Institution: King's College London

Unit of Assessment: C26 - Sport, Exercise, Leisure and Tourism

Title of case study: An effective new treatment for visual vertigo

1. Summary of the impact (indicative maximum 100 words)

Dizziness is one of the most common presenting symptoms in General Practice, Ear Nose and Throat and neurology clinics. Chronic dizziness in particular has a major impact on individual and health service resources. Researchers at King's College London (KCL) have developed an effective exercise-based rehabilitation programme incorporating optokinetic stimulation to treat a specific form of chronic dizziness, visual vertigo. This programme has been adopted by audiology and physiotherapy services across the UK and is now being adopted internationally and commercialized. The work of KCL researchers is also reflected by inclusion in information and continued educational activities with regard to visual vertigo.

2. Underpinning research (indicative maximum 500 words)

Vestibular disorders are highly prevalent, affecting 35% of US adults aged over 40 years; 25% of community-dwelling adults have significant dizziness at any given time. Vestibular rehabilitation is the standard of care for patients with vestibular dysfunction, with 50-80% of individuals completing a customised programme achieving significant improvements. Visual vertigo (VV) is a specific form of chronic dizziness whereby symptoms occur due to an over-reliance on visual cues for posture and orientation (i.e. visual dependence). Symptoms can be provoked by disorienting visual environments such as crowds, supermarket aisles, watching repetitive moving scenes on television or travelling on an escalator. However VV symptoms do not improve with customised vestibular exercises alone.

Since 2000, Dr Marousa Pavlou (2003-present, Lecturer in Physiotherapy) at KCL, together with Professor Adolfo Bronstein at Imperial College London have carried out research to improve the management of VV symptoms. They initially investigated whether exposure to dynamic visual motion (optokinetic stimulation - OKS) would promote desensitisation. Using a "hi-tech" approach with inertial and visual motion simulators they found a 75% improvement in VV symptoms (as provoked by walking down supermarket aisles) after 8 weeks of treatment (n = 40) (Pavlou M, et al. 2004). In a study seeking to investigate the mechanism by which OKS works, KCL researchers exposed 26 healthy subjects to OKS over 5 days. Results showed that this form of therapy significantly reduced visual dependency, the main aetiology of VV symptoms, hence confirming the validity of OKS for this group of patients (Pavlou M, et al. 2011). In a subsequent study, KCL researchers identified that the presence and severity of VV symptoms could effectively be identified using a simple questionnaire (the Situational Characteristics Questionnaire – SCQ) compared to more expensive, cumbersome laboratory methods (i.e. Computerised Dynamic Posturography, approximate cost £80,000). The SCQ is a 19 question tool that queries how frequently symptoms are provoked or exacerbated in environments with visual-vestibular conflict or intense visual motion (e.g. supermarket aisles) (Pavlou M, et al. 2006).

Wanting to make this type of physiotherapy treatment accessible to all balance centres, and not just supra-specialist ones, Dr Pavlou initiated a RCT to evaluate the responses to treatments that incorporated optokinetic training *via* either a) a full-field visual environment rotator, b) a DVD with supervision or c) a DVD without supervision. This clinical trial showed no differences between groups with all showing significant improvements in functional gait and VV symptoms. This provided evidence that treatment was equally successful when optokinetic stimulation was provided via a DVD. Whilst it would be most convenient and economical for this DVD to be supplied directly to patients, this trial identified a significantly higher dropout rate in the unsupervised groups, underlining the importance of supervision. This study therefore indicated that the DVD, when used under supervision, is an effective and economical method of integrating visual motion into vestibular rehabilitation (Pavlou M, et al. 2013).

