

## Exercise and FES cycle fact sheet

FES = Functional Electrical Stimulation.

- An electrical current is passed through paralysed muscle causing it to contract.
- The electrical current uses the peripheral nerves to pass the current to the muscle (the peripheral nerves must be intact for a contraction to occur)
- In patients with a COMPLETE spinal cord injury, this contraction is not voluntary and cannot be replicated when the stimulation is removed.
- In people with an INCOMPLETE spinal cord injury, this contraction may be stronger than what can be performed without the stimulation.

FES cycling uses co-ordinated electrical stimulation to create a cycling pattern. This cycling pattern exercises the large muscles of the legs as running or cycling would do in a person who doesn't have a spinal cord injury.

The FES cycle at Royal Talbot is called the RT300 - SLSA. It is made by a company called Restorative Therapies. You can see more information about the cycle on the website: <http://www.restorative-therapies.com/>

### What does FES cycling do?

Research has shown some positive benefits:

- Increase in bulk of stimulated muscles
- Increase in bone density in some leg bones
- Reduced body fat content
- Improved cardiovascular health (fitness training)
- Reduced risk of diabetes (improved glucose tolerance)
- Reduced spasticity in stimulated muscles
- Maintained flexibility

Feedback from people who use FES cycling:

- Feel happy seeing leg muscles contracting and exercising
- Feel healthy doing regular exercise
- For some people with very high injuries, FES cycling is the only way to exercise at an intensity that provides a fitness benefit

There are also some risks:

- Some people suffer from Autonomic Dysreflexia when they use the cycle.
- Some people have more violent spasms after using the cycle (as their leg muscles get stronger, their spasms cause more problems)

- You might get other injuries to your skin or joints if you are not set up on the cycle properly (Blisters, pressure ulcers, strained joints, broken bones etc)

### **Who will benefit from FES cycling?**

- People with incomplete injuries who may see improvements in their ability to voluntarily use their muscles
- People with an upper motor neurone lesion
- People who cannot undertake any other form of cardiovascular exercise

### **Will FES cycling help recovery?**

There is no evidence that FES cycling will stimulate motor recovery if you are not able to contract any muscles below the level of your injury.

If you have an incomplete injury and can contract muscles but they are weak, FES cycling is one way to promote use of the intact pathways and train your muscles to work better. Other activities you undertake in therapy sessions also promote the use of these pathways.

### **How much FES cycling do I need?**

Research shows you need to use the cycle 3 times per week for 30 minutes at a time to get any benefits.

The FES cycle must be set up to provide the right intensity for you to get a training effect.

Like all forms of exercise, the benefits of FES cycling are only retained while you keep cycling. (If you stop doing weights sessions, you will get weaker. If you stop doing cardiovascular training, you will lose fitness)

### **How do I get to use the FES cycle?**

First step is to discuss it with your physiotherapist. They can help you determine whether FES cycle is appropriate for you. (For more information about this, read the 'Definitions' section at the end of this fact sheet). They will also make sure you understand the benefits and limitations of the FES cycle before you start on a program.

Your physiotherapist may wish to undertake some testing of your reflexes and trial electrical stimulation on your leg muscles to see if it will stimulate a contraction before trying the FES cycle.

Once you and your physiotherapist have determined it is suitable for you:

- Initial trial with physiotherapist is booked (this would be considered your physio treatment for the day it is booked)
- Follow up sessions with your physiotherapist are booked as needed
- You work towards the goal of being able to use the machine without your physiotherapist (often this requires teaching a friend or family member how to help you set up on the machine)

- Each time you use the machine with your physiotherapist, it will be considered your physio treatment for that day. (Remember you have other physio goals to work on as well, it is not appropriate that every session is taken up with using the FES cycle).
- When your physiotherapist signs off that you are safe to use the FES cycle without them, you can book in to use the machine at a time when you are free.
- You will be asked to sign the FES cycle agreement. This indicates you understand the benefits and limitations of the machine and that you agree to abide by the terms of use.

### **What happens when I leave inpatient rehabilitation?**

The FES cycle at Royal Talbot is only for use by inpatients. You will not be able to come back to use the FES cycle once you are discharged.

An FES cycle for use at home costs approximately \$20,000. There is a yearly cost of \$850 for the disposable electrodes.

#### *If you are covered by compensation:*

When you have shown you are motivated to use the FES cycle (3 times per week for 30 minutes) your physiotherapist will discuss the clinical benefits that apply to you and what other options you have to exercise for health and fitness. If appropriate, your physiotherapist may recommend purchase of a cycle for you to use at home. The FES cycle is new technology on the Australian market. At this stage, the compensation bodies have not funded purchase of a cycle for any patient although some cycles have been funded for an extended trial in the community.

#### *If you are not covered by compensation:*

There is not funding available to purchase an FES cycle. If you have used the cycle while you are in hospital and feel strongly that it is of benefit to you, then you might consider purchasing one to use at home. Keep in mind that this is just one option in terms of exercise equipment and it is very expensive. You may want to discuss this further with your physiotherapist to make sure you have considered all your options. Some people have used fundraising to purchase an FES cycle. However, there are many other costs associated with equipment that you need to live with a spinal cord injury and not all costs are covered by government funding. This purchase needs to be considered in the broader context of your financial situation.

