Supporting Information

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SI Methods

Cognitive Behavioral Therapy Treatment for Obsessive–Compulsive Disorder. Two licensed therapists with extensive training in CBT for OCD conducted the treatment. Both had received 3 or more y of specialty training in the UCLA OCD Intensive Treatment Program under the supervision of J.D.F. and other senior therapists in addition to 3 or more y of training in outpatient CBT for OCD. Therapy sessions of participants who provided consent (61%) were videotaped, and an independent evaluator (also a trained CBT therapist with 8 y experience treating OCD) rated all sessions for quality assurance, including adherence to the treatment manual and overall quality of the session. Average treatment adherence was rated at 97.7%, and average quality of sessions was rated at 9.96 (0–10).

The therapists followed the treatment protocol for ERP (a type of CBT for OCD) based on the manual by Kozak and Foa (1). Each OCD participant was treated one on one by one of the two study therapists, who were experienced in ERP for OCD. The ERP sessions were 90 min each in duration and were 5 d per week (Monday through Friday) for 4 wk, for a total of 20 sessions. Participants were told that they could not be more than 10 min late to sessions or miss sessions. The study psychiatrist (J.D.F.) also met with each participant once weekly for 20 min. At each of these visits, if the participant was taking a stable dose of a serotonin reuptake inhibitor before enrollment, the psychiatrist assessed if he/she maintained the same dose of medication and assessed for medication adherence. During the last week of treatment, the study therapist and study psychiatrist assisted the participant in referrals to outpatient treatment.

Outlines of the content of the therapy by session number are as follows.

Sessions 1 and/or 2:

Rapport building

Patient history

Ascertainment of level of knowledge about OCD

Facilitated discussion about the impact of OCD on their lives

Description of OCD as a neurobehavioral disorder

Demonstration of use of monitoring forms of symptoms, daily schedule, and structure

Homework assignment: monitoring, or listing of obsessions and compulsions, and/or reading

Reading material provided

Sessions 2 and/or 3:

Homework review

Identifying obsessions and compulsions

Distinguishing obsessions and compulsions from other problems

Description of the cycle of obsessions and compulsions

Rationale and description of ERP

Visual presentation and explanation of the course of OCD with and without response prevention

Explanation of subjective units of distress (SUDS) graph

Creation of hierarchy

Homework assignment: self-monitoring of obsessions and compulsions, reading

Sessions 4/5 through 18/19:

Review of significant events since last session

Homework review

Cognitive restructuring: (*i*) to manage anxiety and resist compulsions if necessary, (*ii*) for reappraisal after exposure to consolidate learning, and (*iii*) discussion of when it is not appropriate to use cognitive restructuring techniques (during exposures)

Exposures exercises in session (in vivo or imaginal)

Homework assignment: specific exposure exercises, self-monitoring using SUDS

Sessions 19/20:

Homework review

Assessment of progress: review progress on hierarchy, discuss improvements overall with obsession thoughts and compulsive behaviors, improvements in overall functioning, improvements in overall anxiety and mood

Current symptomatology and course of treatment: discuss and reinforce participant's positive changes made during treatment (symptom reduction and better functioning)

Inquiry of what participant learned from treatment

Discuss relapse prevention: future plans for continuing treatment with outpatient CBT therapist; recognizing and dealing with symptoms as they arise; soliciting help from family or friends when necessary; increasing activities (e.g., work, school, relationships, hobbies); goals for 1 mo, 3 mo, 6 mo, and 12 mo in the future

Address termination

Discussion of importance of follow-up treatment

Independent Evaluators. Independent evaluators not involved in treatment or assessments administered psychometric instruments. Independent evaluators were PhD-level psychotherapists specializing in OCD with several years of experience with CBT as performed in the trial and supervised weekly by J.D.F. Estimated reliability between evaluators was high (intraclass correlation coefficient of 0.74, 95% confidence interval: −0.87, 1.00).

