



Using Cortical Activation Patterns to Predict Treatment Response among Youth with Trauma and PTSD Symptoms

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Introduction

Identifying neural activation patterns that predict youths' treatment response may aid in the development of imaging-based assessment of emotion dysregulation following trauma and foster tailored intervention (Balters et al., 2021). Changes in cortical hemodynamic activity measured with functional near-infrared spectroscopy (fNIRS) may provide a time and cost-effective option for such work. We examined youths' PTSD symptom change following treatment and tested if previously identified activation patterns would predict treatment response.

Research Questions

Does trauma focused-cognitive behavioral therapy (TF-CBT) and cue-centered therapy (CCT) improve PTSD symptom severity compared to treatment as usual (TAU)?

Do cortical activation patterns predict treatment response?

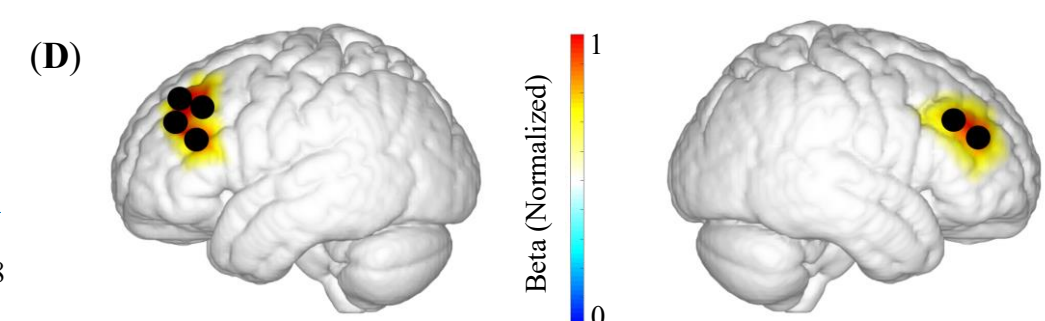
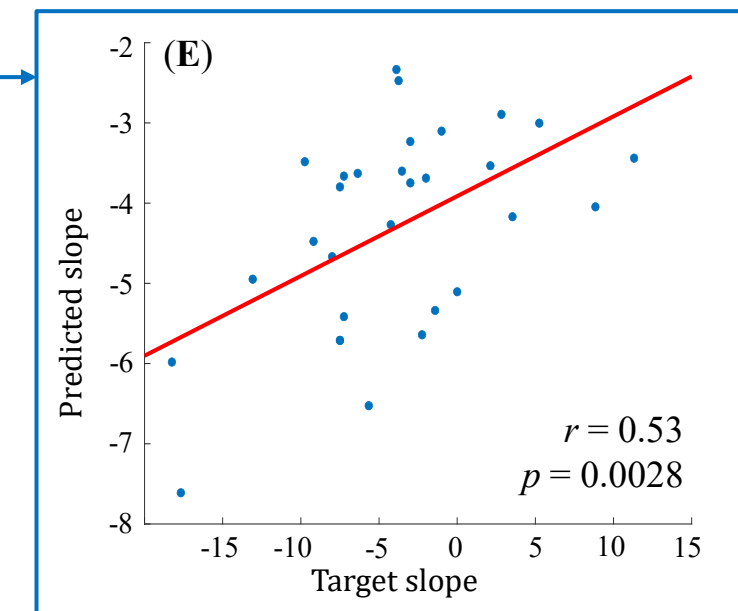
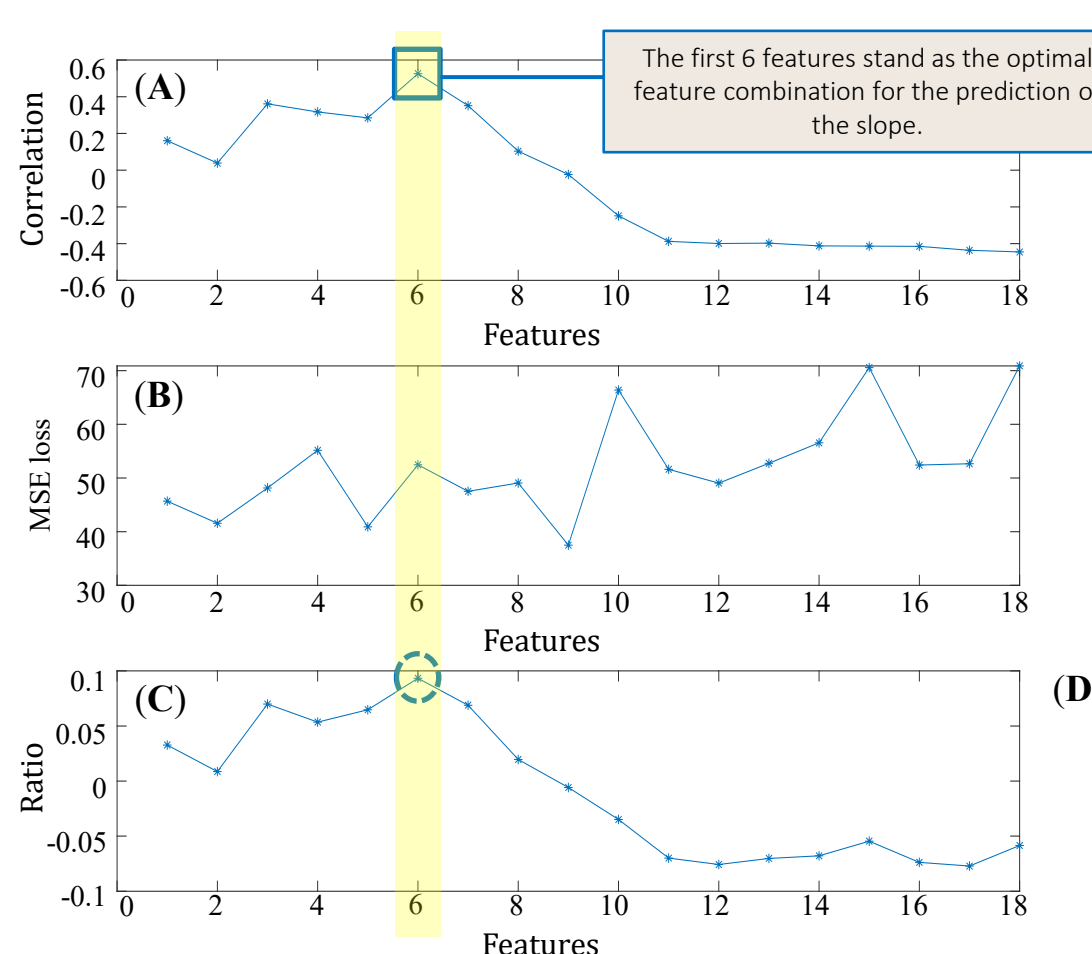
Methods

