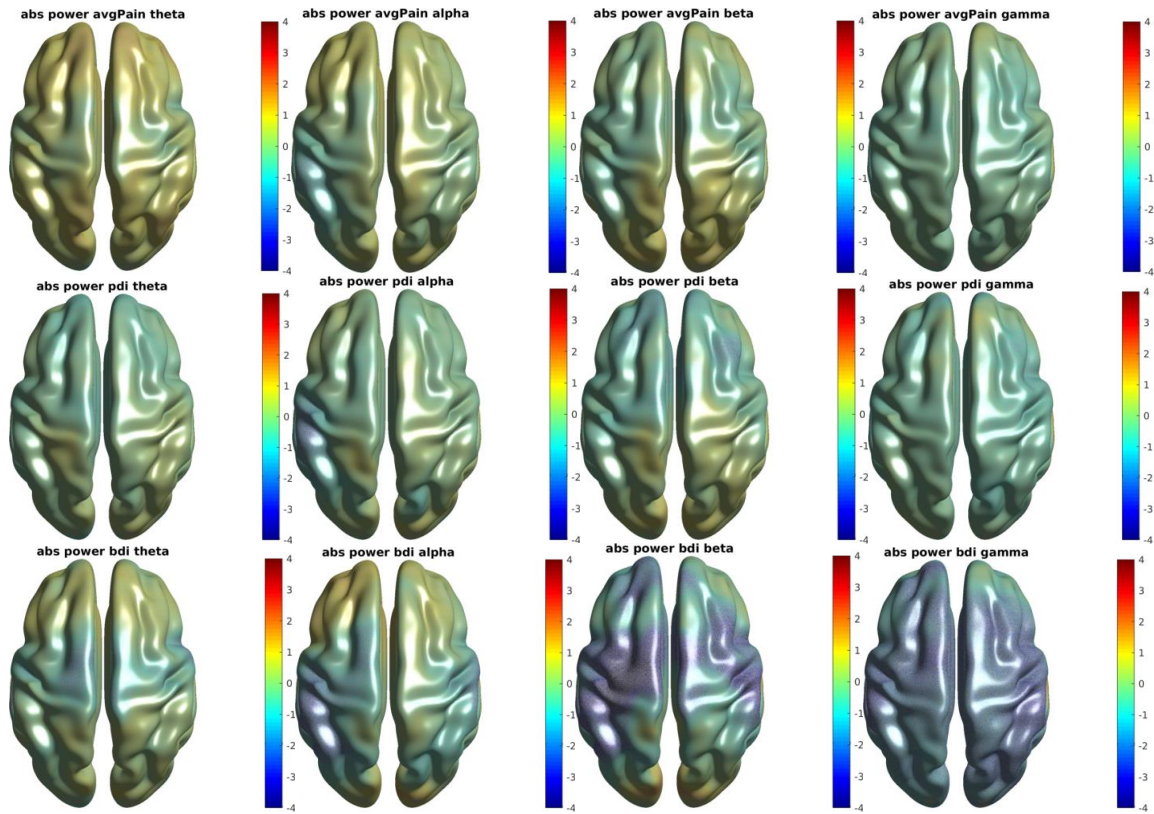


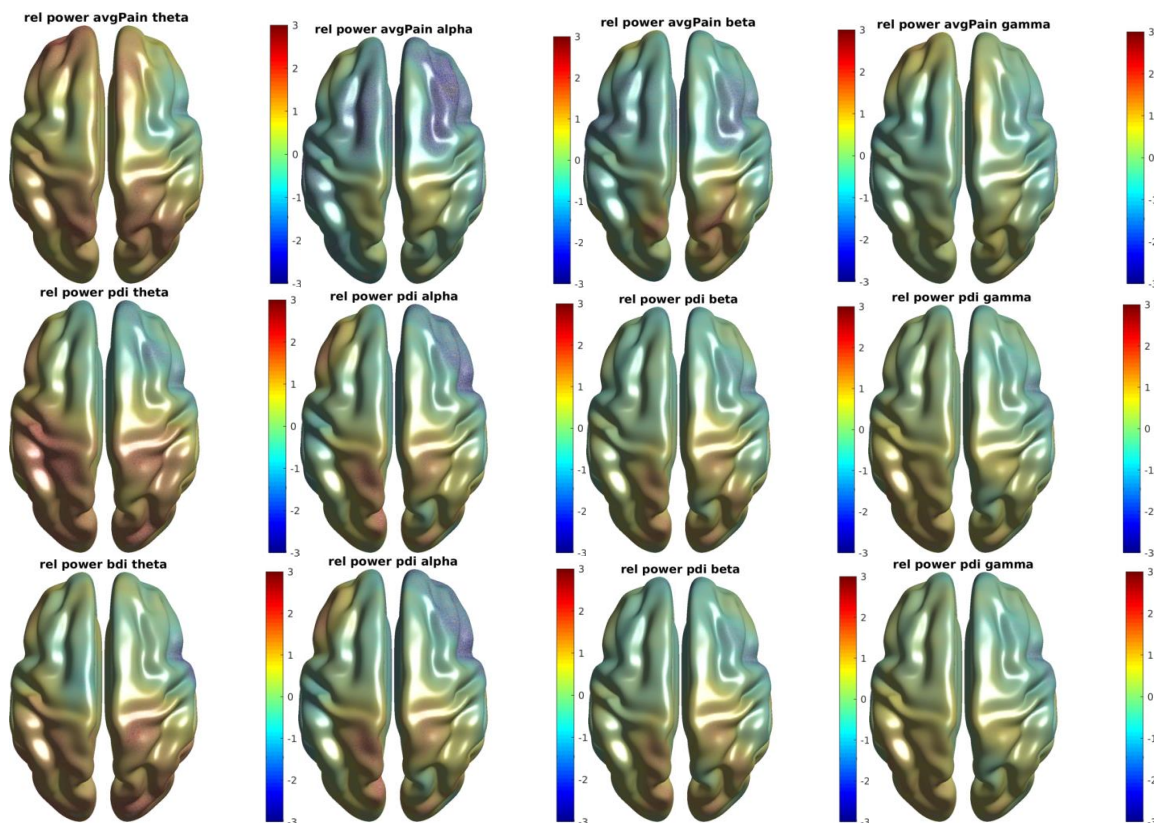
Supplementary Material

Supplementary Figure 1: t-maps for correlations between changes in clinical measures and changes in local amplitudes of neuronal oscillations (absolute and relative power).

Absolute power:

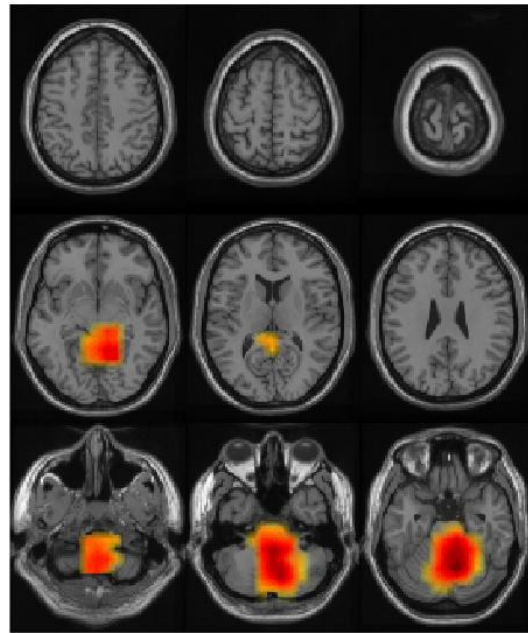


Relative power:

