyzed muscles.

This module will look at the use of FES for loss of function, pain, or spasticity (stiffness) of the legs and feet. StrokEngine also provides information on Functional Electrical Stimulation of the Hemiplegic Shoulder and Functional Electrical Stimulation of the Upper Extremities.

## **Are there different kinds of FES?**

Yes. You may see different names, including functional electrical stimulation, functional neuromuscular stimulation, and electrical stimulation. But they all have the same goal: to stimulate muscle contraction which in turn may lead to an increase in function, strength, and movement as well as a decrease in pain and spasticity.

FES can be used on different parts of the body (arms, legs, shoulders, etc) and also on specific muscles in order to achieve different goals. For example, in the lower extremities, a therapist may apply FES to the quadriceps (muscles of the thighs) in order to help the patient walk.

## **Why use FES on the legs after stroke?**

Loss of leg function, movement, and strength are common after a stroke. This occurs because muscles become paralyzed, and cannot receive electrical impulses from the brain. This impairs walking and standing, and can also cause pain and spasticity. FES may be useful for increasing leg function and preventing pain and dysfunction after a stroke.

## Does it work for stroke?

Researchers have studied how FES can help patients with stroke through its effects on muscles in the legs and feet:

### **Strength of muscle contraction**

FES was shown to strengthen muscle contractions in individuals 1 to 6 months post-stroke.

### **Walking**

FES showed some improvement in walking in patients 1 to 6 months post-stroke. However, research indicates that FES is more useful more than 6 months post-stroke.

### **Perceived health status**

Studies showed that FES for the lower extremities was not effective in improving the perceived health of patients more than 6 months post-stroke.

### **Spasticity (stiffness)**

Research showed that when combined with other therapy, FES caused a reduction in spasticity when used for patients more than 6 months post-stroke.

### **Range of motion (movement of joints)**

FES was shown to be moderately effective in improving range of motion for individuals more than 6 months post-stroke, when combined with other therapy.

### **Functional Ambulation (mobility)**

There was some evidence that FES improved ability to move around more easily in patients more than 6 months post-stroke.

### **Lower extremity coordination**

There was improvement in knee coordination in patients more than 6 months post stroke, however no improvement was seen for general coordination of the legs and feet.

### **Activity level**

Studies did not show improvement in level of activity of patients more than 6 months post-stroke after using FES.

## **Balance**

Research showed some evidence that FES did not improve balance in individuals more than 6 months post stroke.

## **What can I expect?**

Small square stickers (electrodes) are placed over the centre of the bulk of the muscle to be stimulated. Wires connect the electrodes to a stimulator, a small machine that produces the electrical current. The stimulation is usually started at a very low level, causing a tingling "pins and needles" feeling on the skin. The current will then slowly be increased after each stimulation, until it is strong enough to make the muscle contract. This level (the smallest current necessary to make the muscle contract) will be used for the FES treatment.



Although some people find the treatment uncomfortable, it is usually well tolerated. FES may give some discomfort, but it is virtually painless. Treatment times may vary, however, the time is usually divided into a number of daily sessions. FES treatments are usually done for 30 - 45 minutes, but once you are set up, you can typically perform the treatments on your own or with a family member.

## **Are there any side effects/risks?**

There are few risks that come with the use of FES. Some people may find that certain types of electrical stimulations are irritating, but this can be easily fixed by changing the level of the current. The electrodes can irritate the skin, but this is uncommon. Using non-latex hypoallergenic electrodes can often solve this problem. After the treatment, there may be pink marks left on the skin where the electrodes were placed, but these usually fade within an hour. Although it is very

rare, this type of therapy can increase spasticity (muscle tightness).

**NOTE: People with epilepsy, poor skin condition, hypersensitivity to the electrical stimulation, cancer, and cardiac pacemakers should not receive FES treatment.**

## Who provides the treatment?

Physical therapists or occupational therapists will usually provide FES treatment. However, due to the long duration of the stimulation, it is possible for the treatment to be done at home after discharge from the hospital. This will require you to have a stimulator machine at home. If you are provided with a home stimulator, family members or friends will be given instructions on how to assist with treatments. Usually, once the electrodes are placed, the rest of the procedure is very simple. To operate an FES machine, you simply switch it on and increase (slowly and gradually) the intensity of the current on a knob - just like switching on a radio and increasing the volume.

**NOTE: Consult with your therapist or medical professional on the exact use of specific models of FES equipment.**

## How many treatments do I need?

Some patients continue to use FES for many years. To maximize the benefits after stroke, it should be used for at least 6 weeks.

## How much does it cost? Does insurance pay for it?

Although the cost of a FES stimulator machine varies, some systems are relatively inexpensive. Rental or lease options reduce the cost to the equivalent of 1 or 2 clinical visits per month. Some insurance plans cover the purchase or rental of such equipment. Check with your insurance company.

## Is FES for me?

There is clear evidence that there are benefits to using functional electrical stimulation in comparison to regular therapy. These benefits include increased force of contraction and improved walking. However, in terms of general activity level after stroke, balance, and perceived health status, FES was not shown to be more effective than conventional therapy. So overall, FES is an effective treatment you may want to consider after a stroke. If you are interested in learning more about FES, speak to your rehabilitation provider about the possibility of using this treatment.

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