Exclusion Criteria. Exclusion criteria for OCD included any psychotic disorder, bipolar disorder, lifetime substance dependence, or attention-deficit hyperactivity disorder. Comorbid anxiety and depressive disorders (major depressive disorder, dysthymic disorder, or depressive disorder not otherwise specified) were allowed if OCD was the primary diagnosis; however, individuals were excluded if the ADIS-IV clinical significance rating for depression was ≥6 (severe). We excluded those with ≥30 sessions of prior CBT to minimize the possibility of brain changes induced by previous CBT. Exclusion criteria also included IQ < 80 on the WASI (2) and medical conditions affecting cerebral metabolism (e.g., thyroid disorders and diabetes).

Anxiety and Depression SVM Classifications. To confirm that our results were specific to OCD outcome and not comorbid conditions such as depression and anxiety, we used the pretreatment functional connectivity with medication variable and pretreatment YBOCS treatment scores in two SVM cross-validations to predict whether a participant had (*i*) a depressive disorder ($n = 10$; major depressive disorder, dysthymic disorder, and depressive disorder not otherwise specified) and/or (*ii*) an anxiety disorder ($n = 24$; generalized anxiety disorder, social anxiety disorder, panic disorder, posttraumatic stress disorder, specific phobia, and body dysmorphic disorder). Although body dysmorphic disorder (BDD) is an obsessive–compulsive and related disorder and not an anxiety disorder per *DSM*, we opted not to create a third category for those in this small comorbidity subgroup ($n = 4$) but rather to include it with the anxiety disorders because many BDD patients have prominent anxiety, particularly in social situations. No feature sets had a classification accuracy (averaged over 10 iterations) that was statistically different from chance (50%) in either cross-validation.

Bootstrap Significance Testing. For each fold of the cross-validation, we shuffled the training set's clinical scores before building the LASSO model and used the resulting intercept term and beta coefficients to predict the left-out participants' actual clinical scores. This resulted in an array of predicted values, which we then correlated with the actual values. We repeated this procedure 10,000 times, effectively approximating a null distribution of R values to rank our true results against (3). True results falling above the top 5% of the null distribution ($p_{bs} < .05$) were considered significant.

Additional Tests of Robustness.

Motion and classification accuracy. We observed that adding motion parameters (FD and DVARS) to our feature sets did not affect classification accuracy substantially. Although there was an increase of variance explained in the default mode network (67–69%) when FD and DVARs were included in the feature set, we did not see any increase by adding FD and DVARS to the visual network feature set. This is an interesting finding in its own right as it suggests that participants' motion itself may contribute information to prediction of outcome for the DMN and does not appear to confuse the model.

Comorbidity and classification accuracy. We added anxiety and depression comorbid status (two features, dummy coded for anxiety and depression) to our feature sets when predicting YBOCS and noticed minimal improvement in the DMN only (DMN $R^2 = 0.67$, $p_t < 0.001$; $p_{bs} < 0.001$; DMN + Comorbidity: $R^2 = 0.70$, $p_t < 0.001$; $p_{bs} < 0.001$).

Feature sets without functional connectivity. We ran a LASSO cross-validation that did not use connectivity features and, instead, only pretreatment YBOCS, medication, and comorbidity to predict posttreatment YBOCS. These efforts were not significant ($R^2 = 0.0016$). Adding age and sex to that feature set also did not yield significant classifications ($R^2 = 0.05$). Additionally, the medication binary and pretreatment YBOCS variables, when not including FC values, did not hold any predictive power on their own ($R^2 = 0.021$; $P = 0.49$).

1. Kozak MJ, Foa EB (1997) *Mastery of Obsessive-Compulsive Disorder: A Cognitive-Behavioral Approach Client Workbook* (Oxford Univ Press, New York).
2. Weschler D (1999) *Wechsler Abbreviated Scale of Intelligence (WASI)* (Psychological Corporation, San Antonio).
3. Etzel JA, Braver TS (2013) MVPA permutation schemes: Permutation testing in the land of cross-validation. *2013 International Workshop on Pattern Recognition in Neuroimaging* (Institute of Electrical and Electronics Engineers, Philadelphia), pp 140–143.

