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Feasibility Study Combining Art Therapy or Cognitive Remediation Therapy with Family Based Treatment for Adolescent Anorexia Nervosa

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Abstract

Adolescents with AN who have obsessive-compulsive (OC) features respond poorly to family-based treatment (FBT). This study evaluated the feasibility of combining FBT with either cognitive remediation therapy (CRT) or art therapy (AT) to improve treatment response in this at-risk group. Thirty adolescents with AN and OC features were randomized to 15 sessions of FBT plus CRT or AT. Recruitment rate was 1 per month, treatment attrition was 16.6% with no differences between groups. Suitability, expectancy and therapeutic relationships were acceptable for both combinations. Correlations between changes in OC traits and changes in cognitive inefficiencies were found for both combinations. Moderate changes in cognitive inefficiencies were found in both groups but were larger in the FBT plus AT combination. This study suggests that an RCT for poor responders to FBT because of OC traits combining FBT with either CRT or AT is feasible to conduct.

Keywords

anorexia nervosa; adolescents; family based treatment; cognitive remediation therapy; art therapy

Introduction

Anorexia Nervosa (AN) usually begins during adolescence (Hoek & Van Hoeken, 2003; van Son, van Hoeken, Bartelds, van Furth, & Hoek, 2006) and is a serious psychiatric disorder associated with high morbidity, mortality, and economic cost (Arcelus, Mitchell, Wales, & Nielsen, 2013; Golden et al., 2003; Striegel-moore, Leslie, Petrill, Garvin, & Rosenheck, 2000). Although Family-Based Treatment (FBT) leads to full and stable recovery in 35–45% of adolescents with short duration AN (Lock et al., 2010), there are no evidence based interventions for those who do not respond and who are as a result at approximately 33% risk for becoming chronically ill (Bulik, Berkman, Brownley, Sedway, & Lohr, 2007; Keel & Haedt, 2008; Steinhausen, 2009; Treasure & Russell, 2011).

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Two studies of moderators of outcome in FBT found that higher levels of obsessive - compulsive (OC) features based on scores on the Yale-Brown-Cornell Eating Disorder Scale (YBC-ED; Sunday, Halmi, & Einhorn, 1995) lead to poorer outcome (Le Grange et al., 2012; Lock, Agras, Bryson, & Kraemer, 2005). Developing an intervention targeting OC features in this less responsive group is a logical goal in the effort to enhance the effectiveness of FBT and thereby prevent the development of chronic AN.

A link is proposed between these OC features and an inflexible, perseverative, and overly detailed cognitive processing style found in patients with both Obsessive-Compulsive Disorder (OCD) and AN (Andrés-Perpiña et al., 2011; Chamberlain, Blackwell, Fineberg, Robbins, & Sahakian, 2005; Lang & Tchanturia, 2014; Lang, Treasure, & Tchanturia, 2016; Tchanturia et al., 2012; Treasure, 2007; Westwood, Stahl, Mandy, & Tchanturia, 2016). Meta-analytic reviews of neuropsychological studies of AN and OCD identify two specific cognitive inefficiencies for these disorders--i.e., difficulties in cognitive flexibility (impaired set-shifting--SS; Chamberlain et al., 2005; Tchanturia et al., 2012; Westwood et al., 2016) and an overly detailed processing style (weak central coherence--CC; Lang et al., 2016; Lang, Lopez, Stahl, Tchanturia, & Treasure, 2014; Rankins, Bradshaw, & Georgiou-Karistianis, 2005). Data from the available studies in younger patients suggest that cognitive inefficiencies in SS and CC are present in adolescents with AN and associated with OC traits, (Lang, Stahl, Espie, Treasure, & Tchanturia, 2014; Lang & Tchanturia, 2014), but appear to significantly worsen with chronic illness (Andrés-Perpiña et al., 2011; Fitzpatrick, Darcy, Colborn, Gudorf, & Lock, 2012; Hatch et al., 2010).

Two approaches that can be provided as adjunctive therapy to FBT and might address these cognitive inefficiencies are Cognitive Remediation Therapy (CRT) and Art Therapy (AT). It is proposed that CRT could address the cognitive underpinnings of obsessional thought by promoting more flexible and less perseverative thinking (Tchanturia, Giombini, Leppanen, & Kinnaird, 2017; Tchanturia, Lounes, & Holtum, 2014). This task driven therapy targets these specific cognitive inefficiencies through direct cognitive exercises and practices. Preliminary data from a recent pilot RCT comparing CRT to Cognitive Behavior Therapy (CBT) in 46 outpatients with AN demonstrated significantly greater improvements in SS and CC in those treated with CRT (Lock et al., 2013). In addition, case series data and a systematic review in adolescents with AN, found CRT is acceptable and improves cognitive processes related to SS and CC in this age group (Giombini, Turton, Turco, Nesbitt, & Lask, 2016; Tchanturia et al., 2017; Wood, Ai-Khairulla, & Lask, 2011).

