Lecture 7: Effects of tDCS stimulation for PPS patients: protocol for a RCT

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Matsushima highlighted that although there were no validated treatment options, tDCS had been used in PPS patients over pre-motor areas and improved sleep and fatigue symptoms with PPS.

He also highlighted a previous study which identified a neurotrophin- Brain-derived Neurotrophic Factor (BDNF), which can be influenced through transcranial stimulation to create potentiation (or depression), enabling synaptic plasticity. This possibility would affect people with movement disorders. Therefore, the study's aim was to assess the possibility of creating long-term changes through tDCS using protocols previously established with PPS populations.

Study Protocol

- Randomly allocate 20 participants into sham group (10) and tDCS group (10)
- Perform intervention for 2 weeks
    - Sham stimulation of 20min 5x/week
    - tDCS: 2mA; 20 min 5x/week
- Evaluate at the end of 2 weeks
- Follow-up evaluation at the end of a further 4 weeks.

Subjects Inclusion Criteria

- PPS, as diagnosed by March of Dimes criteria
- Aged between 20 – 80 years

Subjects Exclusion Criteria

- History of epilepsy
- Taking anticonvulsants
- Intracranial metal clip

Measurements

- Primary Outcome Measurement: Multidimensional Fatigue Inventory
- BDNF: serum BDNF and BDNF Val60Met polymorphism
- Fatigue: (Visual Acuity Score)
- Sleep: Pittsburgh Sleep Quality Index (PSQI)
- Muscle strength: dorsi flexors and knee extensors
- Gait: 10-metre walk test; 6-minute walk test
- Upper limb function: Finger tapping test; 9 hole peg test
- Quality of Life: Short-Form 36 Health Survey (SF36)
- Oxidative Stress: Urinary 8-hydroxyguanine
- Nerve conduction study: repeater F-waves of upper and lower extremities

Matsushima played a video of a woman (with PPS history) who had quadriplegia and used an electric wheelchair before and post-tDCS performing the finger tapping test. The results with hand dexterity improvement were remarkable.

Investigations with transcranial stimulation thus far (among all movement disorders) demonstrates great improvements, however the alterations have yet to be show long-term adaptation (permanency). The possibility of creating plasticity has been identified but not converted into practice (i.e. 3 months or 6 months post-intervention).

Questions will continue to remain with PPS and transcranial stimulation. Firstly, if the condition mainly effects lower motor neurons, how will an intervention that targets upper neurons elicit benefits? If it can elicit benefits, how will this translate for the lower motor neuron stress to enable innervation and muscle contraction? Some of the studies with stroke have been able to demonstrate the stimulation of pre motor cortex and motor cortex have enabled new neural pathways to be established, and did not elicit increased innervation of existing neurons. This will be interesting to see if this is possible in PPS patients given the timeframe of paralysis, and the issues of motor unit stress and overuse.