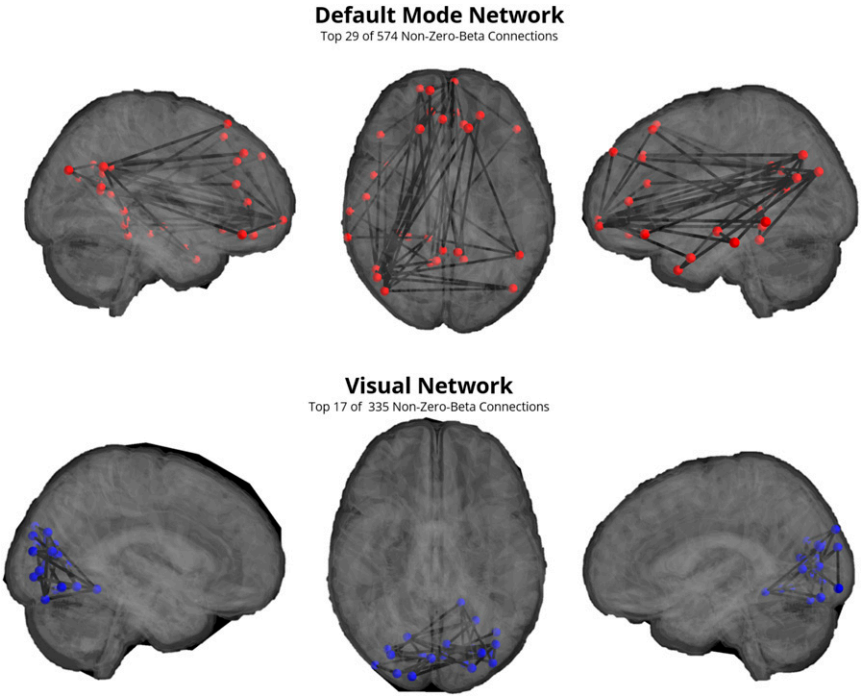

Fig. S1. Pretreatment functional connections across ROIs in the DMN and visual network that contributed to prediction of posttreatment OCD symptoms. Resultant betas from the LASSO cross-validation that were nonzero were averaged across each fold of the cross-validation and sorted as a function of magnitude. The top 5% of connections are shown here for visualization purposes.

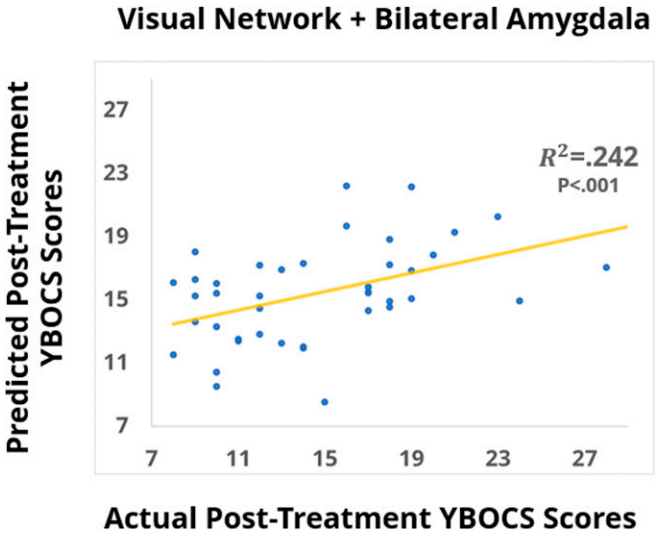

Fig. S2. Scatterplot depicting the relationship between the array of predicted posttreatment YBOCS values ($\hat{Y}$) with the actual posttreatment YBOCS values (Y) when the LASSO cross-validation model was relying on feature sets that included posttreatment functional connectivity.

