Institution: Imperial College London

Unit of Assessment: 01 Clinical Medicine

Title of case study: Improved Treatment of Balance Disorders

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

Dizziness is a common presenting symptom in general practice, neurology, ENT and old age medicine. Chronic dizziness in particular has a major impact on the individual and health service resources. Imperial College researchers have shown that the best treatment, from primary to tertiary care, is balance rehabilitation. Imperial researchers have provided the scientific basis for understanding a common form of chronic dizziness triggered by visual movement, which we labelled and is now known as "visual vertigo". We have developed an effective desensitization treatment program for this condition which is acknowledged in a Department of Health (DoH) "Good practice guide" document in 2009. The new desensitization treatment has now been adopted by rehabilitation professionals worldwide.

2. Underpinning research (indicative maximum 500 words)

Key Imperial College London researchers:
Professor Adolfo Bronstein, Professor of Neuro-otology (2001-present)
Professor Lucy Yardley, post-doctoral researcher (1995-1998), now at Southampton University
Professor Michel Guerraz, research assistant (1998-2002), now at Universite de Savoie
Dr Marousa Pavlou, PhD student (2002-2005), now at King's College London

After headache, dizziness is the second most frequent neurological presentation in general practice. It is estimated that 1/4 of adults in the UK have significant dizziness at any given time (DoH 2009 document [1] Evidence section). Chronic dizziness, in particular, has a major impact on the individual's well-being and working capacity, for example, 27% change their jobs and 21% give up work as a result (1). Vestibular and balance rehabilitation is the best treatment with nearly 70% of individuals completing a customised program achieving significant improvements (DoH 2009 document [1] Evidence section). However, Professor Bronstein and colleagues noticed that rehabilitation efficacy was compromised both by a) the pre-conception that rehabilitation cannot be implemented in primary care due to infrastructure limitations and b) the fact that no rehabilitation program existed for patients not responding to conventional hospital treatments – particularly for chronic patients with dizziness prompted by disorienting visual surroundings ("visual vertigo").

We tackled these two problems by a) identifying the scientific basis of a hitherto poorly defined form of dizziness, 'visual vertigo', where chronic dizziness is aggravated by visual movement (e.g. busy supermarkets, driving) and b) by developing appropriate rehabilitation strategies, both at primary and tertiary care level.

First, in 2001, Professor Bronstein and colleagues examined chronic patients' physiological responses to visual motion stimuli and found that such symptoms arise from a form of defective multisensory integration called "enhanced visual dependency" (2). Essentially, spatial orientation in these difficult patients is unduly influenced or biased by disorienting visual scenes in the environment (2-3). This work provided the scientific basis for developing rehabilitation randomized controlled trial (RCT) using visual motion desensitization (4). In this RCT, we compared hospital-based state of the art rehabilitation (customised exercise regime) with our new treatment using visual motion desensitization, which included exposing patients to simulated motion. The results showed significantly superior results in patients utilising the new regime incorporating simulated motion treatment. Encouraged by our observations with the hospital population, we also developed rehabilitation solutions for primary care by training existing GP surgery nurses to do balance rehabilitation. We found that a single training session with GP nurses made them capable of implementing a rehabilitation program which led to significantly superior outcomes when compared to standard GP treatment, typically drugs (5).

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

(1) Bronstein, A.M., Golding, J.F., Gresty, M.A., Mandalà, M., Nuti, D., Shetye, A., & Silove, Y. (2010). The social impact of dizziness in London and Siena. *J Neurol*, 257, 183-190. DOI. Times cited: 10 (as at 7th November 2013 on ISI Web of Science). Journal Impact Factor: 3.4

(2) Guerraz, M., Yardley, L., Bertholon, P., Pollak, L., Rudge, P., Gresty, M.A., & Bronstein, A.M. (2001). Visual vertigo: symptom assessment, spatial orientation and postural control. *Brain*, 124, 1646-1656. DOI. Times cited: 85 (as at 7th November 2013 on ISI Web of Science). Journal Impact Factor: 9.4

(3) Bronstein, A.M. (2002). Visual and psychological aspects of vestibular disease. *Curr Opin Neurol*, 15, 1-3.DOI. Times cited: 5 (as at 7th November 2013 on ISI Web of Science). Journal Impact Factor: 4.9

(4) Pavlou, M., Lingeswaran, A., Davies, R.A., Gresty, M.A., & Bronstein, A.M. (2004). Simulator based rehabilitation in refractory dizziness. *J Neurol*, 251, 983-995. DOI. Times cited: 49 (as at 7th November 2013 on ISI Web of Science). Journal Impact Factor: 3.4

(5) Yardley, L., Donovan-Hall, M., Smith, H.E., Walsh, B.M., Mullee, M., & Bronstein, A.M. (2004). Effectiveness of primary care-based vestibular rehabilitation for chronic dizziness. *Ann Intern Med*, 141, 598-605. DOI. Times cited: 52 (as at 7th November 2013 on ISI Web of Science). Journal Impact Factor: 16.7

Key funding:
- Medical Research Council (MRC; 2001-2005; £280,000), Principal Investigator (PI) A. Bronstein, Visual, cervical and autonomic influences on balance control mechanisms.
- MRC (2006-2011; £2.4million), PI A. Bronstein, Mechanisms Determining Chronic Vestibular Symptoms.
- MRC (2012-2015; £800,000), PI A. Bronstein, Cortical function in visual dependency in patients with chronic dizziness.

