

Project: iCYCLE II Recovery of function through cycling therapy with virtual reality biofeedback for people who have suffered chronic spinal cord injuries

BACKGROUND In recent years INSPIRE has funded the development of specialist recumbent cycling machines which have enabled those who have suffered life changing spinal cord injuries (SCI) to exercise their 'paralysed' legs. This stimulated therapeutic exercise has even led to recovery of some normal leg function and in some cases, years after the injury! Our scientists hypothesized that such recovery was developed by harnessing and exploiting as much user 'voluntary effort' as possible, supplemented with targeted 'Functional Electrical Stimulation' or FES. In order to see whether this could become a generally useful therapy, a project team, led by Nick Donaldson, the world renowned Professor of Neuroprosthesis Engineering at University College London (UCL), is taking this work forward by further developing INSPIRE funded Cycles (iCYCLES).

Based on a successful and proven prototype, these stationary indoor exercise machines use state of the art 'virtual reality' screens which provide landscape options which can be tailored according to each user's requirements. Speed and performance are controlled by dedicated computers which are programmed according to an individual's residual abilities. In this way progress can be monitored and bespoke physical targets can be set. By coercing effort and performance, it is possible to develop maximum effort, motivating cyclists to 'drive' their muscles and reward them with a more exhilarating 'ride' leading to stronger limbs and optimum independence.

SUCCESS TO DATE. Having already developed iCYCLE for supervised use in hospitals and spinal units, our research teams conducted a trial in which 11 people used it 3 times per week for four weeks. None of them gave up during the trial, and many felt the benefits and even enjoyed the exercise. Six of them improved in the standard neurological test by more than 8 on a 50 point scale. This is a rapid improvement, one of the fastest in the rehabilitation literature.

NEXT STEPS. The latest exciting juncture is to develop iCYCLE II for use in patients' homes and/or in gyms rather than restricting it to one of the UK's 11 spinal units. The benefits are far reaching and include readily available and more frequent training sessions and increased therapy. This development should not be expensive and could be widely applied to those living with recent or even old spinal injuries, leading to increased independence, a sort after goal for many people living with SCI.



ENGINEERING THEN DELIVERY. Initially, we will concentrate on the design and engineering so iCYCLE II is fit for supervised trialling and then, after minimal training, suitable for patients' own homes. We further plan to re-consider the duration of therapy sessions, assess how much neurological recovery is possible and analyse the reduction of disability. To achieve this, six participants with chronic SCI will carry out one hour iCYCLE training sessions three times per week, for up to 12 weeks. Measurement of neurological and functional recovery will be analysed before, during and after each therapy session. This scientific data will help steer our subsequent detailed research.

INSPIRE'S RESEARCH TEAM



Left: Principal Investigator Nick Donaldson
Professor of Neuroprosthesis Engineering,
University College London (UCL)

Right: Ms Sue Paddison
Superintendent Physiotherapist, London Spinal
Cord Injury Centre, Royal National Orthopaedic
Hospital, Stanmore (on mock-up of iCYCLE II)



Below left: Dr Lynsey Duffell, Lecturer & Clinical Scientist, UCL
Centre: Mr Maurizio Belci, Consultant in Spinal Cord Injuries, National Spinal
Injuries Centre, Stoke Mandeville Hospital
Right: Professor Jane Burridge, Professor of Restorative Neuroscience,
University of Southampton



HOW MUCH, HOW LONG, AND WHERE. The 24 month project will start in February 2020 and will cost **£160,842**. Engineering work will be conducted at UCL and the subsequent patient focused assessments will take place at the National Spinal Injuries Centre, Stoke Mandeville and the London Spinal Cord Injury Centre within the Royal National Orthopaedic Hospital, Stanmore.

WHO BENEFITS AND WHY DOES INSPIRE NEED FUNDING. There are 50,000 people living with spinal cord injuries in the UK and they all stand to benefit directly or indirectly from our research programme, currently consisting of nine projects costing **£1.4 million**. We receive no Government or NHS funding and our programme is almost totally dependent on funds donated by charitable bodies and grant making trusts; without them INSPIRE would not exist and our research programme would cease.

...researching independence, quality of life and dignity after spinal cord injury...