3. References to the research (indicative maximum of six references)

Pavlou M, Lingeswaran A, Davies RA, Gresty MA, Bronstein AM. Simulator based rehabilitation in refractory dizziness. J Neurol 2004;251(8):983-95. Doi: 10.1007/s00415-004-0476-2 (59 Scopus citations)

Pavlou M, Quinn C, Murray K, Spyridakou C, Faldon M, Bronstein AM. The effect of repeated visual motion stimuli on visual dependence and postural control in normal subjects. Gait Posture 2011;33(1):113-8. Doi: 10.1016/j.gaitpost.2010.10.085 (10 Scopus citations)

Pavlou M, Davies RA, Bronstein AM. The assessment of increased sensitivity to visual stimuli in patients with chronic dizziness. J Vestibular Res 2006:16(4-5)223-31. Pdf available on request (11 Scopus citations)

Pavlou M, Bronstein AM, Davies RA. Randomized trial of supervised versus unsupervised optokinetic exercise in persons with peripheral vestibular disorders. Neurorehabil Neural Repair 2013;27(3):208-18. Doi: 10.1177/1545968312461715 (1 Google Scholar citation)

Funding:

Marousa Pavlou, Advances in falls rehabilitation, KCL PhD studentship, 2008-2011, £100,000

4. Details of the impact (indicative maximum 750 words)

King's College London (KCL) research on visual vertigo (VV) has been used in a number of ways but a wide array of services. For instance, in 2009, the Department of Health issued a good practice guide for '*Provision of adult balance services'* that included input from Dr Pavlou. Within this, citing Pavlou 2004, they stated that "Innovative technology has been highlighted by the Government as critically important in delivering services for 21st century healthcare." As such, they recommend that all supra-specialist centres should have access to dynamic visual stimulation equipment (1).

Work at KCL has established that customised vestibular rehabilitation *via* a DVD that incorporates visual motion exposure is an effective treatment for people with dizziness and is particularly effective for improving symptoms of VV. Most importantly, the DVD makes this type of treatment accessible to all balance centres, not just supra-specialist ones and, when used under supervision of a trained professional, is as effective as the use of expensive and high-tech equipment. There are approximately 160 physiotherapists with an interest in vestibular rehabilitation across the United Kingdom, with each seeing between 1-20 patients weekly. Currently the DVD is being used in around 30 rehabilitation centres in the UK by both NHS and private clinicians. Experts at the National Hospital for Neurology and Neurosurgery, Queen Square, London will attest to the use of this DVD for their patients (2). KCL has copyrighted the DVD and it is now available for purchase (3). There is a recognised need for this tool in that a poll carried out by KCL researchers at the conference of the Association of Chartered Physiotherapists with an interest in Vestibular Rehabilitation in May 2012 found that of 70 participating physiotherapists who treated VV symptoms, 80% said they would like to use the visual motion DVD together with Google images, an optokinetic drum or virtual reality (4). The Vestibular Rehabilitation Special Interest Group of the American Physical Therapy Association has details on how to purchase the DVD on their website following multiple requests by its members (5).

Through training sessions at relevant meetings, the work of KCL researchers in assessing and treating VV has been disseminated to clinicians both inside and outside of the UK. These involve a lecture followed by a number of practical elements including case studies, exposure to the optokinetic stimuli and appropriate types of exercises, along with discussion of patient presentation, subjective symptom reports and factors affecting outcome. Training sessions have occurred at UK meetings of the National Hospital for Neurology and Neurosurgery Dizziness Course (November 2010, June 2013); Royal College of Medicine (March 2012); the British Society of Audiology (annually) and the Association of Chartered Physiotherapists with an interest in Neurology or Vestibular rehabilitation in 2011 and 2012. Outside of the UK they have occurred at the American Physical Therapy Association's Combined Sections Meeting in 2012;

the Vestibular Assessment and Rehabilitation Workshop, Doha, Qatar, 2012 and in Germany (2007) (6).

This work has also been utilised in a variety of clinical practice materials. The 2011 'International Guidelines for Education in Vestibular Rehabilitation Therapy' (VRT) has a number of clinical science recommendations and state that for VRT therapists to be able to properly evaluate, treat and manage the care of patients with vestibular disorders they need an understanding of "the clinical problems with which these patients present." One of the areas of understanding with regard to "visual-vestibular interaction and the effects of apparent visual motion in patients with vestibular impairments" cites Pavlou 2006 as the sole source of recommendation to fulfil this educational need (7). The 2012 Handbook of Clinical Neurology series includes a volume on Neurological Rehabilitation, which is described as 'a definitive review of current neurorehabilitation practice' aimed at 'a wide range of clinicians and scientists.' Dr Pavlou, along with Professor Bronstein at Imperial College London authored the chapter on Balance, which includes reference to Pavlou 2013 and cites Pavlou 2004 and 2006 with regards to incorporation of optokinetic stimulation into balance rehabilitation programmes (8). Pavlou 2006, along with Pavlou 2011, is also cited in a fact sheet on VV produced by the American Physical Therapy Association aimed at general physicians (9) and in a podcast on VV organised by the same association with Dr Pavlou and Dr Jeffrey Staab as the invited speakers (10). Their website also includes a link to 'Dr Pavlou's Situational Vertigo Questionnaire,' which is a KCL-modified version of the SCQ used in Pavlou 2006 (11).