AT is commonly used in many clinical programs to help patients express and explore emotions, but it has not been systematically researched. AT is conceived of as an emotion based therapy that promotes improved comprehension of thoughts and behaviors based on the expression and increased understanding of emotions through making art. While preliminary data suggest that these types of therapies may improve emotional deficits (Davies et al., 2012; Tchanturia, Doris, & Fleming, 2014; Tchanturia, Doris, Mountford, & Fleming, 2015; Wildes & Marcus, 2011), the impact on cognitive inefficiencies like SS and CC is underexplored. However, there is reason to consider this possibility because AT challenges rigid and perseverative thinking (i.e., potentially improving SS) by focusing on creative and expressive processes while also encouraging integrative thinking aimed at

seeing the big picture rather than rigidly focusing just on details (i.e., potentially improving CC) to produce expressive art works.

As a feasibility study, our primary aim is to examine the feasibility of incorporating CRT and AT with FBT for adolescents with OC traits at risk for poor response to FBT alone. This includes assessing recruitment and retention rates as well as acceptability of the treatments among patients. Secondary aims were to assess preliminary evidence of changes in OC traits, neurocognitive functioning, weight, eating related cognitions and co-morbid symptoms of depression and anxiety in those who received FBT plus CRT compared to FBT plus AT.

Method

Participants

Participants for this study were recruited by informing colleagues and organizations treating eating disorders. Participants eligible for this study were adolescents who were 1) 12–18 years of age that met DSM-IV criteria for AN except for the amenorrhea requirement; 2) medically stable for outpatient treatment according to the recommended thresholds of the American Academy of Pediatrics and the Society of Adolescent Medicine (Golden et al., 2003); 3) YBC-ED score > 1; or C-YBOCs score > 8). These cutoff scores were based on median split results in previous FBT RCTs in adolescent AN (Agras et al., 2014; Lock et al., 2005) that were used to identify treatment moderators. If a participant was taking a psychotropic medication for a co-morbid condition, participants met all eligibility criteria while on stable dose of psychotropic medication (8 weeks). Participants were excluded from the study if any of the following were present: 1) associated physical illness that necessitated hospitalization; 2) psychotic illness or other mental illness requiring hospitalization; 3) current dependence on drugs or alcohol; 4) physical conditions (e.g. diabetes mellitus, pregnancy) known to influence eating or weight; 5) scores below the normal range in the Wechsler Abbreviated Scale of Intelligence (WASI); 6) family history or current child abuse or neglect; and 7) previous CRT, AT, or FBT for AN.

This study was approved by the IRB at our institution. Parents signed consents and participants signed assents for those under age 18. Participants over age 18 signed consents.

Measures

Recruitment—Recruiting participants is a key variable in assessing study feasibility. Previous studies suggest that between 1–2 randomized participants per month would be a sufficient rate for gathering a large enough sample for an adequately powered RCT in FBT in the future (Lock et al., 2010, 2012, 2005).

Attrition—Attrition is a major problem in studies of AN, particularly in adults (Halmi et al., 2005). Data suggest that in FBT attrition rates are between 10–25% (Agras et al., 2014; Lock et al., 2010, 2005).

Helping Relationship Questionnaire (HRQ; Luborsky, 1984)—The HRQ measures two main aspects of the therapeutic relationship: Being understood and receiving a helpful attitude, and the experience of being involved in a collaborative effort.

Therapy Suitability and Patient Expectancy (TSPE)—Participant perceptions of the suitability and expectancy of the treatment is rated on a visual analogue scale (0–10) at the end of session one.

Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999)—The WASI is a brief measure of general intelligence for ages 8–88 years of age. It includes four subtests: block design, vocabulary, matrix reasoning and similarities.

Rey-Osterrieth Complex Figure (RCFT; Osterrieth, 1944)—The RCFT is a pencil and paper task in which participants are required to make a direct copy of a complex figure. CC can be measured using Booth's scoring system (Booth, 2006) which takes into account the order and style of copying (see also Lang et al., 2016)

Wisconsin Card Sort Task (WCST-Computerized version: CV4)—The WCST is a highly studied and well-normed test of SS and problem-solving and has been used extensively of study SS among patients with AN (Westwood et al., 2016).

