PLASTICITY AND DISEASE

2020 - 2021

by Jakob Blicher

In the Plasticity and Disease group, we conduct clinical and translational research using a wide range of imaging modalities including MR Spectroscopy, Hyperpolarized MRI, high resolution fMRI and Magnetoencephalography. The goal is to gain insight into disease pathophysiology and thereby lay the groundwork for future development of rehabilitation and treatment.

Development of assistive movement devices for ALS patients

Several Plasticity and Disease group members were taking part in the REMAP project, in which the aim was to develop a Brain-computer interface controlled assistive device for patients suffering from Amyotrophic Lateral Sclerosis (ALS).

The first results were published in 2020. A group of 30 patients suffering from ALS were investigated with EEG as they tried to move their hand. The results showed that even in patients with complete paralysis it is possible to record movement related cortical potentials (MRCPs) demonstrating the intention to move. This raises hope that MRCP-detection could be used in a Brain-computer interface in combination with a robotic device to assist patients suffering from ALS(1,2).

The next part of the REMAP project aimed to follow a group of patients suffering from ALS and simultaneously develop and implement a BCI-device controlling a soft-robotic glove (SEM-Glove) developed by the Swedish company BioServo®. We recruited and followed a group of 13 patients suffering from ALS and followed them for more than a year. Unfortunately, the COVID outbreak and subsequent nationwide lock-down was a severe challenge. The project had to be suspended, and all patients were unfortunately not available for follow-up when the lock-down was lifted. In October 2020, two patients were tested and showed promising results in terms of activating the robotic glove by the developed algorithm. Unfortunately, no further patient follow-up was possible in the project due to another lock-down. One of the patients, participating in the exciting test in October 2020, had his participation documented in a webdoc produced by the patient organization Muskelsvindfonden. The patient story caught the attention of Danish national TV (DR) and was featured on the program "21 Søndag" 27th of September 2021. Despite the lock-down, the project resulted in important new knowledge about ALS, and results from the follow-up of patients are undergoing analyses.

Jakob Blicher and DR journalist, Peter Qvortrup Geisling during the making of the "21 Søndag" TV feature on ALS treatment.
Photo: XXX

NEW FACE at CFIN

Lasse Knudsen is a PhD student at CFIN with Jakob Blicher as his main supervisor. He graduated from the SDC master degree program, Neuroscience & Neuroimaging, in 2020.

During his master, Lasse collaborated with Chinese researchers at the Institute of Biophysics in Beijing, where he used ultra-high field (7T) fMRI with submillimeter spatial resolution, to measure layer-dependent cortical activation in humans. Ultra-high field scanners have the advantage of increased signal-to-noise ratio, which is critical for submillimeter resolution acquisitions, but they are expensive and still relatively rare worldwide. Therefore, in the first part of his work at CFIN, Lasse will attempt to increase the feasibility of this tool at 3T. In later stages of the project, he plans to use it to study the primary motor cortex of ALS patients. This neurodegenerative disease is hypothesized to target specific layers of motor cortex, and layer-dependent fMRI recordings might thus provide novel insights into the pathophysiology of ALS.

Myopathy might explain long-term fatigue after COVID

With the COVID pandemic, several interesting research projects could not be completed as planned, but the pandemic also raised new and important research questions as a surprisingly large proportion of patients suffering from COVID complained of long-lasting symptoms such as fatigue, muscle pain, and cognitive problems.

In October 2020, the Danish Health Authority (Sundhedsstyrelsen) published its recommendation for the establishment of nationwide post-COVID clinics to help patients suffering from prolonged symptoms after COVID infection. Head of the plasticity and disease group, Jakob Blicher, was taking part in establishing the Post COVID clinic at Aarhus University Hospital as a representative of the Department of Neurology. This led to a good collaboration with Dr. Jane Agergaard and Professor Lars Østergaard from Department of infectious diseases and Dr. Hatice Tankisi from Department of Neurophysiology. Twenty patients were investigated with quantitative electromyography (EMG) and abnormal muscle activity was recorded in 11 patients, all of which reported physical fatigue post COVID. The exact mechanism in which COVID causes fatigue and abnormal EMG is still not fully understood. A subsequent study showed widespread histological changes in muscle tissue raising concerns of mitochondrial changes, inflammation, and capillary injury (Hejbøl EK et al. 2022).

References

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FACTS

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REMAP

REMAP (Restore motor function through robotic arm exoskeleton and brain computer interface) is funded with 8 million DKK from the Innovation Fund Denmark. The project is a collaboration between CFIN, Department of Neurology Aarhus University Hospital, Aalborg University, The Danish Rehabilitation Centre for Neuromuscular Diseases (RCFM) and the Swedish Company BioServo ®.