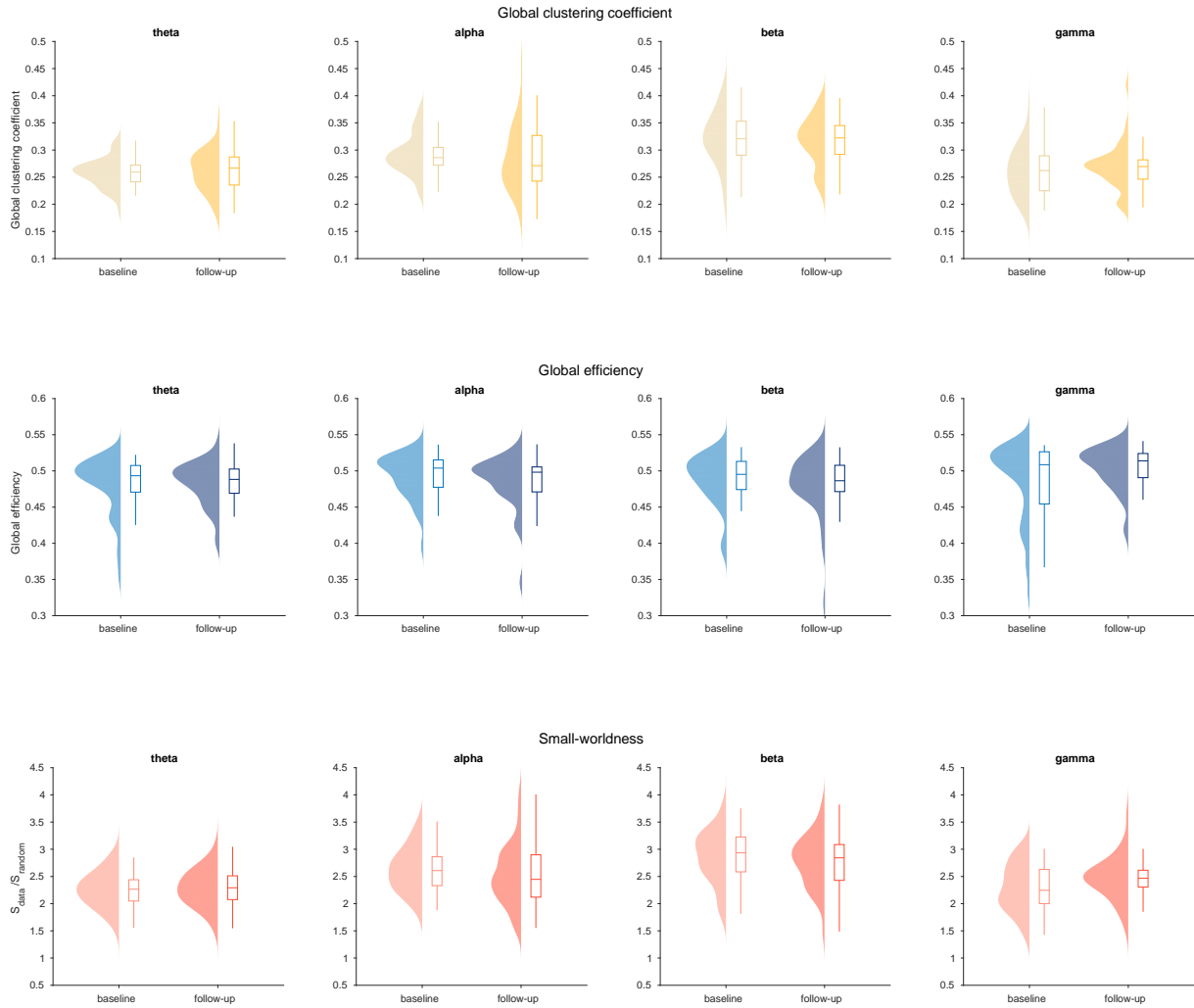


Supplementary Figure 2: Cluster-based permutation statistics for the correlation of local change (Δ) in degree (voxel-wise) with change in pain related disability.

Depicted is a significant cluster indicating a positive relationship between changes in pain-related disability (PDI) and changes in the graph theory-based measure local degree in the beta band (p [corr./uncorr.] = 0.028 /0.007).