Kiddie-Sads-Present and Lifetime Version (K-SADS-PL; Kaufman et al., 1997)—The K-SADS-PL is a standardized, validated measure that examines current disorders occurring within the previous 12 months and lifetime history. It is appropriate for children and adolescents between 6 to 18 years of age.

Eating Disorder Examination (EDE; Cooper & Fairburn, 1987)—The EDE is a standardized investigator-based interview that measures the severity of the characteristic psychopathology of eating disorders.

Weight (percentile BMI)—Weights and heights will be collected on a calibrated scale at each session by the therapist. Weight percentile will be calculated using the Centers for Disease Control and Prevention (CDC) tables for age, height, and gender.

Yale-Brown-Cornell Eating Disorder Scale (YBC-ED; Mazure, Halmi, Sunday, & Romano, 1994)—The YBC-ED assesses impairment, persistence and degree of obsessional thinking and compulsiveness about eating thoughts and behaviors.

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Scahill et al., 1997)—The CY-BOCS is a modified version of the Y-BOCS that assess symptoms of obsessive compulsive disorder from childhood through early adolescence.

Beck Depression Inventory (BDI; Beck, Steer, & Brown, 1996)—The BDI is a 21-question scale that has been used in numerous studies of adolescent depression.

Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988)—The BAI includes 21 questions about anxiety.

Treatments

Family-Based Treatment (Lock & Le Grange, 2013)—The short version of manualized FBT is divided into 3 phases over 9 months. In the first phase (sessions 1–8), therapy is focused on the eating disorder and includes a family meal. Families are encouraged to work out for themselves how best to promote weight restoration in their child with AN. In Phase 2–3 (sessions 9–15), once weight restoration is nearing completion, parents are helped to transition eating and weight control back to the adolescent in an age appropriate manner.

Cognitive Remediation Therapy (Tchanturia, 2014)—The goals of CRT are to address cognitive inefficiencies through cognitive puzzles and games to help participants to become aware of their cognitive styles and strategies. CRT uses a range of cognitive exercises and tasks aimed at practicing holistic and flexible thinking style. The core theory of cognitive remediation therapy is that practicing a skill set will improve performance and awareness of this skill. In addition to practice, CRT focuses on developing meta-cognitive skills. Therapist-mediated practice returns focus to thinking styles, strategic approaches and objective evaluation of performance while training away from perfectionistic, rigid performance. CRT focuses on thinking styles and problem-solving instead of processing emotional stimuli or discussing EDs symptoms. As a result, emotion is not a primary target of treatment intervention. In the current study, the CRT sessions (30 minutes) were provided prior to each of the 15 FBT sessions.

Art Therapy (Silverstone, 2009)—We employed a manualized AT aimed at promoting creative thinking, practicing different ways to express and identify emotions through art. Similar to CRT, the ED symptoms are not the focus of AT. However, unlike CRT, each session included exercises to promote emotional expression and understanding via a range of art materials and activities (e.g., “draw a feeling”). The therapist was as non-directive as possible. As in CRT, AT also aims at encouraging metacognition by thinking about one’s production but with an emphasis on various ways to express and understand emotions. Each session includes several art activities and a discussion with the therapist on the process and outcome. A list of “homework” assignments are provided to allow for further exploration outside of session. The art activities were adopted from the book “Art Therapy Exercises” by Liesl Silverstone (Silverstone, 2009). The AT sessions (30 minutes) were provided prior to each of the 15 FBT sessions.

Statistical analyses

Baseline demographic and clinical variables were compared between the groups using independent *t*-tests for continuous variables and Mann-Whitney U tests for categorical variables.

Paired *t*-tests were used to compare pre-to-post treatment scores on clinical and neuropsychological measures. Independent *t*-tests were used to compare the pre-to-post

change scores between CRT+FBT and AT+FBT. Cohen's d is reported with 0.2, 0.5, and 0.8 representing small, medium and large effect sizes (ESs), respectively. Lastly, exploratory analyses examined correlations between change in OC features and change in neurocognitive functioning in each group separately. Statistical significance testing was conducted on exploratory basis on all variables.

Results

Baseline demographic and clinical characteristics

Demographic and clinical characteristics at baseline are presented in Table 1. There was no significant difference between the treatment groups on any of these variables except EDE-Global score. Participants in the AT+FBT group had a higher score in the EDE compared to those in the CRT+FBT group, $t(28) = 2.26$, $p = .03$.

