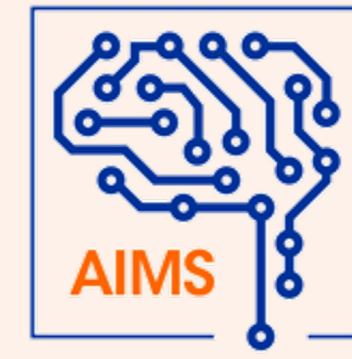


# Validation of the 1/f ratio as a marker of excitation/inhibition balance through benzodiazepines use in multiple sclerosis



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**Background:** Recent research combining neuro-computational modeling with measurements of local field potentials indicates that the slope with which the spectrum of neuronal activity rolls off is a non-invasive marker of the excitation/inhibition balance [1].

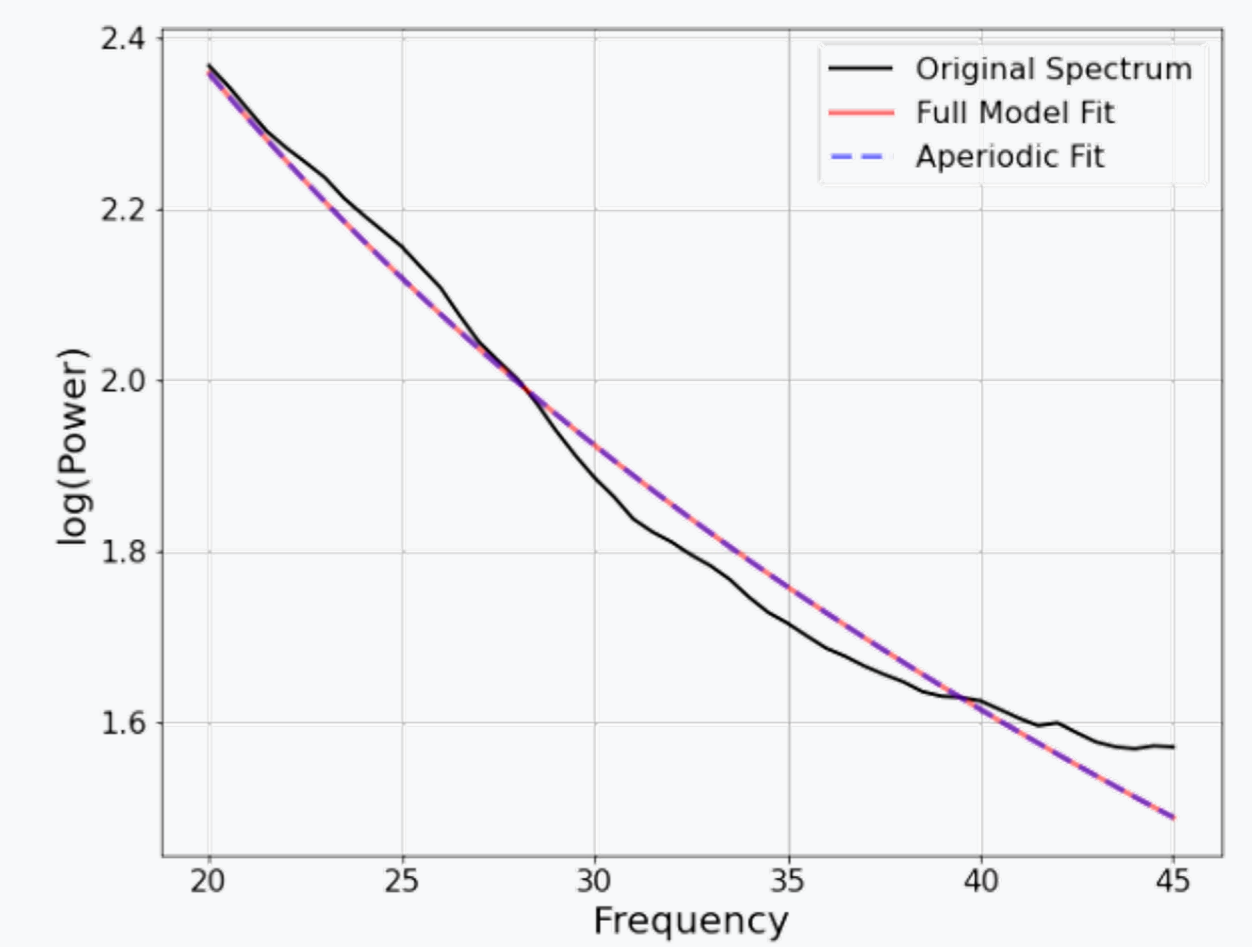
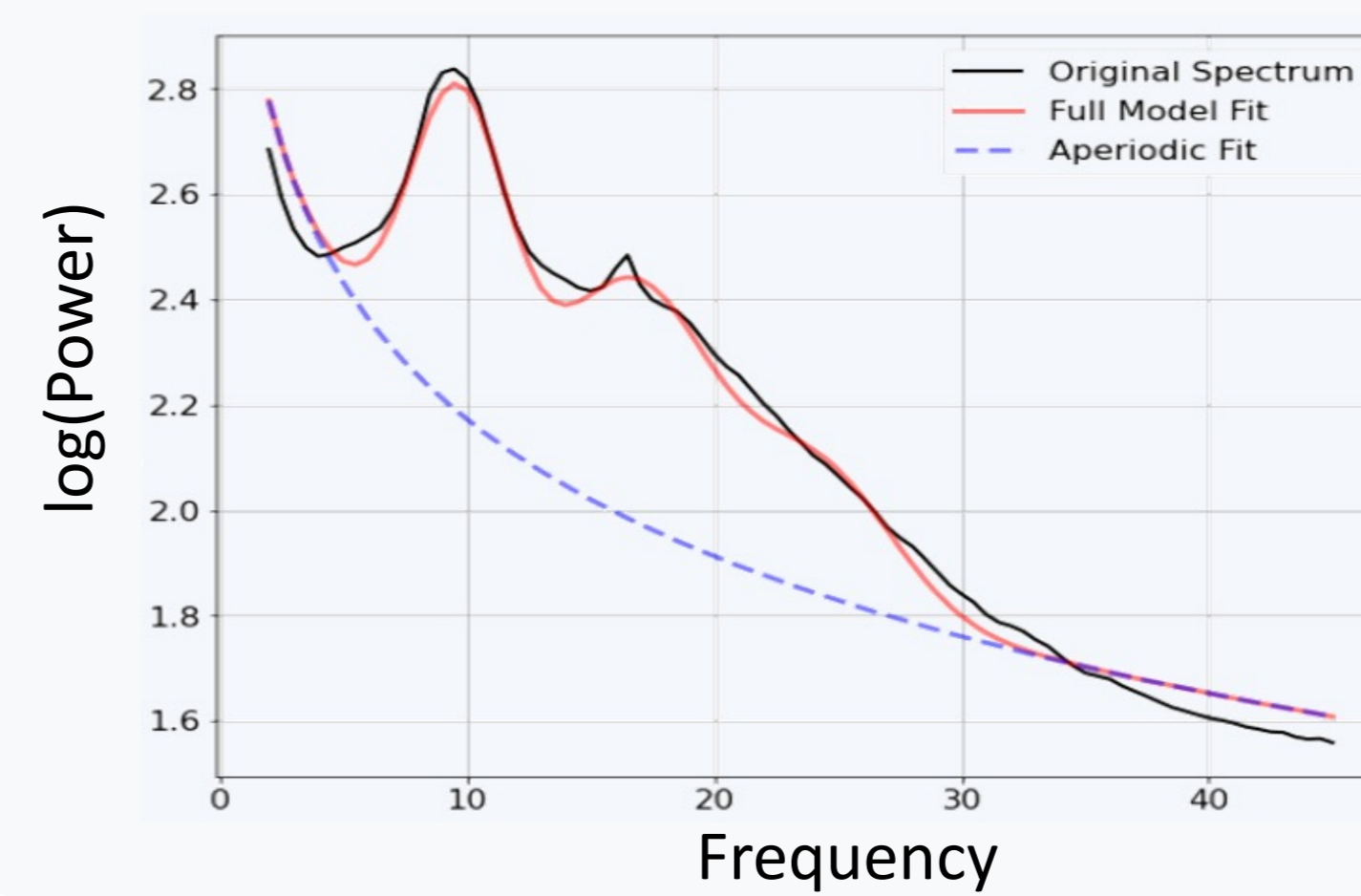
**Aim:** Validating this technique in a dataset of multiple sclerosis patients who were treated and not treated with Benzodiazepine which is a symptomatic treatment that reinforces the inhibitory effects of GABA.

**Hypothesis:** The 1/f exponent in the power spectrum of patients treated with benzodiazepines is steeper due to the inhibitory effect of benzodiazepines.

**Method:** MEG datasets were acquired from 64 MS patients during the resting-state eyes-closed condition.

- 50 MS(BZD-): patients not treated with benzodiazepines
- 14 MS(BZD+): patients treated with benzodiazepines

**Algorithm:** We used the “fitting oscillations and one over f” (FOOOF) algorithm to estimate the 1/f exponent [2] within the fitting frequency range [20-45Hz].