Youth (n=73, Mage=12.97, SD=3.09) were randomly assigned to TF-CBT, CCT, or TAU. Parents and youth reported on youth's PTSD symptoms at pre-intervention, post-intervention, and follow-up. Neuroimaging data (n=40) assessed at pre-intervention were obtained while youth were engaged in an emotion expression task. Using a continuous wave fNIRS system, 28 optodes (16 sources x 12 detectors) were placed over the bilateral frontal and right temporoparietal regions. The fNIRS channel montage was designed to measure cortical activity in key PTSD-related Brodmann areas, including the bilateral dorsolateral, ventrolateral, orbitofrontal prefrontal regions and the right temporal and parietal regions. A GLM was applied to the preprocessed HbO and HbR signals to assess cortical activation associated with face processing. Treatment response slopes were calculated for each youth's PTSD symptoms.

Results

Measure	Group	n	Pre	Post	Follow Up	Effect Size (d)		
			Mean (SD)	Mean (SD)	Mean (SD)	Pre to Post	Post to Follow Up	Pre to Follow Up
UCLA PTSD-RI (Child report)	TAU	26	38.08 (14.04)	29.57 (17.39)	36.6 (9.24)	0.34	0.62	0.68
	TF-CBT	22	37.1 (15.53)	32.00 (13.61)	20.71 (12.65)	0.65	0.85	1.12*
	CCT	25	35.28 (15.66)	29.58 (14.22)	26.75 (16.17)	0.47	0.81	1.11*

Condition / Channel	BA	ROI 1	ROI 2	Activation
Fear/ 9	BA46	DLPFC	L-MFG	Increased
Fear/ 10	BA9			
Fear/ 11	BA9			
Calm/ 2	BA46	DLPFC	R-MFG	Increased
Calm / 18	BA46			
Calm/28	BA46			



Conclusions and Future Directions

Overall, youth showed decreases from pre-intervention to post-intervention to follow-up across conditions with evidence of relative benefit of TF-CBT and CCT over TAU but significant individual variation in treatment response. Cortical activation patterns were strongly correlated with PTSD symptom improvement slopes ($r=0.53$). In particular, there was increased cortical activation to fearful facial stimuli in the left dlPFC and increased cortical activation to neutral facial stimuli in the left dlPFC and the right dlPFC.

The use of fNIRS provides a method of monitoring and assessing cortical activation patterns in a relatively inexpensive and portable manner. Associations between functional activation and youths' PTSD treatment response is a promising avenue for understanding emotion regulation dysregulation in clinical applications.

Scan the QR code for additional results and graphics



Balters, S., Li, R., Espil, F. M., Piccirilli, A., Liu, N., Gundran, A., ... & Reiss, A. L. (2021). Functional near-infrared spectroscopy brain imaging predicts symptom severity in youth exposed to traumatic stress. *Journal of psychiatric research*, 144, 494-502.