Primary outcomes

Recruitment rate averaged one new participant per month. There were five dropouts overall (16.6%), 4 from AT+FBT and 1 from CRT+FBT (see also Consort chart in Figure 1). Two patients (1 from each randomized group) were withdrawn from the study because they required a higher level of care. There was no significant difference between the groups in rating of suitability ($M = 5.27$, $SD = 2.84$ for AT+FBT and $M = 4$, $SD = 3.3$ for CRT+FBT, $t(25) = .39$, $p = .69$, $d = 0.41$) or expectancy ($M = 4.73$, $SD = 2.89$ for AT+FBT and $M = 4.25$, $SD = 3.54$ for CRT+FBT, $t(25) = 1.07$, $p = .29$, $d = 0.14$) as evaluated by the TSPE. At the end of treatment, there was no difference between the groups in the rating of the therapist-patient relationship ($M = 15.66$, $SD = 17.49$ for AT+FBT and $M = 11.81$, $SD = 14.95$ for CRT+FBT, $t(18) = .53$, $p = .60$, $d = 0.23$) as assessed by the HRQ.

Secondary outcomes

Table 2 shows the difference between baseline and end of treatment on secondary outcome measures for each group. Table 3 shows the difference between the groups in the change score from baseline to end of treatment.

Correlations between changes in OC features and neurocognitive functioning

To examine whether reduction of OC features following treatment is associated with improvement in neurocognitive functioning we examined correlations between the change score in the YBC-ED and C-YBOCS and the change score in measures of SS and CC by group.

In the AT+FBT group, we found a large effect size, although not statistically significant association between reduction of perseverative errors in the WCST and reduction of OC traits as assessed by the YBC-ED ($r = .59$, $p = .09$) and the C-YBOCS ($r = .56$, $p = .11$). There was a moderate but not significant correlation between the change score of the CC index in the RCFT and that of the YBC-ED ($r = .30$, $p = .39$) and a small correlation with the change score of the C-YBOCS ($r = .21$, $p = .55$).

In the CRT+FBT group, there were moderate and not significant correlations between the change score in the WCST-perseverative errors and the YBC-ED ($r = .32$, $p = .30$) and the C-YBOCS ($r = .30$, $p = .35$). There were small and not significant correlations between the change score of the CC index and that of the YBC-ED ($r = .15$, $p = .69$) and C-YBOCS ($r = -.09$, $p = .80$).

Discussion

This study examined the feasibility of conducting an RCT that compared outcomes of adolescents with AN who at baseline reported OC traits and who received FBT with either CRT or AT. The results of this study support the view that an RCT comparing these two approaches for a population at risk of poor response because of baseline OC traits is feasible to conduct. Recruitment rates were similar to those in previous studies that did not require the presence of OC features (Agras et al., 2014; Lock et al., 2010). Retention in the study was also similar to that found in other RCTs comparing treatments for adolescent AN with FBT (Agras et al., 2014; Lock et al., 2010). Suitability and expectancy ratings for the combination of FBT and either CRT or AT did not differ. Further, the assessment battery associated with this study which included extensive measures of neurocognitive process was generally well tolerated. Taken together, the results support the primary hypothesis of the study and suggest that an RCT of this type is feasible and acceptable.

Our secondary goal was to assess preliminary results of treatment effects on OC traits, neurocognitive functioning, weight, eating-related cognitions and co-morbid symptoms of depression and anxiety. It should be noted that these analyses are conducted on an inadequately powered sample as this is a feasibility study. Therefore, the results are preliminary and should be treated as such. We report significance levels for information only on the outcome table and instead emphasize effect size as the best indicator of change in this small sample.

The results revealed effects on the baseline OC trait variables as measured by YBC-ED and CY-BOCS. Both treatments demonstrated effects on changes in the YBC-ED associated with moderate (FBT plus CRT) and large (FBT plus AT) ES. Similarly, both treatments demonstrated improvements in CY-BOCS scores: FBT plus AT was associated with a large ES and FBT plus CRT associated with a moderate ES. Taken together these data support the view that combining FBT with either AT or CBT may have clinical impact on the baseline risk variable of OC features.

We also explored the impact of both treatment combinations on neurocognitive processes. Specifically, the impact on SS as measured by the WCST perseverative error score was associated with a large effect size in those that received AT and FBT. There was also a moderate ES change in the CC index score as measured by the RCFT in those who received AT and FBT. In comparison, there was a small effect for WCST in those who received CRT and FBT and a small effect in the opposite direction to that expected in the CC index. Furthermore, in the AT+FBT group, large correlations were observed between improvement in SS and reduction in OC feature. The same correlations were of moderate size in the CRT +FBT group. There were small sized correlations between the CC index and OC features in

both groups. These results are largely consistent with the conclusions of a recent systematic review and meta-analysis of CRT in youth (Tchanturia et al., 2017).

