Neuroimaging Mechanisms of Therapeutic Transcranial Magnetic Stimulation for Major Depressive Disorder

Supplemental Information

Search terms

For this review, we searched PubMed (searches performed between 5/15/2017-6/30/2017). Stimulation search terms included repetitive transcranial magnetic stimulation, accelerated TMS, and theta burst stimulation. Imaging search terms included PET and SPECT, and magnetic resonance imaging resting state functional connectivity. All searches used the whole terms, their constituents and associated abbreviations. Additional searches were made from recent imaging papers (e.g., Liston et al.(1)) and descriptions of highly impactful TMS studies (2). Search results were reviewed by NSP and JB.

1. Liston C, Chen AC, Zebley BD, Drysdale AT, Gordon R, Leutcher B, *et al.* (2014): Default mode network mechanisms of transcranial magnetic stimulation. *Biol Psychiatry* 76(7):517–526.
2. Ziemann U. Thirty years of transcranial magnetic stimulation: where do we stand? Exp Brain Res. 2017 Apr;235(4):973-984.

Table S1. Data Analyses in Prospective Resting State Imaging Studies of TMS

Study	Contrast Sample Size (*n*)	Motion Confound Adjustment [a]	Global Signal Regression	Tissue Regression	Bandpass Filter (Hz)	Statistical Thresholds (*p*-value)	Multiple Comparisons Correction (Program/Toolbox)	CV
Baeken *et al.*, 2014 (62)	Group x time (20) Responder (7) vs. Nonresponder (13)	Standard realignment	Yes	CSF, WM	0.01-0.08	Voxel height (<.05) Cluster size (<.05)	FWE (AlphaSim/AFNI)	No
Downar *et al.*, 2014 (72)	Responder (24) vs. Nonresponder (23)	Standard realignment	No	CSF, WM	0.009-0.09	ROI-to-ROI Monte Carlo permutation (<.05)	Bonferroni-correction, 515 cross-correlations	No
Liston *et al.*, 2014 (63)	MDD (17) vs. HC (35) Strong (9) vs. Weak (8) response	Standard realignment, RMS motion regression	No	CSF, WM	0.005-0.1	Voxel height (<.005 or <.05) Cluster size (<.05 or >.01)	FWE (AlphaSim/AFNI)	No
Salomons *et al.*, 2014 (74)	Pre-treatment RSFC (25) Pre vs. Post RSFC (25)	Standard realignment, Post hoc correlation of motion and RSFC change	No	CSF, WM	0.009-0.09	Cluster size (<.05)	FWE (FLAME/FSL)	No
Kang *et al.*, 2016 (68)	Active (12) vs. Sham (9)	Standard realignment	No	CSF, WM	0.01-0.08	Voxel height (<.001) Cluster size (<.05)	FWE (AlphaSim/AFNI)	Yes
Baeken *et al.*, 2017 (65)	MDD (44) vs. HC (44) Group x time (25) Responder (20) vs. Nonresponder (18)	Standard realignment, Motion censoring	Yes	CSF, WM	0.008-0.1	Voxel height (<.005 or <.05) Cluster size (<.05 or <.01)	FWE (GLMFlex/SPM)	No
Ge *et al.*, 2017 (70)	HC ICA (21) MDD ICA (18) R (11) vs. NR (7)	Mean FD regression	No	No	No	Voxel height (<.05) Cluster size (<.001)	FWE (AlphaSim/AFNI)	No
Avissar *et al.*, 2017 (71)	MDD (27) vs. HC (27) Responder (15) vs. Nonresponder (12)	Standard realignment	No	CSF, WM	0.005-0.1	Voxel height (<.01) Cluster size (<.01)	FWE (3dClustSim/AFNI)	No
Philip *et al.*, 2017 (67)	Pre vs. Post RSFC (25) Responder (11) vs. Nonresponder (22)	Standard realignment + 1st temporal derivative	No	aCompCor	0.01-0.1	Voxel height (<.005) Cluster size (<.05)	FDR (CONN)	Yes
Taylor *et al* [b]	Time 1 vs. Time 1 (32) Responder (12) vs. Nonresponder (20)	24 realignment parameters, Motion censoring, Post hoc RSFC-motion correlation testing	No	aCompCor	0.01-0.1	Voxel height (<.001) Cluster size (<.001)	FWE (SPM)	No

Note: Some sample sizes differ from above reports due to usable MRI data.

Key: CV, statistical cross validation; CSF, cerebral spinal fluid; WM, white matter; FWE, family-wise error; AFNI, Analysis of Functional NeuroImages; ROI, region of interest; MDD, major depressive disorder; HC, healthy control; RMS, root mean squared; RSFC, resting-state functional connectivity; FLAME, FMRIB's Local Analysis of Mixed Effects; FSL, FMRIB Software Library; ICA, independent component analysis; FD, frame-wise displacement; SPM, statistical parametric mapping; aCompCor, anatomical component based noise correction; CONN, Conn: Functional Connectivity Toolbox.

[a] Standard realignment defined as 6 parameter regression

[b] personal communication