## The 1/f ratio enables us to pick up the effect of benzodiazepines in people with multiple sclerosis.



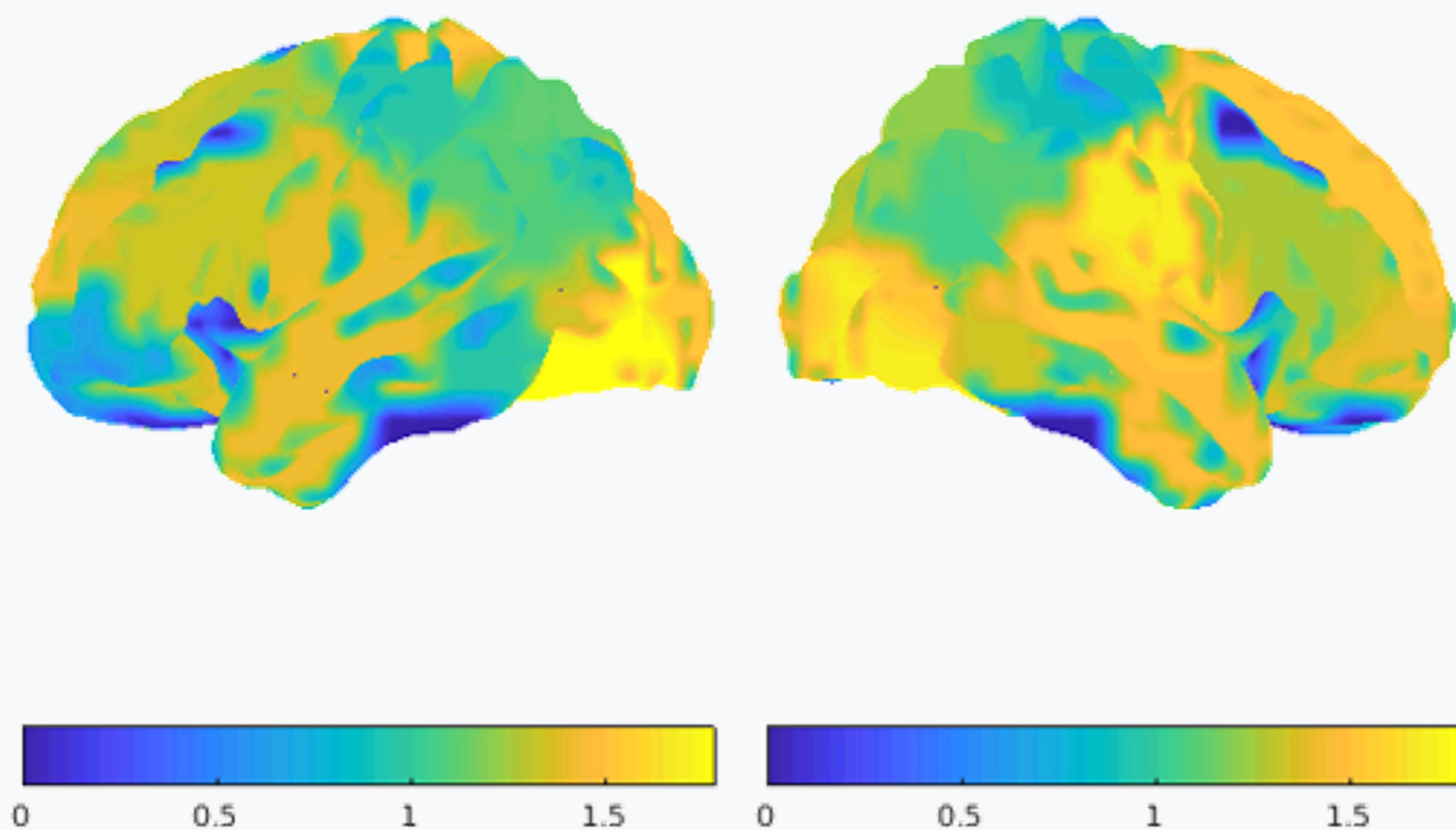
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**Results:** As expected, we observe a significant difference in 1/f slope when comparing MS(BZD+) vs MS(BZD-).

