

# A clinical investigation of a novel functional electrical stimulation system

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		<input type="checkbox"/> Protocol
<b>Registration date</b> 13/01/2017	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan
		<input type="checkbox"/> Results
<b>Last Edited</b> 13/01/2017	<b>Condition category</b> Nervous System Diseases	<input type="checkbox"/> Individual participant data
		<input type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

A stroke is a serious condition where the blood supply to a part of the brain is cut off, usually by a blood clot blocking an artery (ischaemic stroke) or a bleed (haemorrhagic stroke). Around 150,000 experience a stroke each year in the UK, leaving large numbers of people living with the consequences of a stroke. Many stroke victims suffer from long-term complications depending on the area of the brain that is affected, which can affect their ability to move, speak or even their cognitive function (memory loss, difficulty reasoning and confusion). One of the most common complications of a stroke is weakness or paralysis on one side of the body. At least half of the people who survive a stroke experience reduced function in one of their arms. A number of studies show that repeating arm exercises can help to restore function, however this not much time is spent on this in current therapy on offer. Functional electrical stimulation is a treatment that uses small electrical pulses to cause muscle contractions, sequenced in such a way as to assist with the performance of functional tasks. This technology offers the potential to deliver high doses of therapy, but without needing a therapist to be continuously present. A number of studies have shown that its use may help to improve arm function following a stroke. However, there are limitations with current FES devices. For instance, many of the devices are difficult to use effectively with people who have weakness in multiple joints, while others are inflexible in the way in which they are controlled. To address this, a new FES system (FES-UPP system) has been designed to support people with arm problems following a stroke to practice functional tasks. The system has sufficient channels of stimulation to generate muscle contractions around all arm joints, and it uses information from movement sensors to decide which muscles to stimulate and when, offering flexibility in control. The aim of this study is to explore whether this FES system is able to support people with stroke to perform arm exercises they would otherwise be unable to perform unaided and how usable therapists find the system.

### Who can participate?

Practicing therapists working with stroke patients and adults who have had a stroke and are experiencing arm weakness.

### What does the study involve?

People with stroke take part in up to six sessions using the FES-UPP system. During one of the sessions (whichever is most convenient for the participant) participants are asked how they are

finding the system and are assessed to find out how well they can perform arm exercises both when using the system and when not using the system, to see whether the system is effective in supporting people to practice these activities. Information on how much practice can be delivered using the system and any practical issues, such as how long it takes to set up the system, are also recorded.

Therapists are training to use the FES-UPP system. At the end of the training, they are invited to complete two questionnaires, one on the training process and one on the system itself. They are then invited to use the FES-UPP system as required with up to 10 stroke patients. At the end of the study, they are invited to attend an interview addressing their perceptions of the system and the study design, as well as complete another questionnaire on the system design.

What are the possible benefits and risks of participating?

There are no notable benefits or risks involved with participating.

Where is the study run from?

1. Salford Royal Hospital (UK)
2. Bury Community Stroke Team (UK)
3. Salisbury District Hospital (UK)

When is the study starting and how long is it expected to run for?

June 2013 to September 2017

Who is funding the study?

National Institute for Health Research (UK)

Who is the main contact?

Ms Helen Luckie

H.M.Luckie@salford.ac.uk

## Contact information

### Type(s)

Public

### Contact name

Ms Helen Luckie

### Contact details

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## Additional identifiers

### Protocol serial number

32126

# Study information

## Scientific Title

A clinical investigation of a novel functional electrical stimulation system (FES-UPP) for early post-stroke upper limb rehabilitation in 3 clinical settings

## Study objectives

The aim of this study is to:

1. Verify that, under normal conditions of use, the performance characteristics of the device are those intended by the manufacturer
2. Determine any undesirable side effects and assess whether these constitute risks when weighed against the intended performance of the device

## Ethics approval required

Old ethics approval format

## Ethics approval(s)

Yorkshire & The Humber - Leeds West Research Ethics Committee, 07/09/2016 , ref: 16/YH/0258

