STEPS study

28 April 2017

FES USER DAY
The STEPS team

Paul Taylor PhD Chief Investigator and local PI, Consultant Biomedical Engineer, Head of Research, The National Clinical FES Centre, (study inception, design and management lead)

Ben Beare, Research Physiotherapist, STEPs study, UCLH
Trish Sampson, Research Physiotherapist, STEPs study, Salisbury

Co-Investigators
• Dr Diran Padiachy, Consultant Physician in General and Elderly Medicine, Salisbury NHS Foundation Trust (Medical lead)
• James Lee, Movement Disorder Nurse Specialist, Salisbury District Hospital (Recruitment lead)
• Sheila Nell, Chair of the Salisbury branch of the Parkinson’s Disease Society. (PPI lead)
• Paul Strike, Statistician, Research Design Service, Salisbury District Hospital (Study methodology)
• Maggie Donavon-Hall PhD, Health Psychologist, University of Southampton (Qualitative research lead)
• Elsa Marques PhD, Research Fellow in Health Economics, Bristol University (Health economics lead)
• Coralie Seary, Therapy Outpatients, The National Hospital for Neurology and Neurosurgery (Physiotherapy lead)
• Val Stevenson, The National Hospital for Neurology and Neurosurgery (Neurology lead and local PI)
• Peter Thomas PhD, Professor of Healthcare Statistics and Epidemiology, Bournemouth University (Statistical lead)

Patient Advisory Group
• Sheila Nell, Christopher Wadge, Gillian Wadge, David Houghton, Evelyn Houghton, Ronald Lines, Joyce Lines
AIM / Learning outcomes

What does STEPS stand for?
The PD patient - common issues for people with Parkinsons (pwPD)
  o 3 main PD symptoms
  o Common issues: PD/medication
  o Hoehn and Yahr Staging

Background to the STEPS study
Purpose of the STEPS study
Study Detail
  o Inclusion/Exclusion Criteria
  o Study Design
  o Outcome measures

TIPS on FES use for pwPD from observations: Ax and Rx
Funding
Case Study
What does STEPS stand for?

The Effectiveness of Peroneal Nerve Functional Electrical STimulation (FES) for the Reduction of Bradykinesia in Parkinson’s Disease:

A Pragmatic Two Site Feasibility Study for a Single Blinded Randomised Control Trial (STEPS).
3 main PD symptoms = parkinsonism

**Tremor** *(shaking)* - usually starts in the upper limb and is more likely to occur when the limb is relaxed and resting.

**Bradykinesia** *(slow physical movement)* - results in a distinctive slow, shuffling walk with very small steps *(festination)*.

**Rigidity** *(muscle stiffness)* – stiffness and tension in the muscles, making it difficult to move around and make facial expressions.
Common Problems in Parkinsonism and/or Side Effects of Medication

- Lightheadedness
- Memory problems
  - Confusion
  - Hallucinations
  - Delusions
- Dry or oily scalp or face
- Slurred speech
- Drooling
- Swallowing problems
  - Weak voice
- Nausea
- Constipation
- Diarrhea
- Weight loss
- Weight gain
- Change in handwriting
  - Loss of dexterity
- Pain
  - Medication wears off suddenly
  - Extra squirming movements (dyskinesia)
  - Twisting postures (dystonia)
  - Hesitation/freezing
- Impotence/loss of orgasm
  - Decreased or increased sex drive
  - Loss of control of urine
- Sadness/depression
  - Caregiver stress
  - Loss of motivation
- Loss of pleasure from activities
  - Anxiety
  - Euphoria
  - Gambling
- Dry eyes
- Change in vision
- Loss of sense of smell
- Loss of facial expression
- Skin redness
- Rash
- Mole changes
- Itching
- Stooped posture
- Tremor
  - Slowness
  - Stiffness
- Problems walking
- Swelling
Hoehn and Yahr Staging of PD

1. Symptoms on one side of the body only
2. Bilateral symptoms; no balance impairment
3. Impaired postural reflexes; physically independent
4. Severe disability, yet still able to walk or stand unassisted
5. Wheelchair bound or bedridden

Increasing Disability; Decreasing Independence
Background to the STEPS study

1. Mann et al. (2008)
   - 10 pwPD used FES for 2 months
   - Training effect
   - ↓ Freezing and Falls

2. Popa and Taylor (2013)
   - 11 pwPD (Hoehn and Yahr 2-3) used FES for 2 weeks
   - Training effect
   - Mean increase in step length ↑ walking speed in 9 pwPD

3. Popa et al. (2013)
   - Stimulated 10 pwPD wrists, fingers and thumb for 30 min over 10 days.
   - Transcranial magnetic stimulation (TMS) showed ↑ cortical activity.
   - Also 21% increased hand mvt
Purpose of the STEPS study

pwPD often walk slowly and fall → a reduced quality of life
Small studies suggest patients walk faster and have reduced PD symptoms after using FES

STEPS is a feasibility, single blinded, multi-centre RCT to inform the design a larger RCT
  o Recruitment rate, willingness to be randomised, loss to follow up
  o Pt view on meaningful outcome measures
  o Data to inform sample size calc, duration and cost of full RCT and to refine methods

FUTURE, larger RCT is to investigate whether:
  o FES would be beneficial to patients in the longer term compared to routine care AND
  o Value for money for the NHS.
Inclusion and Exclusion Criteria

Inclusion criteria:
Over 18 years

**Idiopathic Parkinson’s disease** (Hoehn and Yahr stages I to IV)

Difficulty with gait - reduced dorsiflexion or eversion, bradykinesia < 1.25ms⁻¹, festination, akinesia (freezing), hypokinesia (short steps)

Can walk 10m with appropriate walking aids but without assistance from another person

Able to standing without the assistance of another person.