We also examined weight and eating related outcomes. Both treatments resulted in weight improvements that was associated with large ES. FBT plus AT was superior to CRT plus FBT in weight improvement (i.e., medium ES) and in improvement in EDE (i.e., large ES). Finally, pre-to-post changes on depression level were associated with a large ES in FBT plus AT and small-moderate ES in FBT plus CRT. The difference between the groups on this change score was associated with medium ES in favor of FBT plus AT. Additionally, pre-to-post changes in anxiety level were associated with small-moderate ES in FBT plus AT and low ES in FBT plus CRT. The difference between the groups in this change score was associated with low ES.

The finding that combining CRT and AT with FBT is acceptable and feasible is important because there remain a significant proportion of poor responders to FBT with OC features that might benefit from combined treatment. These combinations were well tolerated by participants and their families. Further, clinical outcomes were significantly improved from baseline measurement, though the study was not scaled to detect statistical differences on these measures.

Overall, this study suggests that it is possible to change OC thinking in adolescents with AN through the combination of FBT with either AT or CRT and that these changes might be related to improvement in neurocognitive functioning. Further studies that examine each of the approaches as well as a randomized comparison of the approaches seems warranted, especially for those adolescents at risk for not responding to FBT based on an OC thinking style at presentation.

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References

- Agras WS, Lock J, Brandt H, Bryson SW, Dodge E, Halmi KA, Woodside B. Comparison of 2 family therapies for adolescent anorexia nervosa: A randomized parallel trial. *JAMA Psychiatry*. 2014; 71:1279–1286. <http://doi.org/10.1001/jamapsychiatry.2014.1025>. [PubMed: 25250660]
- Andrés-Perpiña S, Lozano-Serra E, Puig O, Lera-Miguel S, Lázaro L, Castro-Fornieles J. Clinical and biological correlates of adolescent anorexia nervosa with impaired cognitive profile. *European Child and Adolescent Psychiatry*. 2011; 20:541–549. <http://doi.org/10.1007/s00787-011-0216-y>. [PubMed: 21984403]
- Arcelus J, Mitchell AJ, Wales J, Nielsen S. Mortality rates in patients with anorexia nervosa and other eating disorders: A meta-analysis of 36 studies. *Archives of General Psychiatry*. 2013; 68:724–731. <http://doi.org/10.1001/archgenpsychiatry.2011.74>.
- Beck A, Epstein N, Brown G, Steer R. An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology*. 1988; 56:893–897. [PubMed: 3204199]
- Beck, A., Steer, R., Brown, G. Beck depression inventory-II. San Antonio, TX: The Psychological Corporation; 1996.
- Booth, R. Local-global processing and cognitive style in autism spectrum disorders and typical development. London: King's College London; 2006.

