Web supplement: Detailed description of outcome measures

*Balance, gait mobility*

- **Two-minute walk Test** (2MWT)

  This is a measurement of endurance by assessing timed walking distance over 2 minutes. It has been suggested that it is an acceptable alternative to the more common 6 minute walk test. The 2MWT will be conducted in a >12 metre hallway with markers at each end to show the point to turn. The individual is instructed to walk for two minutes and to cover as much ground as possible in that time. The distance covered is measured and logged. Habitual assistive devices and orthotics can be used. We will use instructions based on the American Thoracic Society guidelines for the six minute walk test and modified instructions. The modified instructions focus on maximising effort by emphasising speed and omitting instructions for permitted rest in the 2 minutes.

- **Step test**

  This is a test of dynamic standing balance. It involves recording the number of times a participant steps one foot fully on, then off a block as quickly as possible in a 15 second time period. Two block heights are used: 7.5 cm and 15 cm. Each leg is tested separately. Participants are instructed to perform this task as quickly as possible.

- **Steady Stance tests**

  Steady stance tests measure the ability of an individual to maintain a steady stance for a 60 second period in five predetermined stances without support: (1) feet apart, with feet placed 10 cm apart; (2) feet together; (3) stride stance, with feet placed 10 cm apart and with the toes of the rear foot in line with the heel of the front foot; (4) tandem stance, with one foot directly in front of the other, with the heel of the front foot in contact with the toes of the rear foot; and (5) single leg stance, with the individual standing on one leg with the opposite foot held off the floor. The tests end when an
individual either maintains steady stance for the 60 second testing duration, loses balances and takes support or alters their foot position.

- **Instrumented Timed Up and Go (ITUG)**
  This is a timed test used to examine functional mobility and requires the individual to stand up from a seated position, walk 3 metres, turn, walk back, and sit down. Recently researchers have found that an instrumented version of the TUG (ITUG) achieved using a body-fixed accelerometer to record movement during the standard TUG assessment protocol can improve its sensitivity. We will use an accelerometer to measure the initialisation and completion times of the TUG manoeuvre and its overall duration. Time for completion, number of steps and duration of standing and sitting position will be recorded.

- **Gait stride-time rhythmicity**
  This is measured in a laboratory-free setting using a portable recorder connected to flat in-shoe heel impact sensors. The extended walk of up to 256 steps per foot is not accompanied by the assessor. The participant may use a normal walking aid or orthotic. Participants are asked to walk at their natural walking speed and instructed not to stop to talk if they see people they know. The walk route is flat and covered throughout. The stride time between adjacent heel strikes is recorded for each foot separately and the mean and standard deviation stride times are calculated.

- **Static posturography (Limits of Sway)**
  The Poole Hospital Static Posturography System provides a method for objectively assessing balance via the tracking of limits of sway in a series of standardised conditions. It uses ultrasound time-of-flight (ToF) posturography measurements to locate an individual’s centre of gravity (CoG) in a protocol mirroring the Equitest sensory organisation test protocol. Two orthogonal 40 kHz ultrasound transmitters are mounted on the individual's waist at the height of the centre of gravity.
(CoG). Anterior/posterior and lateral motions are detected independently by measuring variations in the ToF from the transmitters to appropriately positioned wall-mounted receivers. The motion of the CoG is accurately tracked during the course of 20 second assessment periods as the individual stands on either a solid or soft surface with eyes open or eyes closed or when doing a cognitive distractor task. Measures obtained include the Equilibrium Quotient (EQ) percent score (100-(Anterior posterior maximum sway during 20 seconds/maximum anterior posterior movement possible without losing balance)*100) and the average speed of CoG movement during measurement.

Physical activity

- **Godin Leisure-Time Exercise Questionnaire (GLTEQ)\textsuperscript{11,12}**

  This is a self-reported measure of usual physical activity that has been widely used in epidemiologic, clinical and behavioural change studies. It consists of 2 items: the first is open ended and measures frequency and intensity of exercise during free time in a typical week. The weekly frequencies are multiplied by metabolic equivalents and summed to form a measure of total leisure activity. The second question is ordinal with 3 options and measures the frequency of engaging in any regular activity long enough to work up a sweat.

- **ActivPAL\textsuperscript{TM}\textsuperscript{13}**

  This classifies an individual's free-living activity into periods spent sitting, standing and walking and gives the number of steps and sit-to-stand episodes. This information can be used to estimate daily energy expenditure, and time spent resting. [http://www.paltechnologies.com]. We will ask participants to wear an ActivPAL\textsuperscript{TM} for periods of 7-days.

Motor Coordination

- **Nine-hole peg test\textsuperscript{14}**
This timed test assesses finger and hand dexterity in both hands. It involves placing nine pegs and then removing them from a peg board as quickly as possible.

Self-efficacy

- **The Spinal Cord Injury (SCI) Exercise Self Efficacy Scale (SCI-ESES)**\(^{15}\)
  
  As the name suggests, this scale was originally developed and validated in spinal cord populations. However, it has since been used with multiple sclerosis patients\(^{16}\). It consists of 10 items with higher scores indicating higher perceived self-efficacy. It uses a 4-point Likert-type response scale.

- **The Multiple Sclerosis Self-Efficacy (MSSE) Scale**\(^{17}\)
  
  This 22-item scale comprises two subscales: i. confidence with function and ii. confidence with ability to manage symptoms/cope with the demands of illness. The rating scale consists of 10-points where 10 is *very uncertain*, 50 is *moderately certain* and 100 is *very certain*. Higher scores indicate greater self-efficacy.

Psychological well-being and quality of life

- **Hospital Anxiety and Depression Scale (HADS)**\(^{18}\)
  
  The HADS is a self-report measure consisting of an anxiety and a depression subscale. Each subscale consists of 7 items with a 4-point Likert-type response scale. Higher scores indicate worse levels of anxiety and depression.

- **EuroQual 5 Dimensions-5 Levels**\(^{19}\)
  
  EQ-5D-5L is a standardised measure of health status developed by the EuroQoL Group. The EQ-5D consists of the EQ-5D -5L descriptive system and the EQ visual analogue scale (EQ VAS). The EQ-5D descriptive system comprises 5 dimensions: mobility, self-care, usual activities,
pain/discomfort and anxiety/depression. Each dimension has 5 levels: no problems, slight problems, moderate problems, severe problems, and extreme problems.

The EQ VAS records the respondent’s self-rated health on a 20 cm vertical, visual analogue scale with endpoints labelled ‘the best health you can imagine’ and ‘the worst health you can imagine’.

- **Multiple Sclerosis Impact Scale (MSIS-29)**\(^{20,21}\)

This scale measures the physical (20 items) and psychological impact (9 items) of MS on day-to-day life. It uses 5-point Likert-type scales ranging from ‘not at all’ to ‘extremely’ and is based on quality of life in the last two weeks.

- **The Fatigue Symptom Inventory (FSI)**\(^{22}\)

The FSI is a 14-item self-administered multi-dimensional questionnaire which measures the severity, frequency and diurnal variation of fatigue and its perceived interference on quality of life. We will use 4 items comprising the severity subscale that assess most, least, and average fatigue in the past week, as well as current fatigue.

- **The Medical Outcomes Short-Form Survey version 2 (SF-36v2)**\(^{23}\)

The SF-36 measures eight dimensions: physical functioning, role limitations because of physical health problems, bodily pain, general health perceptions, vitality, social functioning, role limitations because of emotional problems, and mental health. It generates scores for the eight dimensions as well as two summary measures (physical health and mental health). It uses Likert-type response scales.

**References**

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