Medically stable defined as no significant changes in the participants condition over the last 3 months

Can give informed consent and can understand and comply with the treatment and assessment procedures

Exclusion criteria:
Faster than 8.0s over 10m (>12.5m/s)

Non standard drug therapy (DBS)

Atypical or secondary parkinsonism or parkinsonism related to other neurodegenerative diseases, pyramidal and/or extrapyramidal systems injuries

Untreated or refractory epilepsy (fits in last 3 months), pregnancy, cardiac pacemaker, or other active medical implanted devices, malignancy or dermatological conditions in the area of the electrodes

Denervation of the common peroneal nerve or other neurological condition known to cause dropped foot

Severe osteoarticular pathology that significantly affects walking

Major cognitive impairment; dementia.
Study Design

Group 1
Control

Group 2
FES

Group 2
NO FES

Time line
week 0
week 6
week 18
week 22

Treatment and non-blinded assessment schedule
Group 2 only

2 sessions to set up and teach device use and non-blinded assessments

1 follow up session to ensure continued effective device use and non-blinded assessments

Final non-blinded assessments & return of FES equipment to clinic

Normal FES treatment procedure

Blinded assessment schedule
Groups 1 & 2

Week 0
Recruitment, consents, screening and base line assessments followed by randomisation (PI)

6 week
Interim assessments

18 week
End of intervention assessments

22 week
Training effect assessments

Additional for the study
Falls and health resource use diary throughout the study week 0 to 22

Telephone interviews Groups 1 & 2

Prior to intervention to explore aspects of walking that are important to pwPD & Reasons for not taking part if participation is declined

Participants who drop out from the study as they drop out

At the end to find out what participants thought of FES and of taking part in the study

Additional for the study
STEPS Outcome Measures

Semi-structured interviews
PDQ-39 (QoL questionnaire)
10mWT (+ number of complete steps)
UPDRS part 1-4 (impairment, activity and participation - 50Q)
A/PROM and MRC
N-FOG (freezing)
FES-I (fear of falling)
Health resource use (Bristol)
MiniBEST (which includes TUG)
EQ-5D-5L
Falls Diary
Observation of pwPD gait

- Reduced arm swing and step length
- Unilateral or bilateral foot drop / scuffing
- ‘slow shuffling gait’ / festination
- Difficult to initiate walking, may stop abruptly or can’t stop!
- Turning - difficult and slow
- Freezing
- Bradykinesia but can also have slow mental processing
- TUG > 11.5 secs can predict falls in pwPD (Nocera et al, 2013)
TIPS on FES use for pwPD

Queueing effect - consider leaving sounder on?

PD default:
R-Ramp=150, Ext=150, F-Ramp=50
SYM waveform
Pulse width to start on 50%

TA stimulation

Observation:
Potentially training effect > orthotic effect
Funding

3 pwPD from STEPS have secured funding - Wiltshire & Hampshire
- 2 from control group and 1 from FES group

One pwPD was refused funding and paying privately (Dorset)
One from control group is paying privately (Dorset).

Process:
- Letter to GP giving rationale for funding:
  - description of gait,
  - if in FES group how they responded, and compliance in the trial
- GP writes to OML
- IFR requested from CCG
Participant from FES group

**Hx:** Dx 14 years PD, clot on lung

**PD Meds:**
- Apomorphine pump and ropineroile (dopamine agonist), amantadine, co-beneldopa (levodopa), selegiline (MAO-I)

**GAIT (NS):** Dyskinesia, Fwd stoop, fast shuffle, toe walking.

<table>
<thead>
<tr>
<th></th>
<th>0 wks</th>
<th>6 wks</th>
<th>18 wks</th>
<th>22 wks</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10mwT</strong></td>
<td>11.9</td>
<td>10.7</td>
<td>9.9</td>
<td>9.3</td>
<td>28%</td>
</tr>
<tr>
<td>steps</td>
<td>24</td>
<td>23</td>
<td>20</td>
<td>20</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Comments** “feels FES helps her stand more upright and helps right leg move. Had difficulty with the box due to her pump”

**Hampshire just agreed funding!**
DISCLAIMER:
This presentation presents independent research funded by the NIHR under its Research for Patient Benefit (RfPB) Programme (Grant Reference Number PB-PG-1014-35012).

The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health.

Mann GE, Finn SM, Taylor PN. A pilot study to investigate the feasibility of electrical stimulation to assist gait in Parkinson’s disease. *Neuromodulation* 2008; 11(2): 143-149.