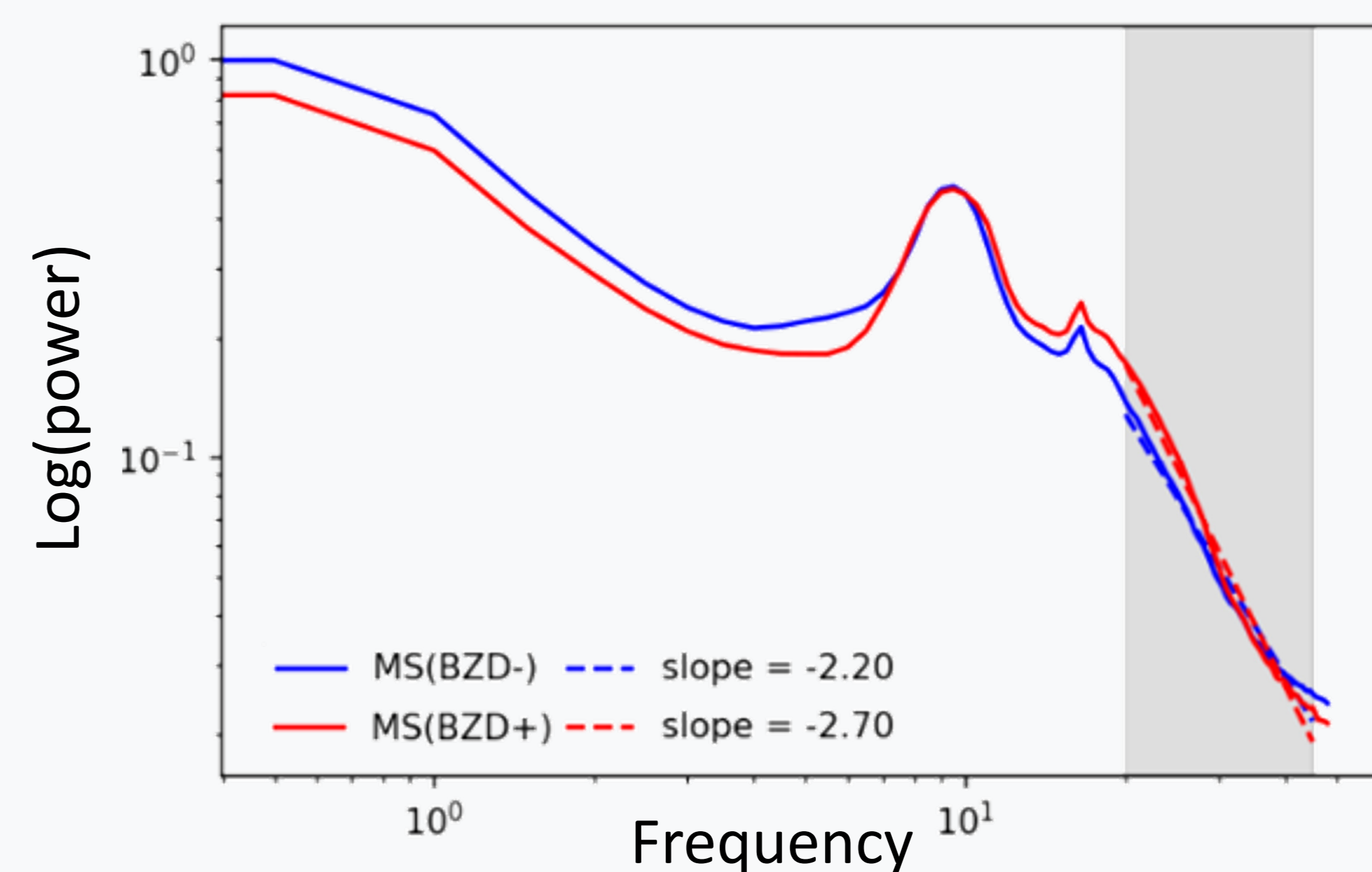
MS patients treated with benzodiazepines have a steeper roll (p-value = 0.006, Cohen's d = 1.22).

The comparisons have been done for the whole brain and then re-done at the parcel level for 42 brain parcels [3].

All results were corrected for multiple comparisons to control the false discovery rate [4].



-log<sub>10</sub>(p-value) (>1.3 indicates a p-value < 0.05)



## References:

- [1] Gao, R., Peterson, E. J. & Voytek, B. Inferring synaptic excitation/inhibition balance from field potentials. *NeuroImage* (2017). [2] Donoghue, T. *et al.* Parameterizing neural power spectra into periodic and aperiodic components. *Nature Neuroscience*. (2020). [3] Vidaurre, D. *et al.* Spontaneous cortical activity transiently organises into frequency specific phase-coupling networks. *Nature Communications* (2018). [4] Benjamini, Y. & Hochberg, Y. Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *Journal of the Royal Statistical Society: Series B (Methodological)* (1995).