- Bulik CM, Berkman ND, Brownley KA, Sedway JA, Lohr KN. Anorexia nervosa treatment: A systematic review of randomized controlled trials. *International Journal of Eating Disorders*. 2007; 40:310–320. <http://doi.org/10.1002/eat.20367>. [PubMed: 17370290]
- Chamberlain SR, Blackwell AD, Fineberg NA, Robbins TW, Sahakian BJ. The neuropsychology of obsessive compulsive disorder: The importance of failures in cognitive and behavioural inhibition as candidate endophenotypic markers. *Neuroscience and Biobehavioral Reviews*. 2005; 29:399–419. <http://doi.org/10.1016/j.neubiorev.2004.11.006>. [PubMed: 15820546]
- Cooper Z, Fairburn C. The eating disorder examination: A semi-structured interview for the assessment of the specific psychopathology of eating disorders. *International Journal of Eating Disorders*. 1987; 6:1–8. [http://doi.org/10.1002/1098-108X\(198701\)6:1<1::AID-EAT2260060102>3.0.CO;2-9](http://doi.org/10.1002/1098-108X(198701)6:1<1::AID-EAT2260060102>3.0.CO;2-9).
- Davies H, Fox J, Naumann U, Treasure J, Schmidt U, Tchanturia K. Cognitive remediation and emotion skills training for anorexia nervosa: An observational study using neuropsychological outcomes. *European Eating Disorders Review*. 2012; 20:211–217. <http://doi.org/10.1002/erv.2170>. [PubMed: 22431401]
- Fitzpatrick KK, Darcy A, Colborn D, Gudorf C, Lock J. Set-shifting among adolescents with anorexia nervosa. *International Journal of Eating Disorders*. 2012; 45:909–912. <http://doi.org/10.1002/eat.22027>. [PubMed: 22692985]
- Giombini L, Turton R, Turco M, Nesbitt S, Lask B. The use of cognitive remediation therapy on a child adolescent eating disorder unit: Patients and therapist perspectives. *Clinical Child Psychology and Psychiatry*. 2016; 22:1–13. <http://doi.org/10.1177/1359104516657859>.
- Golden NH, Katzman DK, Kreipe RE, Stevens SL, Sawyer SM, Rees J, Rome ES. Eating disorders in adolescents: position paper of the Society for Adolescent Medicine. *The Journal of Adolescent Health*. 2003; 33:496–503. [PubMed: 14642712]
- Halmi KA, Agras WS, Crow S, Mitchell J, Wilson GT, Bryson SW, Kraemer HC. Predictors of treatment acceptance and completion in anorexia nervosa: implications for future study designs. *Archives of General Psychiatry*. 2005; 62:776–781. <http://doi.org/10.1001/archpsyc.62.7.776>. [PubMed: 15997019]
- Hatch A, Madden S, Kohn MR, Clarke S, Touyz S, Gordon E, Williams LM. In first presentation adolescent anorexia nervosa, do cognitive markers of underweight status change with weight gain following a refeeding intervention? *International Journal of Eating Disorders*. 2010; 43:295–306. [PubMed: 19434607]
- Hoek HW, Van Hoeken D. Review of the prevalence and incidence of eating disorders. *International Journal of Eating Disorders*. 2003; 34:383–396. <http://doi.org/10.1002/eat.10222>. [PubMed: 14566926]
- Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, Ryan N. Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): Initial Reliability and Validity Data. *Journal of the American Academy of Child & Adolescent Psychiatry*. 1997; 36(7):980–988. <http://doi.org/10.1097/00004583-199707000-00021>. [PubMed: 9204677]
- Keel PK, Haedt A. Evidence-based psychosocial treatments for eating problems and eating disorders. *Journal of Clinical Child & Adolescent*. 2008; 37:39–61. <http://doi.org/10.1080/15374410701817832>.
- Lang K, Lopez C, Stahl D, Tchanturia K, Treasure J. Central coherence in eating disorders: An updated systematic review and meta-analysis. *The World Journal of Biological Psychiatry*. 2014; 15:586–596. <http://doi.org/10.3109/15622975.2014.909606>. [PubMed: 24882144]
- Lang K, Roberts M, Harrison A, Lopez C, Goddard E, Khondoker M, Tchanturia K. Central coherence in eating disorders: A synthesis of studies using the rey osterrieth complex figure test. *PLoS ONE*. 2016; 11:e0165467. <http://doi.org/10.1371/journal.pone.0165467>. [PubMed: 27806073]
- Lang K, Stahl D, Espie J, Treasure J, Tchanturia K. Set shifting in children and adolescents with anorexia nervosa: An exploratory systematic review and meta-analysis. *International Journal of Eating Disorders*. 2014; 47:394–399. <http://doi.org/10.1002/eat.22235>. [PubMed: 24347025]
- Lang K, Tchanturia K. A systematic review of central coherence in young people with anorexia nervosa. *Journal of Child and Adolescent Behaviour*. 2014; 2(3):140. <http://doi.org/10.4172/jcalb.1000140>.

