BU MATCH FUNDED STUDENTSHIPS 2024 PROJECT DESCRIPTION

PROJECT TITLE

Combining functional electrical stimulation and spinal stimulation to optimise walking in people with Multiple Sclerosis, a feasibility study

PROJECT SUMMARY

Electrical stimulation, specifically functional electrical stimulation (FES) has been used in clinical practice for over 25 years to support rehabilitation for people with upper motor neuron conditions such as Multiple Sclerosis (MS), stroke and spinal cord injury (SCI). FES is effective through small electrical impulses to activate weak or paralysed muscles through exciting the nerves that connect to the muscles. It is most frequently administered through self-adhesive patches or electrodes which are placed on the surface of the skin directly above the muscle. The electrical stimulation can be used during functional activities such as walking, reaching or cycling to help enhance the muscle contraction or motor control.

Surface spinal stimulation works in the same way as FES, electrical impulses administered through sticky pads to electrodes. However, the target area of stimulation is the spine/spinal cord at the level of the nerve root of the weakened muscle.

Clinician's and researchers are continuing to understand the underlying mechanisms of how electrical stimulation works and its impact on neuroplasticity. Neurophysiological techniques such as functional magnetic resonance imaging (fMRI) and transcranial magnetic stimulation (TMS) have been used to establish neurophysiological changes because of using FES technologies, these techniques are not often used alongside behavioural measures and patient reported outcomes.

The aim of this interesting and novel project is to explore electrical stimulation in more depth to better understand how stimulation can contribute to improved function for people with MS.

The successful applicant will work with the research team to develop the project and research methodology providing an exciting opportunity to develop and shape the research in this area.

ACADEMIC IMPACT

The academic impact of this research will be within the field of functional electrical stimulation and neuromodulation. This project will deepen our understanding of a novel stimulation technique combining spinal and the impact of the intervention on people with Multiple Sclerosis. In turn this new understanding may impact on how electrical stimulation is used in clinical practice as well as lead to the development of a definitive trail to explore if the this novel stimulation technique changes outcomes for people with Multiple Sclerosis.

The expected outputs of this project are publications in peer reviewed academic journals, presentation at national or international conferences, and public knowledge exchange events.

SOCIETAL IMPACT

The societal impact of this research will be on people with MS and the community of therapists that use electrical stimulation. This novel stimulation technique may contribute to improved functional outcomes, reduced disability, and improved quality of life for people living with MS. If the intervention is successful, this will be an additional tool therapists will have to help people with MS regain or maintain function which will contribute to improved quality of life and participation.

PGR DEVELOPMENT OPPORTUNITIES

This research project will offer the successful candidate a range of opportunities for development. The successful candidate will take the Odstock Medical Ltd (OML) course in functional electrical stimulation (FES) developing and deepening the candidate's knowledge and skills in using FES which is directly applicable to this project.

The successful candidate will develop the research methods with the supervisory team. Bournemouth University Doctoral College has workshops in a variety of research methods and research related training. The successful candidate would select workshops that would help to develop the skills needed to carry out the research. Furthermore, through the collaboration with OML the candidate will gain skills in industry and the process of MHRA device approval. All the skills gained during the PhD are transferable to a career in research and academia.

