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Competition:

UQUAPS 2016 "Pitching Research" Competition

Submission id:	Date submitted:
UQUAPS-2016-040	**12 Sep 2016 at 11:21 AWST**

Faculty or Institute:	School:
UQ Health and Behavioural Sciences	**Human Movement and Nutrition Sciences**

Programme:	Load:	Level:
PhD	**Full-time**	**7-9 months**

Name:

Shari O'Brien

(A) Working Title:

Training to enhance neuromuscular control of the ankle in cerebral palsy.

Word count: **779 words**

(A) Working Title	Training to enhance neuromuscular control of the ankle in cerebral palsy.
(B) Basic Research Question	Does active movement training improve neuromuscular control of the ankle in cerebral palsy and transfer to functional tasks?
(C) Key paper(s)	Ekblom, M. M. (2010). "Improvements in dynamic plantar flexor strength after resistance training are associated with increased voluntary activation and V-to-M ratio." J Appl Physiol (1985) 109(1): 19-26. Kirk, H., et al. (2016). "Explosive resistance training increases rate of force development in ankle dorsiflexors and gait function in adults with cerebral palsy." J Strength Cond Res. Willerslev-Olsen, M., et al. (2015). "Gait training facilitates central drive to ankle dorsiflexors in children with cerebral palsy." Brain 138(Pt 3): 589-603.
(D) Motivation / Puzzle	Cerebral palsy is a neurological condition resulting in motor impairment which is pronounced at the extremities i.e. ankle/wrist and affects functional movements including walking. The neural mechanisms behind this poor control are unknown and difficult to assess due to the nervous systems complexity. Previous work has focused on training interventions for enhancing muscle size and strength, not how muscles are controlled by the brain and nerves. We know the brain is capable of learning in those without neurological conditions, can individuals with cerebral palsy learn to improve neuromuscular control of the ankle and will this lead to walking improvements?
THREE	**Three** core aspects of any empirical research project i.e. the "IDioTs" guide
(E) Idea	A novel training intervention based on motor learning principles will be implemented where participants are required to move their ankle to trace a pre-determined path shown on a screen using custom built equipment. This differs from other training interventions which use commercial gym equipment to perform resistance exercises or walking protocols which focus solely on strength gains or whole body movements and may not maximise the potential improvement in neural control at individual joints. It is hypothesised that active movement training (requiring voluntary muscular effort) will improve ankle position control and joint movement accuracy. It will then be explored whether improvements on an isolated task illicit favourable changes in the biomechanics of walking. It is hypothesised that the training intervention will lead to increases in ankle power production and the ability to lift the toes while walking.
(F) Data	Data will be collected from participant's pre and post intervention at the University. Outcome measures will include diagnosis, anthropometry (height and weight), ankle range of motion, neuromuscular assessments by recording electrical muscle activity (electromyography), dynamic ankle strength, ankle movement accuracy and functional measures (3D biomechanical analysis of walking, 10m walk speed, timed up stairs). Sample size: 10 in each group (n=20).
(G) Tools	Experimental design (2 groups: intervention and control). Custom training equipment has been designed and will be built. All testing equipment and

	software is on site and the researcher has experience performing the assessment measures. Recruitment will be sort primarily through a register to distribute information to the target population.
TWO	**Two** key questions
(H) What's New?	1. Use of a novel training task using active movements (requiring voluntary muscular contractions as opposed to other methods of electrical stimulation or passive movement) which is specific to the muscle control required to perform the target functional activity of walking. 2. A combination of neural assessments will be performed to provide a greater understanding of potential neural mechanisms responsible for intervention outcomes (previous studies use a variety of measures, each in isolation which limits conclusion about neural adaptations).
(I) So What?	Due to a neural disruption around the time of birth, individuals with cerebral palsy have impaired movements affecting their function and independence. This already reduced function often worsens with age and results in greater reliance on assistance and healthcare. The ability to move effectively is vital for independence in the home and community. This study will provide crucial information on how this type of novel training could maintain or improve neural function in cerebral palsy. If successful there is potential for it to be integrated into traditional rehabilitation practices, used all throughout the lifespan and within other neurological conditions.
ONE	**One** bottom line
(J) Contribution?	Positive outcomes may contribute to the development of effective and targeted rehabilitation protocols which can be implemented all throughout life (children and adults) to improve neuromuscular control and therefore function in individuals with cerebral palsy.
(K) Other Considerations	Collaborations will be formed with gyms and rehabilitation clinics in order to run the intervention in various locations to increase the accessibility of the intervention and aid recruitment. Risk assessment: "Risk to participants" - low for all assessments and training protocol, safety procedures and precautions will be in place. "No result" - low, a result is expected due to the nature of the training task and given what is known about the principles of learning in humans. "Obsolescence" - low to nil due to the minimal data published regarding neural function in cerebral palsy and a continuing need for exercise guidelines and effective rehabilitation protocols which can be implemented by allied health professionals.