- Lang K, Treasure J, Tchanturia K. Is inefficient cognitive processing in anorexia nervosa a familial trait? A neuropsychological pilot study of mothers of offspring with a diagnosis of anorexia nervosa. *The World Journal of Biological Psychiatry*. 2016; 17:258–265. <http://doi.org/10.3109/15622975.2015.1112035>. [PubMed: 26563611]
- Le Grange D, Lock J, Agras WS, Moye A, Bryson SW, Jo B, Kraemer HC. Moderators and mediators of remission in family-based treatment and adolescent focused therapy for anorexia nervosa. *Behaviour Research and Therapy*. 2012; 50:85–92. <http://doi.org/10.1016/j.brat.2011.11.003>. [PubMed: 22172564]
- Lock J, Agras WS, Bryson S, Kraemer HC. A comparison of short-and long-term family therapy for adolescent anorexia nervosa. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2005; 44:632–639. <http://doi.org/10.1097/01.chi.0000161647.82775.0a>. [PubMed: 15968231]
- Lock J, Agras WS, Fitzpatrick KK, Bryson SW, Jo B, Tchanturia K. Is outpatient cognitive remediation therapy feasible to use in randomized clinical trials for anorexia nervosa? *International Journal of Eating Disorders*. 2013; 46:567–575. <http://doi.org/10.1002/eat.22134>. [PubMed: 23625628]
- Lock J, Brandt H, Woodside B, Agras S, Halmi WK, Johnson C, Wilfley D. Challenges in conducting a multi-site randomized clinical trial comparing treatments for adolescent anorexia nervosa. *International Journal of Eating Disorders*. 2012; 45:202–213. <http://doi.org/10.1002/eat.20923>. [PubMed: 21495052]
- Lock, J., Le Grange, D. *Treatment manual for anorexia nervosa: A family-based approach*. 2. New York: Guilford Press; 2013.
- Lock J, Le Grange D, Agras WS, Moye A, Bryson SW, Jo B. Randomized clinical trial comparing family-based treatment with adolescent-focused individual therapy for adolescents with anorexia nervosa. *Archives of General Psychiatry*. 2010; 67:1025–1032. <http://doi.org/10.1001/archgenpsychiatry.2010.128>. [PubMed: 20921118]
- Luborsky, L. *Principles of psychoanalytic psychotherapy*. New York: Basic Books; 1984.
- Mazure CM, Halmi KA, Sunday SR, Romano SJ, Einhorn AM. The Yale-Brown-Cornell eating disorder scale: Development, use, reliability and validity. *Journal of Psychiatric Research*. 1994; 28:425–445. [http://doi.org/10.1016/0022-3956\(94\)90002-7](http://doi.org/10.1016/0022-3956(94)90002-7). [PubMed: 7897615]
- Osterrieth PA. The test of copying a complex figure: A contribution to the study of perception and memory. *Archives de Psychologie*. 1944; 30:286–356.
- Rankins D, Bradshaw JL, Georgiou-Karistianis N. Local-global processing in obsessive-compulsive disorder and comorbid Tourette's syndrome. *Brain and Cognition*. 2005; 59:43–51. <http://doi.org/10.1016/j.bandc.2005.04.003>. [PubMed: 15919144]
- Scahill L, Riddle MA, McSwiggin-Hardin M, Ort SI, King RA, Goodman WK, Leckman JF. Children's Yale-Brown Obsessive Compulsive Scale: reliability and validity. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1997; 36:844–852. <http://doi.org/10.1097/00004583-199706000-00023>. [PubMed: 9183141]
- Silverstone, L. *Art Therapy Exercises*. Jessica Kingsley Publishers; 2009.
- Steinhausen HC. Outcome of Eating Disorders. *Child and Adolescent Psychiatric Clinics of North America*. 2009; 18:225–242. <http://doi.org/10.1016/j.chc.2008.07.013>. [PubMed: 19014869]
- Striegel-moore R, Leslie D, Petrill S, Garvin V, Rosenheck R. One-year use and cost of inpatient and outpatient services among female and male patients with an eating disorder: evidence from a national database of health insurance claims. *International Journal of Eating Disorders*. 2000; 27:381–389. [PubMed: 10744844]
- Sunday SR, Halmi KA, Einhorn A. The Yale-Brown-Cornell Eating Disorder Scale: a new scale to assess eating disorder symptomatology. *International Journal of Eating Disorders*. 1995; 18:237–245. [http://doi.org/10.1002/1098-108X\(199511\)18:3<237::AID-EAT2260180305>3.0.CO;2-1](http://doi.org/10.1002/1098-108X(199511)18:3<237::AID-EAT2260180305>3.0.CO;2-1). [PubMed: 8556019]
- Tchanturia, K. *Cognitive remediation therapy (CRT) for eating and weight disorders*. London: Routledge; 2014.
- Tchanturia K, Davies H, Roberts M, Harrison A, Nakazato M, Schmidt U, Morris R. Poor cognitive flexibility in eating disorders: examining the evidence using the Wisconsin Card Sorting Task.

PloS One. 2012; 7:e28331. <http://doi.org/doi.org/10.1371/journal.pone.0028331>. [PubMed: 22253689]