SUPERVISORY TEAM	
First Supervisor	Dr Kathryn Collins
Additional Supervisors	Dr Susan Dewhurst, Dr Tamsyn Street, Dr Paul Taylor
Recent publications by supervisors relevant to this project	Dr Kathryn Collins 1. Collins, K. C., Clark, A.B., Pomeroy, V.M. and Kennedy, N.C., 2024. The test-retest reliability of non-navigated transcranial magnetic stimulation (TMS) measures of corticospinal pathway excitability early after stroke. *Disability and Rehabilitation*. 2. Hughes, M., Collins, K., Easterbrook, T. and blackman, E., 2023. Involving people with lived experience in physiotherapy education – Research report two: Harnessing the expertise of people with lived experience. *PhysioOpen*. 2. Tariq, H., Collins, K., Tait, D., Dunn, J., Altaf, S. and Porter, S., 2023. Factors associated with joint contractures in adults: a systematic review with narrative synthesis. *Disability and Rehabilitation*, 45 (11), 1755-1772. 3. Collins, K.C., Burdall, O., Kassam, J., Firth, G., Perry, D. and Ramachandran, M., 2022. Health-related quality of life and functional outcome measures for pediatric multiple injury: A systematic review and narrative synthesis. *Journal of Trauma and Acute Care Surgery*, 92 (5), E92-E106. 4. Hancock, N.J., Collins, K., Dorer, C., Wolf, S.L., Bayley, M. and Pomeroy, V.M., 2019. Evidence-based practice ' on-the-go': Using ViaTherapy as a tool to enhance clinical decision making in upper limb rehabilitation after stroke, a quality improvement initiative. *BMJ Open Quality*, 8 (3). 5. Collins, K.C., Kennedy, N.C., Clark, A. and Pomeroy, V.M., 2018. Kinematic components of the reach-to-target movement after stroke for focused rehabilitation interventions: Systematic review and meta-analysis. *Frontiers in Neurology*, 9. 6. Collins, K., Kennedy, N.K., Clark, A. and Pomeroy, V.M., 2018. Getting a kinematic handle on reach-to-grasp: a meta-analysis. *Physiotherapy*. 104(2), pp.153-166 **Dr Tamsyn Street** 1. Bulley C, Meagher C, Street T, Adonis A, Peace C, Singleton C, et al. Development of clinical guidelines for service provision of functional electrical stimulation to support walking: mixed method exploration of stakeholder views. BMC Neurol. 2021 Jul 5;21(1):263.

2. Bulley C, Adonis A, Burridge J, Joiner S, Street T, Singleton C, et al. ACPIN clinical guideline working group. Evidence based clinical guidelines for the use of functional electrical stimulation to improve mobility in adults with lower limb impairment due to an upper motor neuron lesion. Association of Chartered Physiotherapists in Neurology: 2022. Available at: www.acpin.net
3. Brown L, Street T, Adonis A, Johnston TE, Ferrante S, Burridge JH, et al. Implementing functional electrical stimulation clinical practice guidelines to support mobility: A stakeholder consultation. Front Rehabil Sci. 2023 Jan 26;4.
4. Street T, Brown L, Burridge J, Johnston T. Clinician perception of clinical guidelines and confidence in using electrical stimulation technologies. Artif Organs. 2023 Jun 29. doi: 10.1111/aor.14602. Epub ahead of print. PMID: 37381913.

Dr Paul Taylor

1. Taylor PN, Sampson T, Beare B, Donavon-Hall M, Thomas P, Marques E, Strike P, Seary C, Stevenson VL, Padiachy D, Lee J, Nell S. The Effectiveness of Peroneal Nerve Functional Electrical Simulation for the Reduction of Bradykinesia in Parkinson's Disease: A Feasibility Study for a Randomised Control Trial. J. Clin. Rehab. 2020. https://journals.sagepub.com/doi/full/10.1177/0269215520972519
2. Popa L and Taylor P. Functional electrical stimulation may reduce bradykinesia in Parkinson's disease: A feasibility study. Journal of Rehabilitation and Assistive Technologies Engineering January - December 2015 2: 2055668315607836, first published on October 26, 2015 doi:10.1177/2055668315607836
3. Wilkinson I, Taylor P, Windrup J, Burridge J. 'Talking about walking' – a qualitative exploration of changes in walking post-stroke from the perspective of a stroke survivor. International Journal of Stroke Vol 9 (Suppl 4) 2014 31
4. L. Venugopalan,P. N. Taylor,J. E. Cobb &I. D. Swain. TetraGrip – a four channel upper limb FES device for people with C5/C6 tetraplegia: device design and clinical outcome. JMET. Jan 2020 https://doi.org/10.1080/03091902.2020.1713239.
5. Taylor P, Humphreys L, Swain I. A 15 year cost-effectiveness study of the use of FES for the correction of dropped foot in multiple sclerosis. Multiple Sclerosis Journal 2014;20:(7) 1001-2
6. Taylor P., Barrett C., Mann G., Wareham W., Swain I. 2013. A Feasibility Study to Investigate the Effect of Functional Electrical Stimulation and Physiotherapy Exercise on the Quality of Gait of People With Multiple Sclerosis. Neuromodulation 2013; e-pub ahead of print. DOI: 10.1111/ner.12048