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

Impacts include: health and welfare, practitioners and services, public policy and services
Main beneficiaries include: patients, health practitioners, DoH

Chronic dizziness affects millions of people worldwide. Professor Bronstein and colleagues defined Visual Vertigo and developed desensitization treatments which are recommended by DoH and used by balance professionals worldwide. In the DoH "Provision of adult balance services: a good practice guide", the impact of the rehabilitation RCT is acknowledged, as a recommendation [1]: "It has been shown that certain balance symptoms (e.g. visual vertigo) do not respond to physical exercises alone; but in combination with dynamic visual stimulation, significant improvements are noted (41) Evidence suggests that mechanical and novel physiotherapy interventions such as virtual reality (42) and visual flow stimulation can promote improved vestibular compensation and rehabilitation, particularly when the patient experiences visual vertigo. Supra-specialist balance centres should have access to such equipment." (Note Reference 41 in the DoH document is reference (4) above).

A more recent Cochrane review (2011) on Vestibular Rehabilitation [2], also acknowledges the positive effect of our "simulator-based visual and self-motion stimulation" programme from our RCT (reference (4), as above).

The results of our RCT led to lectures and practical workshops for practitioners at medical and physiotherapy meetings in the UK and worldwide (two recent ones were in February 2012 at the American Physical Therapy Association, and UK National Vestibular Therapy Meeting May 2012) [3]. It must be emphasised that the latter events are 'hands on' 'how to do it' sessions for

rehabilitation professionals with a massive projection to the ultimate beneficiaries, the patients.

In the UK, the majority of balance physiotherapists now actively treat visual vertigo symptoms. A survey amongst the 101 therapists attending the National Vestibular Therapy Meeting (London, May 2012) showed that in response to the question "When present, do you treat visual vertigo symptoms: 86% = yes; 14% = no [3]. It should be noticed that before our research there was no concept of how dizziness (an 'ear' problem) could possibly be aggravated by visual stimuli (an 'eye' situation). More importantly, there was no structured treatment for such difficult dizzy patients. There is further evidence that physiotherapists are using and teaching our treatment approach, e.g. see J Beyts (UCLH vestibular therapist) lecture to Royal Surrey NHS Trust, with her slides showing our findings and treatment techniques [4].

The geographical reach of our impact extended to the USA. At a meeting of the ICF Consensus Conference for Vertigo (Kloster Seeon, Munich, May 2012) Professor S Whitney, chairperson of the Vestibular Special Interest Group of the American Physical Therapy Association (APTA) reported that of the approximately 3000 vestibular therapists in the USA, 70% use visual motion treatments as developed by Imperial for patients with chronic dizziness and visually-induced symptoms. In fact, the American Physical Therapy Association "Patient Education Fact Sheet" describes the syndrome of 'visual vertigo', using the term we coined, our interpretation and treatment principles [5]. They also have a dedicated podcast (aimed at physiotherapists but open to the public) on "Visual Vertigo" and "High Tech Vestibular and Balance Gadgets" in which the team at Imperial College is specifically mentioned [6]. The treatment DVD that we devised and copyrighted is also discussed. Imperial College is copyrighting and publishing this DVD in November so it can be easily available for patients and therapists. A deed of Assignment has been signed and this DVD will be commercialised through Imperial Innovations Ltd.

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

[1] The DOH "Provision of adult balance services: a good practice guide", 2009

[2] Hillier, S.L., McDonnell, M. (2011). Cochrane Review: Vestibular rehabilitation for unilateral peripheral vestibular dysfunction. *Cochrane Database Syst Rev*, 2011 (2), CD005397. DOI.

[3] National Vestibular Therapy Meeting Survey, London, May 2012. Full results of the poll can be found in the webpage of the British Society of Neuro-otology, http://www.bsno.org.uk. Archived on 7th November 2013.

[4] Example of lecture to Royal Surrey NHS Trust, showing our findings and treatment techniques: http://www.royalsurrey.nhs.uk/visual_vertigo_management_slide_2011. Archived on 7th November 2013.

[5] The American Physical Therapy Association "Patient Fact Sheet" on "Visual Vertigo and Motion Sensitivity": http://www.neuropt.org/docs/vsig-physician-fact-sheets/visual-vertigo-motion-sensitivity.pdf?sfvrsn=2. Archived on 7th November 2013.

[6] Podcasts: http://www.neuropt.org/special-interest-groups/vestibular-rehabilitation/podcasts (podcast #2 – "Visual vertigo" and podcast #6: High Tech Vestibular and Balance Gadgets mins. 26-36). Archived on 7th November 2013.

Contacts to corroborate the impact claimed:
Chairperson for the Neurology Vestibular Special Interest Group, American Physical Therapy Association