Research Week 2022

Mapping high gamma neural signals in hand primary somatosensory cortex using a multi-thousand channel platinum nanorod microelectrode grid

Maryam N Shahin MD, Christian G Lopez Ramos MD MPH, Youngbin Tchoe PhD, Caleb Nerison BS, Jihwan Lee MS, Keundong Lee PhD, Andrew Bourhis BS, Shadi Dayeh PhD, Ahmed M Raslan MD, Kelly L Collins MD
shahinm@OHSU.edu Papé Family Pediatric Research Institute
Maryam N Shahin, MD Collins Lab

Keywords

Brain electrophysiology, mapping, high gamma signals, brain-computer interface

Abstract

Neurological deficits secondary to pathologies such as stroke, tumor, trauma, and neurodegeneration lead to enduring disability for many patients. Therefore, the development of neurorestorative technologies utilizing brain computer interfaces (BCIs) is an important goal in applied neuroscience. The high-gamma electrocorticographic (ECoG) neural signals from surgically implanted brain electrodes can be used as an indirect proxy for neuronal spiking activity and local neuronal output, which has translated into an effective control signal for BCIs. Direct electrical stimulation (DES) of primary somatosensory cortex has been used to provide sensory feedback in bi-directional sensorimotor BCIs (BBCIs). In these experiments, we characterize the spatial recording parameters of custom multi-thousand channel platinum nanorod subdural grid electrodes (PtNRGrid) in human hand primary somatosensory cortex. These PtNRGrids have up to 100 times the spatial resolution of traditional clinical grids of electrodes. The increased spatial electrode density may have important implications for future BCI development. During an awake craniotomy for tumor resection, a PtNRGrid was placed over primary hand somatosensory cortex while touches were applied to the ipsilateral and contralateral hand and arm. Here, we demonstrate the mapping of the high gamma signal in single digit and individual carpal distribution. This is the first analysis of high gamma signal in human hand primary somatosensory cortex utilizing PtNRGrids.