PTSD and the social brain: affect-related disruption of the default and mirror networks

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Introduction

- Post-traumatic stress disorder (PTSD) is strongly associated with impairments in social inference¹
- The etiology of social inference impairments in PTSD is unknown due to a lack of neuroimaging studies¹
- Social inference recruits the default mode network (DMN) and mirror neuron system (MNS)²
 - MNS represents observable sensorimotor features
 - DMN infers unobservable mental states, traits, and intentions
- We probed DMN & MNS regions in the first neuroimaging study of social inference in PTSD

Materials & Methods

Participants – 35 combat trauma-exposed US veterans with & without PTSD (PTSD N = 18)

Procedure

- Pre-treatment session: baseline clinical interview (Clinician Administered) PTSD Scale; CAPS) & fMRI (Siemens TimTrio 3T)
- Affect labeling therapy: PTSD group continued with 3 weeks of psychotherapy using inhibitory affect regulation strategies³
- Post-treatment session: PTSD patients who completed therapy (N = 13) underwent second clinical interview & fMRI

Why/How social inference task



- Prompts Why (mentalizing) & How (action identification)
- Stimuli Emotions (emotional expressions) & Actions (intentional actions)
- Why-How contrast dissociates DMN & MNS activity²
- Why-How contrast within stimulus type used for all fMRI analyses here

Regions of Interest (ROIs)

Within-Network ROIs



- **DMN** (Why > How) **MNS** (How < Why)
- ROIs defined by Why-How contrast in an independent dataset² (N = 50)
- Within-network ROIs thought to be key nodes of DMN & MNS^{2,4}



- Main effect of Group not significant, Group x Stimulus interaction was robust
- Emotions elicited hyperactivation in the PTSD group relative to controls
- Actions did not elicit significant Group differences



ROIs (networks) mPFC (DMN) vmPFC (DMN) PCC (DMN, FPCN) **TPJ** (DMN, VAN) **pIFG** (MNS, VAN) **dPMC** (MNS, DAN) **IPS** (MNS, DAN)

LOTC (MNS, DAN)



negative post-treatment



- processing in PTSD
- No PTSD-related effects significant in core affect regions like vmPFC, OFC, amygdala & insula
- PTSD-related effects strongest in whole-network DMN & MNS ROIs, and in regions that overlap with the attention networks
- Affective attentional biases, not altered core affect processing, may drive widespread affectselective processing during social inference in PTSD
- Many studies show that attention is inordinately biased towards emotional stimuli in PTSD⁴
- Attentional biases in PTSD are associated with affect-evoked hyperactivation in DMN & attentional regions⁴
- for the attention networks, and have larger sample sizes

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Correlation between Emotions-evoked activation & PTSD severity was positive pre-treatment but

Discussion

Hyperactivation to emotional stimuli may be a defining characteristic of social inference

Future studies should independently manipulate affect & attention, include functional localizers

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