## Study design

Non-Randomised; Interventional; Design type: Treatment, Device

## Primary study design

Interventional

## Study type(s)

Treatment

## Health condition(s) or problem(s) studied

Specialty: Stroke, Primary sub-specialty: Rehabilitation; UKCRC code/ Disease: Stroke/ Cerebrovascular diseases

## Interventions

People with stroke (PwS)

PwS will be recruited at one of the three clinical sites. Each participant will take part in up to eight sessions, lasting approximately one hour over a period of up to six weeks from the first session. There will be two types of session, Type A and Type B. In a Type A session, the therapist and PwS will first agree on one or more activities to be practiced using the FES-UPP system. An activity may be one that has been used in a previous session (where applicable), or may be a new one. Activities will be selected based on clinical assessment to be difficult, or impossible for the PwS to perform unaided. The therapist will then use the FES-UPP system to set up the sequenced patterns of stimulation to multiple muscles to support the PwS in performing each of the functional activities, and to provide appropriate feedback and/or instruction to the PwS. The PwS will then be encouraged to practice, under supervision, each of the FES-supported activities, until the PwS indicates a desire to stop, or 1 hour has passed (whichever is shorter). During each session, the system will log the nature and amount of FES therapy delivered. At site A, for PwS 6-10, a de-weighting system will be made available for use, at the therapist's discretion, in combination with FES-UPP. Type B: Under normal circumstances this will take place on the second, third or fourth of the sessions with FES-UPP. At this session, in addition the PwS and the therapist, a member of the research team will also be present. The purpose of the type B session

is to address the primary research question “does use of the FES-UPP enable PwS to perform a wider range of functional activities, and/or perform the same activities in an improved way?” During this session, the researcher will video each attempt at each activity for later analysis. The researcher, therapist and PwS will agree on two suitable unilateral activities, one or both of which may have been used in a previous session. The researcher, in consultation with the therapist, will then use the FES-UPP system to fine tune the setups to allow a robust attempt at the activity that is suitable for recording on video. They will then use the software to set all stimulation levels in each phase to zero and ask the PwS to attempt the activity unaided (note that the attempt should be completely unaided by FES, therapist or de-weighting system). Next, the therapist will re-instate the FES stimulation levels and invite the PwS to attempt the activity with FES support (note that the attempt should be with only FES support i.e. without therapist or de-weighting support). The process will then be repeated for the second activity. In addition, at a convenient session, each PwS will be assessed on upper limb spasticity, impairment, as well as neglect and cognitive ability. At the end of the last session, each PwS will be invited to complete a short questionnaire on the system.

### Therapists

Therapist participants will report their be trained to use the FES-UPP system. At the end of the training they will be invited to complete two questionnaires, one on the training process and one on the system itself. They will then be invited to use the FES-UPP system as required with up to 10 PwS (see above). Research team members will observe one session per participant for later usability analysis. At the end of the study, therapist participants will be invited to attend an interview addressing their perceptions of the system and the study design, as well as complete another questionnaire on the system design.

## Intervention Type

Device

### Primary outcome(s)

Upper limb function, is assessed with and without FES at a convenient time over the course of the planned therapy sessions (ideally sessions 2, 3 or 4).

### Key secondary outcome(s)

Patient outcomes:

1. Spasticity is measured using the Modified Ashworth Scale at week 1
2. Upper limb impairment is measured using the Fugl-Meyer UE Scale at week 1
3. Neglect is measured using the Star Cancellation Test at week 1
4. Cognitive ability is measured using the Montreal Cognitive Assessment at week 1
5. Therapy delivered is measured using the FES-UPP software at all sessions
6. User perception of the system is measured using the Patient Participant Questionnaire at week 6 (or earlier, if completed 8 sessions before 6 weeks, or exit study for other reason)

Therapist outcomes:

