# Functional Electrical Stimulation (FES)

# Clinical Service at the National Clinical FES Centre

# Salisbury District Hospital

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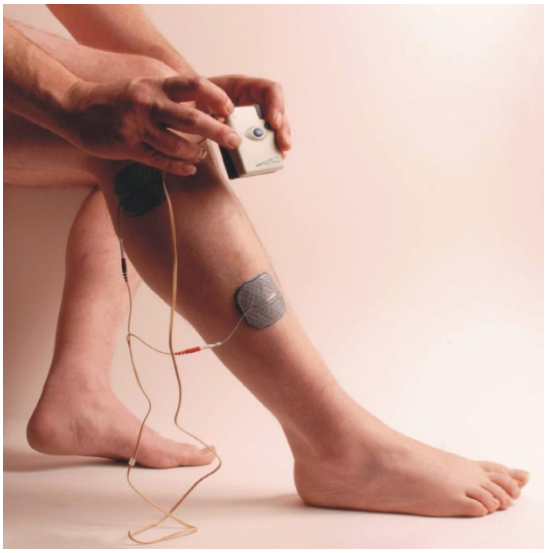
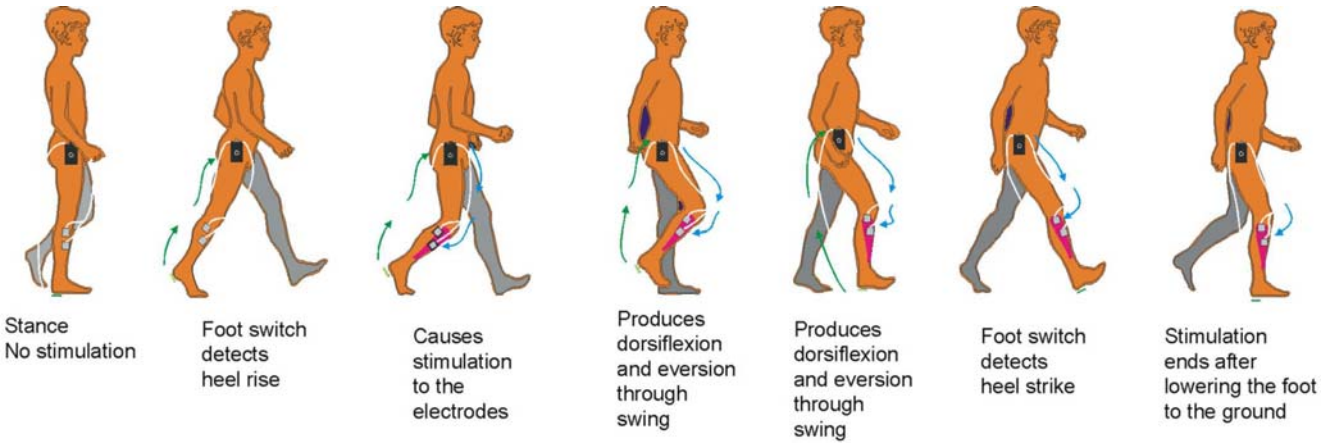
## Correction of Dropped Foot and other gait problems

- Dropped foot is the inability to lift the foot as the leg swings forward when walking. It is caused by weakness in the muscles that lift the foot and / or excessive activity (spasticity) in the antagonist muscles
- Dropped foot increases the risk of falls, reduces mobility and participation.
- Functional Electrical Stimulation (FES) is the production of functional movement in paralysed muscles by the application of small pulses of electrical current to the nerves that supply them.
- The Odstock Dropped Foot Stimulator (ODFS) stimulates the common peroneal nerve using self adhesive skin electrodes mounted on the lower leg. Stimulation is timed to the walking cycle by using a pressure switch placed in the shoe under the heel. Stimulation begins when the heel is lifted from the ground and ends just after heel strike. Stimulation causes the foot to lift and stabilises the ankle when it is returned to the ground
- The ODFS is primarily used as a long term orthosis. However, therapeutic training benefit has been demonstrated in people who have a dropped foot due to stroke, spinal cord injury and some people with MS.
- The main effects of the ODFS are:
    - Increased safety due to reduced tripping and increased stability in stance
    - Increased walking speed and range
    - Reduced effort of walking
    - Greater confidence and independence
- The ODFS is a practical device with compliance with treatment at one year of 86%
- An implanted dropped foot stimulator is available for people expected to obtain long term benefit from FES
- FES can be used to assist in any neurological condition resultant from an upper motor-neuron lesion. This includes stroke, MS, SCI, TBI, CP, HSP and Parkinson's Disease

## Operation of the ODFS



Self adhesive electrodes are placed on the skin over the common peroneal nerve at its most superficial point, over the head of fibula. Stimulation causes dorsiflexion and eversion. By choosing electrode positions and stimulation parameters knee and hip flexion can be improved, further assisting gait. The stimulation is timed using a foot switch placed in the shoe. Stimulation begins when weight is taken from the switch and ends just after heel contact, lowering the foot to the ground. Stimulation feels like pins and needles. Most people quickly become used to the sensation. The foot switch can be easily moved from shoe to shoe enabling any footwear to be used.