KCL work also features in an educational e-learning programme developed by the Joint Neurosciences Council, the European Federation of Neurological Societies and the European Neurological Society. Ebrain is a Europe-focused resource aimed at clinical neurosciences professionals for both training and continued professional development, with certification at the end of each module. Module 16 focuses on neuro-otology and includes information about the inclusion of optokinetic stimulation into vestibular rehabilitation programmes as appropriate for each patient citing Pavlou 2013 (12).

5. Sources to corroborate the impact (indicative maximum of 10 references)

1) Department of Health. Provision of adult balance services: A good practice guide. London: The Stationary office, 2009: https://workspace.imperial.ac.uk/ref/Public/UoA%2004%20-%20Psychology,%20Psychiatry%20and%20Neuroscience/dh_093861.pdf

2) Head of Department of Neuro-Otology, National Hospital for Neurology and Neurosurgery, Queen Square, London (Contact details on file)

3) Optokinetic stimulation DVD link: http://kingsbusiness.technologypublisher.com/technology/13877

4) Visual vertigo: UK physiotherapy poll. Data obtained from 70 physiotherapists polled at the ACPIVR (Association of Chartered Physiotherapists with an interest in Vestibular Rehabilitation) AGM One-day conference on 19 May 2012: http://www.bsno.org.uk/pdfs/VVPhysioUKpoll.pdf

5) Chair, Vestibular Special Interest Group of the Neurology Section of American Physical Therapy Association (Contact details on file)

6) Workshops

- UK
  - National Hospital for Neurology and Neurosurgery: http://www.uclh.nhs.uk/OurServices/ServiceA-Z/Neuro/NOT/Documents/Queen%20Square%20Balance%20Course%20flyer.pdf
- Worldwide
  - American Physical Therapy Association's Combined Sections Meeting Neurology Programming, Chicago, IL, USA, February 2012. http://www.apta.org/CSM/Programming/2012/Neurology/

- Vestibular Assessment and Rehabilitation Workshop, Doha, Qatar, January 2012: http://site.hmc.org.qa/varw/Default.htm

7) Cohen HS, Gottshall KR, Graziano M, Malmstrom EM, Sharpe MH, Whitney SL; Barany Society Ad Hoc Committee on Vestibular Rehabilitation Therapy. International guidelines for education in vestibular rehabilitation therapy. J Vestib Res 2011;21(5):243-50. Doi: 10.3233/VES-2011-0424. http://iospress.metapress.com/content/9467n1732h434545/fulltext.pdf

8) Barnes MP, Good DC. Handbook of Clinical Neurology: Neurological Rehabilitation. Elsevier Science Ltd. Publication date 1Nov.2012. Chapter 16. Balance. Bronstein AM, Pavlou M.

9) Visual Vertigo/Motion Sensitivity Factsheet. American Physical Therapy Association, Section on Neurology: http://www.neuropt.org/docs/vsig-physician-fact-sheets/visual-vertigo-motion-sensitivity.pdf?sfvrsn=2

10) Visual Vertigo podcast. Vestibular Rehabilitation Special Interest Group, American Physical Therapy Association: http://www.neuropt.org/special-interest-groups/vestibular-rehabilitation/podcasts

11) APTA Situational Vertigo Questionnaire: http://www.neuropt.org/special-interest-groups/vestibular-rehabilitation/resources

12) Bamiou DE, Straumann D. Neuro-otology Module 16. Ebrain, an e-learning resource supporting training in the clinical neurosciences, published 25 November 2011: http://www.ebrainjnc.com/curriculum.html