

## **Transcript of Poster 57667:**

### **EEG power bifurcation in the transition zone beta to gamma – from motor function to cognition – in Alzheimer and Long COVID patients versus healthy controls revealed by quantitative EEG time series analysis of lateral EEG data**

#### — TITLE

Hi, I am Frank Wirner and I want to introduce you to our work on the connection between Alzheimer's and Parkinson's disease and Long COVID.

#### — BIFURCATION

We analyzed EEG data of Alzheimer's patients and healthy controls, provided and preprocessed by colleagues Smith, Abasolo and Escudero. On the fly we discovered a new phenomenon when comparing the frontal asymmetry index of these two groups over the full frequency range for electrodes F3 and F4.

You see a power bifurcation occurring at 30 Hz which clearly discriminates Alzheimer's patients from healthy controls on the group level.

#### — LC PATIENT

Inspired by this insight we applied the frontal asymmetry index to EEG data of a medical doctor who is currently suffering from Long COVID since November 2020. The patient, working as a surgeon, developed a tremor that makes it impossible for her to perform surgery.

On the left the frontal asymmetry index of the Long COVID patient shows a significant peak at 30 Hz that immediately caught our attention.

On the right you see the power spectrum for electrodes F3 and F4 which also shows a peak at 30 Hz we haven't seen before in EEG data of Long COVID patients.

Moreover, at several electrodes an additional 20 Hz peak was also observed, indicating motor impairments, which can be attributed to the patient's tremor.

#### — LITERATURE

The appearance of motor impairments due to the stimulation at 20Hz was discussed in several papers, especially by the group of Peter Brown.

Tinkhauser and colleagues showed, that the severity of Parkinsonian symptoms, specifically a tremor, is related to the accumulation of "bursts" with long durations at certain frequencies in the beta band, like we observed for our Long COVID patient.

#### — HYPOTHESIS

Our hypothesis is, that the application of sensory neurostimulation in the lower gamma frequency range decreases the spectral energy in the beta band and thereby dampens the peak at 20 Hz, considered to be a pathological one related to motor impairments.

On the left you see the frequency spectrum of electrode O2 for different measurements without gamma stimulation where you can see a 20 Hz peak, whereas on the right you see the intended effect, the 20Hz peak disappearing during gamma stimulation at 40 Hz, similar to the one used at the MIT.

#### — ANIMATION

Here you see an illustration of this idea: first, the power spectrum without the stimulation and then the dampening of the 20 Hz peak when the gamma stimulation is applied.

#### — CONCLUSIONS

The primary question that remains to be answered is, how we can make the beneficial effect of sensory gamma neurostimulation long-lasting for Long COVID patients or patients suffering from Parkinson's disease.

And our concluding hypothesis is that the same gamma neurostimulation can also be applied to Alzheimer's patients under the assumption that this would reverse their observed gamma shift and, in the longer run, attenuate the related symptoms.

— CREDENTIALS

Here you see all collaborators.

Thank you for listening.