Large Scale Clinical Audit of Functional Walking Category and associated Clinically Meaningful Changes for people with MS and Stroke

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Research Aims

• To determine the effectiveness of FES in terms of walking speed, clinical meaningful changes and functional walking category for people with multiple sclerosis and stroke.

• To our knowledge these are the largest samples collected for MS and Stroke.
Participants

Multiple Sclerosis

• 727 (age range 26-85, average 53) pwMS with dropped foot collected audit data between 1993 and 2013. 508 pwMS were using FES after 19 weeks with 355 complete data sets available for analysis. 85 medical records were not available due to being destroyed or lost.

Stroke

• 848 (median time post stroke: 2.3 years, range: 5 weeks to 34 years) stroke patients referred between 1993 and 2013. 502 patients completed the follow up measures after 20 weeks of treatment.
Main Outcome Measure: Speed (ms)

<table>
<thead>
<tr>
<th>Effect</th>
<th>No Stimulation</th>
<th>Stimulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 1</td>
<td>6 months later</td>
</tr>
<tr>
<td>Initial Orthotic</td>
<td></td>
<td></td>
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<tr>
<td>Continuing Orthotic</td>
<td></td>
<td></td>
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<tr>
<td>Total Orthotic</td>
<td></td>
<td></td>
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<tr>
<td>Training</td>
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</tbody>
</table>

Clinically Meaningful Changes (Perera et al., 2006)

- Minimally meaningful change (>=0.05 m/s)
- Substantially meaningful change (>=0.1 m/s)
Functional Walking Categories
Perry et al., (1995)

<table>
<thead>
<tr>
<th>Walking Category</th>
<th>Speed (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household walking only</td>
<td>&lt;0.4 m/s</td>
</tr>
<tr>
<td>Most limited community walker</td>
<td>0.4 to 0.58 m/s</td>
</tr>
<tr>
<td>Least limited community walking</td>
<td>0.59 to 0.79 m/s</td>
</tr>
<tr>
<td>Community walking</td>
<td>&gt;0.8 m/s</td>
</tr>
</tbody>
</table>
Effort of Walking and Goal Attainment

• **Self-Rated Effort of Walking (Borg Scale 1-10)**
Patients rate the effort of walking after each 10 metre walk using a VAS Scale from 1-10.

• **Goal Attainment Scaling (GAS)**
Up to 3 goals are created collaboratively between the clinician and the patient. A scale is created to enable the patient and clinician to know when the goal has been attained.
Results for Patients with MS
Speed (m/s)

• All orthotic comparisons highly significant ($p<0.001$)
• No significant training effect as you would expect for patients with MS.
• Clinically meaningful changes for all orthotic comparisons ($\geq 0.05\text{m/s}$) (continuing orthotic effect ($0.08\text{ms}^{-1}$))
• 97% maintained or exceeded their functional walking category
Multiple Sclerosis Patients

>0.05 m/s minimum meaningful change

Total Orthotic Effect

Participants (n=355)
Results for Stroke Patients
Speed (ms)

- Highly significant initial, continuing, total and training effect (p<0.001)
- Clinically meaningful changes (≥0.05 m/s)
- Substantial meaningful change (≥0.10 m/s) for total orthotic effect (0.12 m/s).
- 96% maintained or exceeded their functional walking category
Stroke Patients

Total Orthotic Effect

>0.05 m/s minimum meaningful change
MS: Self-Rated Effort of Walking (Borg Scale)

- A significant difference was found for self rated effort of walking ($p > 0.001$).
CVA: Self Rated Effort of Walking

- A significant difference was found for self rated effort of walking (p>0.001).
MS: Goal Attainment Scaling (GAS)

Highest Frequency Goals Selected

- Fear of Falling
- Confidence
- Effort of Walking
- Social/Functional Activities
- Walking Distance

Goal Attainment Score (GAS): 67% achieved or exceeded goals
CVA: Goal Attainment Scaling (GAS)

Highest Frequency Goals Selected

- Independence
- Quality of Walking
- Effort of Walking
- Fear of Falling
- Walking Distance

GAS Score (86% achieved or exceeded their goals)
Multiple Sclerosis: Fear of Falling (VAS Scale 1-10)

![Chart showing Fear of Falling VAS Scale (1-10) before and after FES (n=73)](chart.png)
Conclusions

Functional Electrical Stimulation Enables:

- A significant increase in the speed of walking
- Clinically meaningful changes in functional walking category
- Effort of walking is significantly reduced
- Fear of falling is significantly reduced
- A greater likelihood of achieving personal goals.
Limitations

Audit Data not a Randomized Controlled Trial (RCT)

- Several RCT’s have found similar findings.
- Clinically relevant observational studies have several advantages over an RCT (broader range of patients, timeliness, cost).
- Lack of evidence found for observational studies to be consistently larger or qualitatively different (Benson and Hartz, 2000).
Further Research

• Patient Specific measures of quality of life eg. MSIS-29
• Fear of Falling and participation using the FESI
• Salisbury FES Centre National Audit
• Quality of gait: FES compared to AFO
• Frequency of falling before and after using FES
• Work status
• Impact of FES on being a caregiver
References