The most important factors in successful use of the

ODFS are:

- Appropriately trained clinical staff
- Thorough patient training in the use of FES
- Regular follow up to ensure continued benefit from FES
- Prompt response to any problems

## Development of the ODFS

- The Odstock Dropped Foot Stimulator (ODFS) was developed under funding from the Department of Health between 1988 and 1995 at Salisbury District Hospital.
- The Device was evaluated for dropped foot in chronic stroke by RCT 1993-1995[1, 2]. Additional case series data was collected from patients with MS and incomplete spinal cord injury[3]. The trial demonstrated:
    - Increased walking speed when the ODFS is used
    - Reduced walking effort
    - Reduced spasticity
    - Increased quality of life
    - Significant cost utility gain (QALY analysis)
- In 1996 the clinical service modal and evidence for the ODFS were presented to the Development and Evaluation Committee of the South and West Regional Health Authority who subsequently recommended the treatment for use in the NHS for patients with dropped foot due to upper motor neurone lesions[4, 5]
- A clinical service for the ODFS was established from 1996.
- Regular training courses for clinicians to use the ODFS have been run since September 1995
- Audit of the clinical service confirms the results of the RCT and demonstrates a training effect from using the ODFS and a high level of treatment compliance (86% at one year)[6, 7, 8, 9]. The main reasons patients choose to continue to use the ODFS are:[10]
    - Reduced effort of walking
    - Increased confidence when walking
    - Reduced trips and falls
- An RCT of the use of the device with secondary progressive MS demonstrated increased walking speed with the device, 72% reduction in falls and a significant positive impact on activities of daily living in comparison to a group that received physiotherapy[11, 12]
- A pilot study using the ODFS with people who exhibited freezing of gait due to Parkinson's disease indicated that the device may have a significant training effect[13].
- Use of the ODFS was recommended in the Royal College of Physicians Clinical Guidelines on Stroke (2000)[14]
- In excess of 2000 patients have received treatment for dropped foot using FES in Salisbury since the service began. Over 4000 have received treatment elsewhere in the UK
- In 2007 the UK's first implanted FES clinical service was begun using the STIMuSTEP implanted dropped foot stimulator[15]
- In January 2009 NICE published guidelines recommending FES for dropped foot[16]

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## Clinical Procedure

All patients must be referred by their GP or Medical Consultant and referrals are made to the Head of Department, Prof. Ian Swain, Odstock Medical Limited, National Clinical FES centre, Salisbury District Hospital, Salisbury, Wiltshire, SP2 8BJ, UK. The referral letter is reviewed by Prof. Swain or in his absence by experienced clinical staff at the National FES Centre. If it is judged that FES might be a suitable treatment an appointment is made for an initial assessment. Some times further details are requested form the referring clinician.

At the initial assessment clinic, the above referral criteria are checked. An additional acceptance criterion is the ability to tolerate the sensation of electrical stimulation. A FES device is tried and in most cases an improvement in gait is immediately apparent. Following discussion with the patient a decision whether to proceed with treatment is made. In some cases the clinician may judge that a period of electrical stimulation training is required in order to strengthen muscles, reduce spasticity or to accustom the patient to the sensation of electrical stimulation. Stimulation exercises may be started at this appointment if time permits. Otherwise exercises will be set up at another appointment.

The ODFS is fitted over two clinic sessions on consecutive days. On the first day the user is taught how to apply the device while on the second day their ability to do so is assessed and further training given if necessary. Use of the stimulator is increased gradually over 2 to 3 weeks until it can be used all day. Follow up is made at 6 weeks, 18 weeks, 45 weeks and 72 weeks from first use and then every 6 months or yearly depending on the patient's condition, for as long as the device is used. If users experience problems they are encouraged to contact the clinic so advice can be given, equipment repaired or extra clinic sessions arranged if necessary.

In the case of more complex movement problems where more than one muscle group are stimulated, treatment is often started with a single channel ODFS and the second channel introduced at the 6 or 18 week follow up assessment once the user has become accustomed to FES.