Alterations in resting-state brain activity of fibromyalgia patients

The Pain Relief Foundation

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Fibromyalgia syndrome

• Fibromyalgia syndrome (FMS) is a chronic pain disorder primarily associated with pain and tenderness, fatigue and psychological distress.

• Estimated to affect up to 5% of women.

• Challenging to treat, large socio-economic burden.

Previously considered to be central sensitisation syndrome, now peripheral factors are a major (and perhaps primary) consideration.
Central components of fibromyalgia?

- Neuroimaging studies have frequently shown alterations to central structure or function in FM.

Enhanced activation profile to innocuous stimuli.
Gracely et al., 2002

Reduced DNIC. Julien et al., 2005

Grey matter reduction, and in pain-relevant regions.
Kuchinad et al., 2007
Resting-state analyses

• Resting-state analyses consider the ongoing activity of the brain.

• This allows for investigations of spontaneous brain activity.

• Advantages:-
  • Investigation of brain networks.
  • Allows for a broader sampling of patients, e.g., those too impaired for task-based studies
  • Is not confounded by task performance, effort, practice effects, lab differences etc.
  • Increased signal-to-noise ratio (Fox & Greicius, 2010)
We recruited 19 FM patients and compared to 18 healthy controls.

We utilised EEG with a simple resting-state paradigm to consider the power of different oscillatory frequencies.

The relative power of each frequency band of interest was calculated at scalp and source level.
FM patients demonstrate augmented frontal theta activity in both scalp electrodes and source analysis.

Theta power in frontal regions significantly correlated with measures of tenderness and fatigue on the day of testing.

Resting theta activity could offer some insight into fluctuating levels of chronic pain and other symptoms.

Fallon et al., 2018 Eur J Pain.
• Since our study, similar theta-band resting-state changes have been shown in FM patients using MEG (top right).

• Theta activity has been postulated as a potential biomarker or neural signature for pain using animal models (bottom right).

• Normalisation of theta network activity is a target outcome for tDCS for fibromyalgia (below)

(Choe, Lim, Kim, Lee, & Chung, 2018)

(Castillo-Saavedra et al., 2016)
• Previously we also identified demonstrated altered functional connectivity between resting brain networks using fMRI.

• Our results include connectivity seeds in middle frontal gyrus and ACC.

• Both of our resting-state studies indicate a relationship between alterations in resting brain activity and tonic pain levels from the day of testing.

Conclusions

• It appears that alterations in resting brain activity of FM patients relate to fluctuating experience of symptoms.

• Central alterations could be downstream, or could interact with peripheral mechanisms.

• The direction and causal nature of such interactions is yet to be fully understood.

• Longitudinal analysis of resting-state analysis could prove to be an important tool
  • Objectively evaluate novel treatments

• Identifying patients who are predisposed to develop chronic pain, or most likely to benefit from a particular type of treatment – i.e., personalised medicine.
References