Dr Susan Dewhurst

1. Yasar Z, **Dewhurst S**, Hayes LD., 2019. Peak Power Output Is Similarly Recovered After Three- and Five-Days' Rest Following Sprint Interval Training in Young and Older Adults, Sports. 7. 1-9
2. Maslivec, A, Bampouras, TM, **Dewhurst, S,** Vannozzi, G, Macaluso, A, Laudani, L., 2018. Mechanisms of head stability during gait initiation in

young and older women: a neuromechanical analysis, Journal of Electromyography and Kinesiology. 38, 103-110.

3. Thomas, NM, Donovan, T, **Dewhurst, S**, Bampouras. TM., 2018. Visually fixating an indoor pedestrian decreases balance control in young and older females walking in a real-world scenario. Neuroscience Letters. 677, 78-83
4. Bampouras TM, **Dewhurst S.,** 2018 A Comparison of Bilateral Muscular Imbalance Ratio Calculations Using Functional Tests. Journal of Strength and Conditioning Research. 32, 2216-2220
5. Maslivec, A, Bampouras, TM, **Dewhurst, S.**, 2017. Head flexion and different walking speeds do not affect gait stability in older females. Human Movement Science. 55, 87-93.
6. Thomas, NM, **Dewhurst, S**, Bampouras, TM, Donovan, T, Macaluso, A, Vannozzi, G., 2017. Smooth pursuits decrease balance control during locomotion in young and older healthy females. Experimental Brain Research. Epub
7. Thomas, NM, Bampouras, TM, Donovan, T, **Dewhurst, S.**, 2016. Eye Movements Affect Postural Control in Young and Older Females. Frontiers in Aging Neuroscience, 8, 216.
8. Bampouras TM, **Dewhurst S.,** 2016. Carrying shopping bags does not alter static postural stability and gait parameters in healthy older females. Gait Posture. 46, 81-5.
9. Ruggiero L, **Dewhurst S**, Bampouras TM., 2016. Validity and Reliability of Two Field-Based Leg Stiffness Devices: Implications for Practical Use. Journal of Applied Biomechanics. 32, 415-9.
10. Bazzucchi, I, De Vito, G, Felici, F, **Dewhurst, S**, Sgadari, A, Sacchetti, M,. 2015. Effect of exercise training on neuromuscular function of elbow flexors and knee extensors of type 2 diabetic patients Journal of Electromyography and Kinesiology, 25 (5), 815-823.
11. Thomas NM, **Dewhurst S**, Bampouras TM., 2015. Homogeneity of fascicle architecture following repeated contractions in the human gastrocnemius medialis. Journal of Electromyography and Kinesiology. 25, 870-5.
12. **Dewhurst S**, Bampouras TM., 2014. Intraday reliability and sensitivity of four functional ability tests in older women. American Journal of Physical Medicine and Rehabilitation. 93, 703-7

INFORMAL ENQUIRIES

Please contact the lead supervisor on the following email for informal enquiries: kcollins@bournemouth.ac.uk

ELIGIBILITY CRITERIA

The BU PhD and MRes Studentships are open to UK, EU and International students.

Candidates for a PhD Studentship should demonstrate outstanding qualities and be motivated to complete a PhD in 3 years and must demonstrate:

- outstanding academic potential as measured normally by either a 1st class honours degree (or equivalent Grade Point Average (GPA) or a Master's degree with distinction or equivalent

- an IELTS (Academic) score of 6.5 minimum (with a minimum 6.0 in each component, or equivalent) for candidates for whom English is not their first language and this must be evidenced at point of application.

Candidates for an MRes Studentship should demonstrate outstanding qualities and be motivated to complete a MRes in 18 months and must demonstrate:

- outstanding academic potential as measured normally by an upper second class honours degree (or equivalent Grade Point Average (GPA)
- an IELTS (Academic) score of 6.5 minimum (with a minimum 6.0 in each component, or equivalent) for candidates for whom English is not their first language and this must be evidenced at point of application.

HOW TO APPLY

Please complete the online application form by **the deadline on the project webpage.**

Further information on the application process can be found at: www.bournemouth.ac.uk/studentships