A new approach to SCI rehabilitation

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Introduction

Animal studies have shown lumbosacral spinal cord stimulation can enable locomotor-like movements in gravity neutral conditions (1,2); and in combination with a serotonin agonist, stimulation can also facilitate unsupported walking (3,4). In human studies epidural stimulation also facilitates locomotor-like movements in gravity neutral conditions (5); and in combination with serotonin agonist, stimulation and training, enables unsupported standing in SCI patients (6,7). The aim of this initial independent case study is to assess effects of novel neuromodulatory treatment combinations on postural, locomotor and autonomic function; and, long-term physiological/health effects in a single SCI patient (MP).

Exoskeletal Robotic Walking System

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Study Schedule

<table>
<thead>
<tr>
<th>Phase</th>
<th>Drug</th>
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<th>Stim</th>
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<tbody>
<tr>
<td>Phase 1</td>
<td>August</td>
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<td>Phase 2</td>
<td>September</td>
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<td>Phase 3</td>
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<td>December</td>
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Preliminary Medical Assessments

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<tr>
<th>Body Composition</th>
<th>Blood Pressure / HRV</th>
<th>Muscle CSA</th>
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<tr>
<td>Bone mineral density</td>
<td>Ewing’s Protocol</td>
<td>Muscle Morphology</td>
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Neurophysiological Assessment

Stimulation and EMG recordings to generate response curves:

Walking Assessment

Baseline Ulnar Nerve Stimulation + Gahrian (VEST) + Cervical / Thoracic / Lumbar Cord

Results to date

1. DXA body composition / BMD + bone markers complete BMD T score > 2.5 both hips
2. Body comp + > 40% body fat
3. Initial ‘sit to stand’ on + tilt table analysis data indicate no orthostatic change in BP / TPR + no ANS dysfunction.
4. Preliminary axial MRI studies of lower limbs and pelvis completed
5. Phase 1 Walk and Stand assessments analysis tbc
6. Phase 2 Eko walking + neurostimulation commenced

Future Objectives

1. Complete Phase 3 and 4
2. Analyse results of initial 4 month intervention
3. Develop optimum programme for further 2 x 4 month blocks
4. Completion of 12 month neuromodulation programme in a single SCI patient (n=1)
5. Initiate a larger cohort study in (n=6) Irish SCI patients
6. Further studies to evaluate effects of neuromodulatory treatment combinations on bladder, bowel and sexual function in SCI patients.

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References

5. Gerasimenko et al. (2012f) Neuron 60: 5700-5702