4th URSI AT-RASC, Gran Canaria, 19 – 24 May 2024

Enhanced Non-Invasive Temporal Interference Hypoglossal Nerve Stimulation Targeting Non-Responding Patients

Jan Trajlinek[(1) (3)], Mariane de Araújo e Silva*[(1) (2)] and Ondřej Studnička [(1) (4)]
(1) International Clinical Research Center, St. Anne's University Hospital, Brno, Czech Republic
(2) Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic
(3) Faculty of Medicine, Masaryk University, Brno, Czech Republic
(4) Brno University of Technology, Brno, Czech Republic

1 Extended Abstract

Neuromodulation, a rapidly expanding field in neuroscience, holds the key to unlocking numerous therapeutic options for various conditions. Among these possibilities, peripheral nerve stimulation emerges as a powerful tool with applications in both clinical and research purposes. Although non-invasive stimulation has improved, its current restrictions in reaching deep structures and lacking precise spatial resolution limit its effectiveness in peripheral nerve stimulation applications. Our previous research showed that Temporal Interference Stimulation (TIS) can overcome these challenges, paving the way for an array of potential treatments for neural disorders, including Obstructive Sleep Apnea (OSA). OSA is a common condition where breathing is reduced or stops during sleep, causing several comorbidities. Hypoglossal nerve (HN) stimulation is a treatment that aims to improve airway function, offering an alternative approach to managing this condition. Our initial human trial, bilateral TIS of the hypoglossal nerves was an efficient treatment for female patients with OSA. To address this gender issue, we developed multiple configurations that enhance our initial design by personalizing parameters to achieve optimal results. Initiated via numerous simulations (using Sim4life) to explore various combinations of electrical field interference, our goal was to address depth and focality challenges that had constrained our initial efforts in efficiently applying HN-TIS for all patients with OSA. To enhance flexibility, we designed multiple electrode configurations that could be easily adjusted without the need for electrode replacement. Achieving this objective offers individuals, irrespective of gender, an enhanced quality of life via non-invasive pathways that have not been investigated for OSA yet.