Supplementary Figure 3: Raincloud plots of global graph theory-based measures at baseline and follow-up. Raincloud plots show un-mirrored violin plots displaying the probability density function of the data, boxplots and individual data points. Boxplots depict the sample median as well as first (Q1) and third quartiles (Q3). Whiskers extend from Q1 to the smallest value within $Q1 - 1.5 \times \text{IQR}$ and from Q3 to the largest values within $Q3 + 1.5 \times \text{IQR}$.



| | Age | Sex | Diagnosis | Curr. Pain (NRS) | | Avg. Pain (NRS) | | PDI | | BDI | | PDQ | | MQS | |
|----|-----|-----|-----------|------------------|----|-----------------|----|------|------|-----|----|-----|----|------|------|
| | | | | BL | FU | BL | FU | BL | FU | BL | FU | BL | FU | BL | FU |
| 1 | 53 | f | CBP | 2 | 0 | 3 | 1 | 3,86 | 1,14 | 22 | 2 | 12 | 0 | 3,8 | 5,7 |
| 2 | 76 | f | CBP | 9 | 9 | 9 | 10 | 4,86 | 7,86 | 23 | 28 | 3 | 2 | 0 | 0 |
| 3 | 72 | f | CBP | 6 | 7 | 6 | 7 | 5,71 | 4,14 | 20 | 19 | 20 | 18 | 0 | 0 |
| 4 | 58 | m | CBP | 4 | 3 | 5 | 4 | 3,71 | 2,71 | 17 | 20 | 12 | 14 | 3,4 | 8 |
| 5 | 53 | f | CBP | 8 | 6 | 8 | 7 | 5,14 | 4,43 | 18 | 22 | 19 | 9 | 9,8 | 13,8 |
| 6 | 62 | f | CBP | 5 | 3 | 5 | 5 | 2,57 | 2,43 | 16 | 13 | 9 | 6 | 9,7 | 9,7 |
| 7 | 44 | m | CBP | 8 | 5 | 7 | 6 | 3,86 | 3,86 | 17 | 13 | 2 | 4 | 20,8 | 20,8 |
| 8 | 79 | m | CBP | 7 | 6 | 6 | 6 | 5,14 | 4,43 | 19 | 21 | 26 | 15 | 3,8 | 3,8 |
| 9 | 50 | m | CBP | 7 | 6 | 7 | 5 | 6,14 | 5,43 | 36 | 24 | 16 | 15 | 16 | 12,6 |
| 10 | 76 | f | CBP | 4 | 1 | 3 | 3 | 1,71 | 2 | 10 | 8 | 15 | 8 | 7,8 | 6,3 |
| 11 | 56 | m | CBP | 4 | 3 | 5 | 6 | 6,43 | 5,57 | 18 | 15 | 23 | 21 | 14,4 | 17,3 |
| 12 | 68 | f | NP | 2 | 2 | 3 | 4 | 0,43 | 1 | 1 | 2 | 22 | 25 | 10,8 | 4 |
| 13 | 62 | f | CBP | 5 | 1 | 5 | 3 | 6,14 | 1,86 | 29 | 3 | 14 | 9 | 0 | 9,5 |
| 14 | 68 | m | NP | 0 | 3 | 8 | 3 | 2,57 | 0,14 | 20 | 7 | 22 | 15 | 9,7 | 9,7 |
| 15 | 30 | f | NP | 4 | 4 | 6 | 5 | 4,43 | 3,57 | 12 | 4 | 22 | 22 | 4,9 | 4,9 |
| 16 | 58 | f | CBP | 6 | 6 | 7 | 6 | 5,57 | 4,29 | 24 | 21 | 18 | 21 | 12,4 | 18,1 |