### **Where can I get more information?**

- Your physiotherapist or spinal consultant
- SCIRE – Spinal Cord Injury Rehabilitation Evidence website:  
<http://www.icord.org/scire/chapters.php>
- Restorative Therapies website:  
<http://www.restorative-therapies.com/>

## **Why exercise?**

Regular exercise is important for general health and fitness. Exercise can help prevent some of the common health problems seen in the general community:

- Obesity
- Heart disease
- Diabetes
- Osteoporosis

People who have a spinal cord injury are also at risk of some other problems that are directly related to their injury:

- Pain
- Pressure ulcers
- Spasticity
- Loss of flexibility
- Poor circulation
- Higher rate of fractures (broken bones)

Regular exercise can help to reduce the risk of these problems.

## **How can I exercise?**

There are many forms of exercise that may be appropriate for you. For most people this is some form of upper limb training, for example: arm cycle ergometer, resistance training, wheelchair pushing (intervals or roller training), handcycling, swimming.

Your physiotherapist can work with you to explore options for exercising. You may also wish to seek help from the Community Integration and Leisure Department.

FES cycling is another form of exercise suitable for people with a spinal cord injury. You can read the FES cycling fact sheet for more information.

## **What scientific evidence exists that exercise works?**

### *Aerobic training*

SCIRE (Spinal Cord Injury Rehabilitation Evidence website): There is strong evidence that tetraplegics (quadriplegics) and paraplegics can improve their cardiovascular fitness and physical work capacity through aerobic exercise training which are of moderate intensity, performed 20-60 minutes per day, at least three times per week for a minimum of six to eight weeks.

### *Strength training*

SCIRE: Resistance training at a moderate intensity at least two days per week also appears to be appropriate for the rehabilitation of persons with SCI.

### *FES cycling*

SCIRE: There is some evidence that interventions that involve FES training a minimum of 3 days per week for 2 months may improve muscular endurance, oxidative metabolism, exercise tolerance, and cardiovascular fitness.

### **How much exercise do I need to do?**

Moderate intensity (50-60% Max predicted heart rate) aerobic arm training, performed 20–60 min/day, three days/week for at least 6-8 weeks, is effective in improving the aerobic capacity and exercise tolerance of persons with SCI.

Vigorous intensity (70%–80% Max predicted heart rate) exercise leads to greater improvements in aerobic capacity than moderate intensity exercise.

Resistance training (weights and theraband exercises) should be performed at a moderate intensity at least twice a week.

Specific exercises to strengthen the muscles around your shoulder (including your rotator cuff) are recommended to reduce the risk of shoulder pain.

### **What are the risks?**

Common problems experienced by people with spinal cord injury include:

- Overuse injuries of the shoulder, elbow or wrist (usually caused by poor technique, too much weight or too many repetitions)
- Skin problems (usually caused by friction or moisture from sweating)
- Fractures of the lower limbs (caused by forceful stretching)

Your physiotherapist can provide advice about an appropriate program that minimises these risks for you. They can also provide treatment and advice about modifying your program if you do develop problems.

### **More questions?**

Ask your physiotherapist

**Definitions:**

COMPLETE (ASIA A) - No clinical sign of signals travelling up or down the spinal cord. No voluntary movement is possible below the level of injury and no feeling is preserved at the sacral nerve roots (sensation to the anus).

INCOMPLETE (ASIA B, C or D) – Clinical sign of some signals travelling up and down the spinal cord.

ASIA B – no voluntary movement possible but feeling is preserved right down to the sacral nerve roots (sensation to the anus).

ASIA C – some voluntary movements are possible below the level of the injury. Muscle contractions are weak.

ASIA D – voluntary movements are possible below the level of the injury. Muscle contractions are stronger but are not 'normal' strength.

**UPPER MOTOR NEURONE LESION**

- Damage has occurred directly to the spinal cord.
- The spinal nerves coming off the cord and passing to the limbs are intact. Increased reflexes and spasticity are seen.
- Electrical stimulation to get muscle contraction is possible.

**LOWER MOTOR NEURONE LESION**

- Damage has occurred to the spinal nerves after they have come from the spinal cord.
- This occurs in injuries below T12 when damage occurs to the Cauda Equina (Horses Tail).
- Decreased reflexes and flaccid muscles are seen.
- Electrical stimulation to get muscle contraction is not possible.

*EXCEPTION* - Damage to the spinal nerve at the level of the injury can sometimes occur in traumatic spinal cord injury. This is also a lower motor neurone lesion but is limited to one level. Stimulation to get muscle contraction is not possible at this level but is possible below this level.

**LEVELS OF EVIDENCE**

Not all clinical research is of the same quality. If certain factors are not considered in the research method, the findings may be influenced by bias or may be the result of random chance.

Scientific research is evaluated by set criteria to determine how much weight the findings of a study should be given. One method of evaluation is the PEDro tool which provides a rating in Levels. (Level One = highest). (More information at [http://www.pedro.fhs.usyd.edu.au/scale\\_item.html](http://www.pedro.fhs.usyd.edu.au/scale_item.html)).

If a study has been undertaken using the accepted best methods (usually a Randomised Controlled Trial - RCT), then the findings of the study are given significant weight and considered to be Level One evidence.

If the study was undertaken using more dubious methods, then the findings are given less weight and considered to be of a lower level of evidence.