Conference of Undergraduate Research at Florida International University (CURFIU) 2019 Abstract

Improving the Stability of Referred Sensations Evoked by Transcutaneous Electrical Neuro-stimulation

Luis Herran, Andres Pena, Ranu Jung Ph.D.
Adaptive Neural Systems Laboratory, College of Engineering & Computing, Department of Biomedical Engineering, Florida International University, Miami, FL. USA

Loss of sensory function due to disease or limb amputation can be a devastating, life-changing event. Implantable neural stimulators have shown potential for providing naturalistic referred sensations, however, they require invasive surgical procedures. Transcutaneous electrical neurostimulation has been explored as a non-invasive alternative for delivering sensory feedback. Nonetheless, traditional single-channel stimulation approaches are hampered by large charge requirements, low selectivity, distracting local sensations, and limited stability. Arm motion during single-channel stimulation is known to impact the location, quality and intensity of the referred sensation. This study investigates the potential benefits of using interfering multichannel stimulation through surface electrodes to evoke more stable and consistent distally referred sensations than single-channel stimulation. In this study, charge-balanced biphasic current pulses were delivered to the median nerve of able-bodied participants using single-channel (1CH) and interfering multichannel (2CH) stimulation at the wrist level. Sensory responses were characterized for each approach under 8 different pulse durations, while Psychophysical questionnaires were used to interrogate the perceived location, quality, intensity and comfort of the evoked sensations at different wrist positions. In an early pilot test, the 2CH configuration was observed to be more immune to wrist position changes than 1CH. Further exploration with able-bodied participants is currently underway.

Acknowledgments: This research was supported by the Coulter Undergraduate Research Excellence Program to L Herran and the Coulter Eminent Scholar Endowment to R Jung.