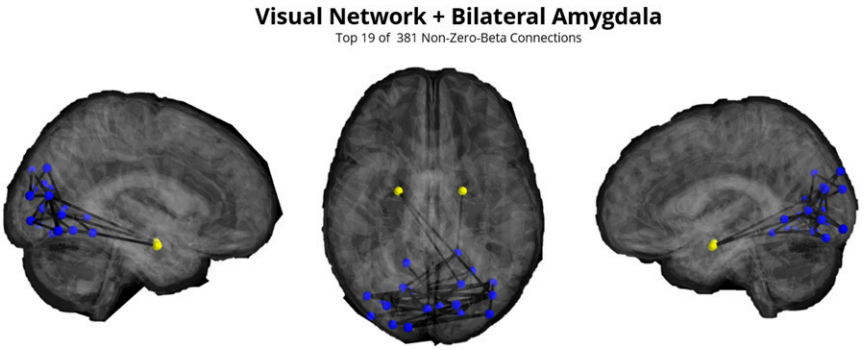

Fig. S3. Posttreatment functional connections across ROIs in the visual network (blue) and bilateral amygdala ROIs (yellow) concatenated into a single network that contributed to prediction of posttreatment OCD symptoms. Resultant beta coefficients from the LASSO cross-validation that were nonzero were averaged across each fold of the cross-validation and sorted as a function of magnitude. The top 5% of connections are shown here for visualization purposes.

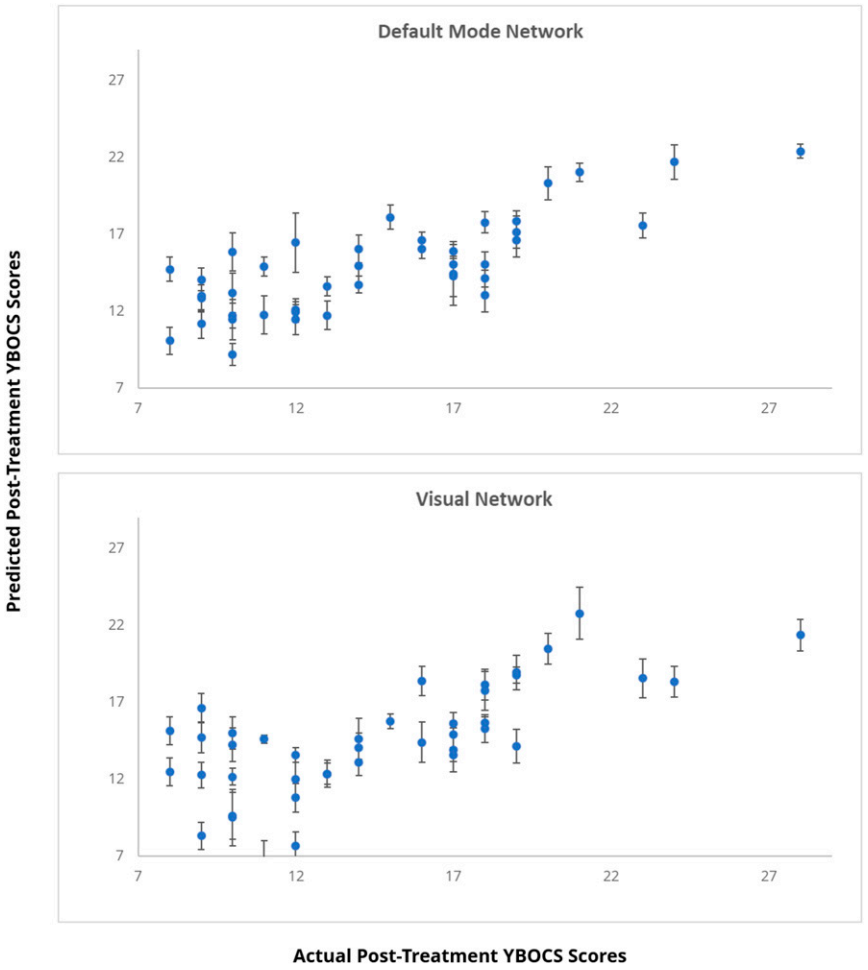

Fig. S4. Scatterplots of predicted posttreatment YBOCS (averaged across 10 iterations of the cross-validation procedure) from pretreatment connectivity feature sets from the default mode network (*Top*) and the visual network (*Bottom*). Error bars denote the standard error across the 10 iterations.

Table S1. OCD group psychiatric comorbidities

DSM–IV comorbidity	*n*
None	12
Panic disorder	2
Generalized anxiety disorder	9
Social anxiety disorder	17
Major depressive disorder	7
Dysthymic disorder	2
Body dysmorphic disorder	4
Posttraumatic stress disorder	1
Specific phobia	6
Depressive disorder not otherwise specified	1