**Congress on NeuroRehabilitation and Neural Repair 2019**

**Neurofeedback for central neuropathic pain treatment: mental strategies used for successful neuromodulation**

Krithika Anil1, Jane Burridge2, Imogen Cotter3, Sara Demain4, David Simpson1, Julian Taylor5,6, Aleksandra Vuckovic7

1 Faculty of Engineering and Physical Sciences, University of Southampton, Southampton, UK

2 Faculty of Health Sciences, University of Southampton, Southampton, UK

3 Department of Clinical Psychology, National Spinal Injuries Centre, Stoke Mandeville Hospital, Aylesbury, UK

4 Faculty of Health and Human Sciences, University of Plymouth, Plymouth, UK

5 Sensorimotor Function Group, Hospital Nacional de Parapléjicos, SESCAM, Toledo, Spain

6 Harris Manchester College, University of Oxford, Oxford, UK

7 Department of Biomedical Engineering, School of Engineering, University of Glasgow, Glasgow, UK

**Introduction**

Central neuropathic pain (CNP) is a debilitating problem prevalent in 65% of the spinal cord injury (SCI) population. EEG-based neurofeedback (ENF) is a process where individuals self-modulate brain activity (neuromodulation) using mental strategies (MS). Preliminary research suggests ENF has potential to reduce CNP after SCI.

**Objective**

This exploratory study examined people’s MS used for ENF neuromodulation, with the aim of understanding the learning process.

**Method**

Twelve patients with CNP after SCI were asked to use ENF on a maximum of eight visits, each consisting of six five-minute ENF sessions; no neuromodulation guidance was given. Resting EEG with eyes open was recorded (baseline) before ENF sessions. Participants were asked at the end of each visit about their MS and perceived-neuromodulation performance. This was compared to actual-performance using frequency-spectrum analysis of their EEG activity and comparing baseline to ENF activity. Interviews were analysed using thematic analysis.

**Main Results and Discussion**

Interviews revealed that mental state (e.g., attentiveness), not MS (e.g., imagination), was associated with neuromodulation success. Unsuccessful patients reported they could not differentiate between successful and unsuccessful strategies; this may be due to an inefficient method of displaying EEG activity.

**Conclusion**

MS are a mediator, where MS are used to invoke specific cognitive processes (mental state) needed for ENF neuromodulation. The display of EEG activity may need modifications to facilitate learning ENF neuromodulation. Detailed results linking neuromodulation success rates and mental state will be presented.

**Acknowledgment**

The authors would like to thank DSTL, Spinal Research, SMSR, and NSIC of the Buckinghamshire Healthcare NHS Trust for their support in this study.