1. Therapist characteristics are measured using the therapist profiling questionnaire at baseline
2. Views on the training is measured using the Training Questionnaire at baseline
3. Perceptions of the system is measured using the Technology Acceptance Model at the end of training and at the end of training and at the end of study baseline and 5 months
4. User perspective is measured using a semi-structured interview at 5 months

## Completion date

01/09/2017

# Eligibility

## Key inclusion criteria

Therapist participants inclusion criteria:

1. Practicing therapist working with stroke patients
2. Successfully completed the training to use FES-UPP

Person with stroke participant inclusion criteria:

1. Aged 18 or over
2. Evidence of a clinical stroke, as defined by the WHO "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin"
3. Impairment of one or both upper limbs, for which they are, or plan to be, participating in therapy
4. Medically fit to engage in active therapy sessions
5. Less than 6 months post-stroke
6. Sufficient level of cognition and communication to comply with the assessments and participate in the study. This will be assessed in the informed consent process, either involving the person with stroke themselves, or declaration of personal consultee where the consent trained professional, therapist and personal consultee are in agreement that it is appropriate for that person to take part in the study
7. Potential person with stroke (pws) participant expected to remain under the care of one of the services (See above for details on the three services) for sufficient time to allow at least 2 sessions with FES-UPP to be completed

## Participant type(s)

Mixed

## Healthy volunteers allowed

No

## Age group

Adult

## Lower age limit

18 years

## Sex

All

## Key exclusion criteria

Participant with stroke exclusion criteria:

1. Any neurological condition that effects voluntary control of upper limb movements, such as Myotonic Muscular Dystrophy, Polio, Multiple Sclerosis, unresolved peripheral nerve injuries
2. Complex regional pain syndrome
3. Orthopaedic conditions that restrict joint range
4. Severe Rheumatoid Arthritis
5. Epilepsy not adequately controlled by medication
6. Cardiac pacemaker or other active implanted device
7. Metal external fixator implant

8. Cancerous tissue/malignancy in the region of stimulation
9. Pregnancy
10. Skin rash, allergy, broken skin, wound or poor skin condition in an area where electrodes are to be placed
11. Requiring an interpreter

Criteria to be discussed with the Research Team:

1. Painful shoulder, or pain in the upper limb
2. Participating in another study
3. Fixed flexion contracture or excessive spasticity in more than 2 muscles
4. Any medical condition other than those listed above that may affect the response to ES

**Date of first enrolment**

27/10/2016

**Date of final enrolment**

31/03/2017

## **Locations**

**Countries of recruitment**

United Kingdom

England

**Study participating centre**

**Salford Royal Hospital**

Stroke services

Stott Lane

Salford

United Kingdom

M6 8HD

**Study participating centre**

**Bury Community Stroke Team**

Holcombe House

Fairfield Hospital

Rochdale Old Road

Bury

United Kingdom

BL9 7TD

**Study participating centre**

**Salisbury District Hospital**

Outpatient services

Odstock Medical Ltd  
The National Clinical FES Centre  
Salisbury  
United Kingdom  
SP2 8BJ

## Sponsor information

### Organisation

University of Salford

### ROR

<https://ror.org/01tmqtf75>

## Funder(s)

### Funder type

Government

### Funder Name

National Institute for Health Research

### Alternative Name(s)

National Institute for Health Research, NIHR Research, NIHRresearch, NIHR - National Institute for Health Research, NIHR (The National Institute for Health and Care Research), NIHR

### Funding Body Type

Government organisation

### Funding Body Subtype

National government

### Location

United Kingdom

## Results and Publications

### Individual participant data (IPD) sharing plan

The datasets generated during and/or analysed during the current study are/will be available upon request from [l.p.j.kenney@salford.ac.uk](mailto:l.p.j.kenney@salford.ac.uk)

### IPD sharing plan summary

Available on request

## Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">HRA research summary</a>			28/06/2023	No	No
<a href="#">Participant information sheet</a>	Participant information sheet	11/11/2025	11/11/2025	No	Yes