| 17 | 48 | m | JP | 2 | 0 | 5 | 2 | 2,57 | 3,14 | 3 | 0 | 5 | 3 | 10,6 | 3,4 |
| 18 | 59 | f | JP | 4 | 8 | 5 | 5 | 3,86 | 5,14 | 13 | 11 | 19 | 16 | 8,6 | 13,2 |
| 19 | 26 | f | CBP | 6 | 6 | 6 | 7 | 6 | 4,43 | 10 | 13 | 14 | 20 | 0 | 6,9 |
| 20 | 37 | m | CBP | 5 | 2 | 7 | 4 | 2,57 | 3,43 | 4 | 2 | 14 | 16 | 10,9 | 1,9 |
| 21 | 46 | m | CBP | 1 | 1 | 4 | 2 | 5,43 | 4,57 | 20 | 13 | 19 | 20 | 11,4 | 8 |
| 22 | 23 | m | NP | 5 | 3 | 4 | 3 | 5,86 | 1,57 | 26 | 7 | 3 | 3 | 4,6 | 0 |
| 23 | 70 | f | CBP | 5 | 3 | 7 | 4 | 2,29 | 1,71 | 25 | 14 | 18 | 23 | 4 | 4 |
| 24 | 20 | m | CBP | 1 | 1 | 2 | 1 | 1,86 | 0,86 | 5 | 7 | 1 | 3 | 11,8 | 0 |
| 25 | 29 | f | JP | 3 | 2 | 2 | 2 | 1,14 | 1,14 | 3 | 4 | 5 | 5 | 5,9 | 5,9 |
| 26 | 38 | m | CBP | 8 | 7 | 8 | 7 | 5,29 | 4,71 | 14 | 6 | 23 | 23 | 31,9 | 26,3 |
| 27 | 58 | f | CBP | 5 | 5 | 6 | 6 | 2,57 | 4,86 | 8 | 6 | 9 | 17 | 2,3 | 2,3 |
| 28 | 39 | m | CBP | 6 | 6 | 5 | 5 | 3,57 | 4,71 | 9 | 13 | 5 | 7 | 11,9 | 2,3 |
| 29 | 73 | m | JP | 3 | 6 | 4 | 7 | 6 | 5,14 | 18 | 13 | 10 | 7 | 12 | 17,7 |
| 30 | 73 | f | CBP | 6 | 6 | 5 | 6 | 1,86 | 3,29 | 6 | 5 | 5 | 18 | 11,2 | 15,3 |
| 31 | 73 | m | CBP | 6 | 5 | 6 | 4 | 6,14 | 5,71 | 23 | 10 | 20 | 17 | 21 | 22,5 |
| 32 | 54 | f | CWP | 8 | 6 | 8 | 7 | 6,71 | 2,43 | 27 | 9 | 17 | 23 | 20 | 16,2 |
| 33 | 38 | f | CBP | 7 | 3 | 7 | 4 | 6 | 1,29 | 18 | 10 | 20 | 14 | 6,8 | 4,6 |
| 34 | 29 | f | CWP | 5 | 4 | 3 | 4 | 5,14 | 6,86 | 23 | 21 | 9 | 7 | 0 | 0 |
| 35 | 41 | f | CBP | 4 | 5 | 4 | 3 | 3,86 | 2,29 | 1 | 1 | 16 | 11 | 6,8 | 6,8 |
| 36 | 77 | f | CBP | 4 | 2 | 5 | 4 | 3 | 2,71 | 14 | 12 | 15 | 12 | 21,9 | 16,5 |
| 37 | 48 | f | JP | 5 | 2 | 6 | 2 | 6,57 | 2,29 | 18 | 3 | 5 | 11 | 14,4 | 11,5 |
| 38 | 50 | m | CWP | 5 | 3 | 7 | 3 | 5,86 | 2,14 | 9 | 2 | 18 | 13 | 3,8 | 3,8 |
| 39 | 38 | f | JP | 2 | 1 | 4 | 4 | 4,43 | 2 | 21 | 16 | 16 | 22 | 1,7 | 1,7 |
| 40 | 36 | f | JP | 2 | 0 | 2 | 1 | 3,71 | 1,57 | 3 | 0 | 3 | 5 | 2,2 | 0 |
| 41 | 22 | f | JP | 7 | 7 | 7 | 9 | 3,29 | 3,29 | 9 | 2 | 11 | 11 | 3,8 | 0 |

Supplementary Table 1: Patient characteristics. f = female, m = male; CBP = chronic back pain; NP = neuropathic pain; JP = joint pain; CWP = chronic widespread pain; Avg. pain intens. = Average pain intensity, past 4 weeks (Numerical Rating Scale, NRS 0-10); PDI = Pain Disability Index; BDI = Beck Depression Inventory II; PDQ = PainDETECT Questionnaire; MQS = Medication Quantification Scale; BL = baseline; FU = follow-up

| | | Δ Avg. pain | Δ PDI | Δ BDI |
|-------------------------|-------|-----------------------------------|-----------------------------------|------------------------------------|
| Δ Absolute power | theta | (-) | p = 0.78 (neg.) | p = 0.49 (neg.) |
| | alpha | (-) | p = 0.43 (neg.) | p = 0.86 (pos.) p = 0.23 (neg.) |
| | beta | (-) | p = 0.75 (neg.) | p = 0.90 (pos.) p = 0.04 (neg.) |
| | gamma | (-) | p = 0.49 (neg.) | p = 0.65 (pos.) p = 0.07 (neg.) |
| Δ Relative power | theta | p = 0.51 (pos.) | p = 0.50 (pos.) p = 1.0 (neg.) | p = 0.99 (pos.) p = 1.0 (neg.) |
| | alpha | p = 0.50 (neg.) | p = 1.0 (pos.) p = 0.65 (neg.) | p = 1.0 (pos.) p = 0.93 (neg.) |
| | beta | p = 0.92 (pos.) p = 1.0 (neg.) | p = 1.0 (neg.) | p = 1.0 (pos.) p = 1.0 (neg.) |
| | gamma | p = 1.0 (pos.) p = 1.0 (neg.) | p = 1.0 (neg.) | p = 1.0 (neg.) |

Supplementary Table 2: Cluster based permutation statistics for the correlations of change in clinical measures with change in absolute and relative local power (voxel-wise) in the theta, alpha, beta and gamma band. Table shows the uncorrected minimum p-values, if a cluster was obtained. (-) = no cluster obtained, (neg.) = negative cluster, (pos.) = positive cluster. Δ = follow-up values - baseline values. Avg. pain = Average pain intensity in the past 4 weeks (Numerical Rating Scale, NRS 0-10); BDI = Beck Depression Inventory II; PDI = Pain Disability Index;

| | | Δ Avg. pain | Δ PDI | Δ BDI |
|-----------------|-------|------------------------------------|-------------------------------------|------------------------------------|
| Δ CC | theta | p = 0.60 (pos.) p = 1.0 (neg.) | p = 0.07 (pos.) p = 0.79 (neg.) | p = 0.26 (neg.) p = 1.0 (pos.) |
| | alpha | p = 0.64 (pos.) p = 1.0 (neg.) | p = 1.0 (pos.) p = 0.88 (neg.) | p = 1.0 (pos.) p = 0.95 (neg.) |
| | beta | p = 0.04 (pos.) p = 1.0 (neg.) | p = 1.0 (pos.) p = 1.0 (neg.) | p = 0.11 (pos.) p = 0.49 (neg.) |
| | gamma | p = 0.71 (pos.) p = 0.39 (neg.) | p = 0.84 (pos.) p = 0.40 (neg.) | p = 1.0 (pos.) p = 0.86 (neg.) |
| Δ degree | theta | p = 1.0 (pos.) p = 1.0 (neg.) | p = 1.0 (pos.) p = 1.0 (neg.) | p = 0.67 (pos.) p = 0.48 (neg.) |
| | alpha | p = 1.0 (pos.) p = 0.13 (neg.) | p = 1.0 (pos.) p = 0.21 (neg.) | p = 1.0 (pos.) p = 0.41 (neg.) |
| | beta | p = 1.0 (pos.) p = 0.27 (neg.) | p = 0.007* (pos.) p = 1.0 (neg.) | p = 0.02 (pos.) p = 0.16 (neg.) |
| | gamma | p = 0.29 (pos.) p = 1.0 (neg.) | p = 1.0 (pos.) p = 1.0 (neg.) | p = 0.87 (pos.) p = 0.07 (neg.) |

Supplementary Table 3: Cluster based permutation statistics for the correlations of change in clinical measures with change in the local graph-theory based measures local clustering coefficient (CC) and degree (voxel-wise) in the theta, alpha, beta and gamma band. Table shows the uncorrected minimum p-values, if a cluster was obtained. Asterisks indicate significant clusters after correction for multiple comparisons across the four frequency bands: *p<0.05. (-) = no cluster obtained, (neg.) = negative cluster, (pos.) = positive cluster. Δ = follow-up values - baseline values. Avg. pain = Average pain intensity in the past 4 weeks (Numerical Rating Scale, NRS 0-10); BDI = Beck Depression Inventory II; PDI = Pain Disability Index;