- Tchanturia K, Doris E, Fleming C. Effectiveness of cognitive remediation and emotion skills training (CREST) for anorexia nervosa in group format: A naturalistic pilot study. *European Eating Disorders Review*. 2014; 22:200–205. <http://doi.org/10.1002/erv.2287>. [PubMed: 24616049]
- Tchanturia K, Doris E, Mountford V, Fleming C. Cognitive Remediation and Emotion Skills Training (CREST) for anorexia nervosa in individual format: self-reported outcomes. *BMC Psychiatry*. 2015; 15:53. <http://doi.org/10.1186/s12888-015-0434-9>. [PubMed: 25884480]
- Tchanturia K, Giombini L, Leppanen J, Kinnaird E. Evidence for cognitive remediation therapy in young people with anorexia nervosa: systematic review and meta-analysis of the literature. *European Eating Disorders Review*. 2017; 25:227–236. <http://doi.org/10.1002/erv.2522>. [PubMed: 28573705]
- Tchanturia K, Lounes N, Holtum S. Cognitive remediation in anorexia nervosa and related conditions: A systematic review. *European Eating Disorders Review*. 2014; 22:454–462. <http://doi.org/10.1002/erv.2326>. [PubMed: 25277720]
- Treasure J. Getting beneath the phenotype of anorexia nervosa: The search for viable endophenotypes and genotypes. *Canadian Journal of Psychiatry*. 2007; 52:212–219. <http://doi.org/10.1177/070674370705200402>. [PubMed: 17500301]
- Treasure J, Russell G. The case for early intervention in anorexia nervosa: Theoretical exploration of maintaining factors. *British Journal of Psychiatry*. 2011; 199:5–7. <http://doi.org/10.1192/bjp.bp.110.087585>. [PubMed: 21719874]
- van Son GE, van Hoeken D, Bartelds AI, van Furth EF, Hoek HW. Time trends in the incidence of eating disorders: a primary care study in The Netherlands. *International Journal of Eating Disorders*. 2006; 39:565–569. <http://doi.org/10.1002/eat.20316>. [PubMed: 16791852]
- Wechsler, D. Manual for the Wechsler abbreviated intelligence scale (WASI). San Antonio, TX: The Psychological Corporation; 1999.
- Westwood H, Stahl D, Mandy W, Tchanturia K. The set-shifting profiles of anorexia nervosa and autism spectrum disorder using the Wisconsin Card Sorting Test: a systematic review and meta-analysis. *Psychological Medicine*. 2016; 46:1809–1827. <http://doi.org/10.1017/S0033291716000581>. [PubMed: 27109830]
- Wildes JE, Marcus MD. Development of emotion acceptance behavior therapy for anorexia nervosa: A case series. *International Journal of Eating Disorders*. 2011; 44:421–427. <http://doi.org/10.1002/eat.20826>. [PubMed: 20721894]
- Wood L, Ai-Khairulla H, Lask B. Group cognitive remediation therapy for adolescents with anorexia nervosa. *Clinical Child Psychology and Psychiatry*. 2011; 16:225–231. <http://doi.org/10.1177/1359104511404750>. [PubMed: 21571765]

Figure 1.

Table 1

Sample characteristics at baseline (counts (%) for categorical and mean (SD) for continuous variables)

Variable	AT + FBT	CRT + FBT	Total
Age	14.55 (1.48)	14.42 (1.83)	14.49 (1.64)
BMI	16.32 (1.20)	16.37 (1.0)	16.35 (1.08)
%EBW	83.17 (4.63)	83.96 (4.04)	83.56 (4.29)
WASI full scale IQ	129.47 (56.49)	110.0 (8.25)	119.73 (48.88)
Comorbidity			
<i>Depression disorders</i>	8 (53.3%)	3 (20.0%)	11 (36.6%)
<i>Generalized anxiety disorder</i>	0 (0%)	1 (6.7%)	1 (3.3%)
<i>OCD</i>	1 (6.7%)	2 (13.3%)	3 (10.0%)
<i>Panic</i>	0 (0%)	2 (13.3%)	2 (6.7%)
<i>Adjustment disorder</i>	0 (0%)	1 (6.7%)	1 (3.3%)
Race			
<i>Caucasian</i>	9 (60.0%)	9 (60.0%)	18 (60.0%)
<i>Asian</i>	3 (20.0%)	2 (13.3%)	5 (16.7%)
<i>More than one race</i>	3 (20.0%)	4 (26.7%)	7 (23.3%)
Hispanic	5 (33.0%)	4 (26.7%)	9 (30%)
Male	1 (6.7%)	2 (13.3%)	3 (10.0%)
Intact Family	10 (66.7%)	11 (73.3%)	21 (70%)
Number of Participants with previous hospitalizations	4 (26.6%)	3 (20.0%)	10 (33.3%)
Duration of illness (months)	8.47 (5.46)	12.43 (17.59)	10.38 (12.75)
Clinical questionnaires			
<i>EDE Global</i>	.14 (0.07)	.08 (0.06)	.11 (0.07)
<i>C-YBOCS Total</i>	19.40 (8.6)	12.86 (10.88)	16.13 (10.18)
<i>YBC Total</i>	18.30 (6.02)	13.73 (8.66)	16.0 (7.68)
<i>BDI Score</i>	23.79 (10.02)	18.69 (10.07)	21.33 (10.18)
<i>BAI Score</i>	18.62 (13.09)	17.0 (11.29)	17.78 (11.98)
Neuropsychological measures			
<i>WCST - perseverative errors T score</i>	62.42 (7.28)	58.53 (11.20)	60.41 (9.55)
<i>RCFT - central coherence index</i>	.92 (0.52)	1.18 (0.33)	1.04 (0.45)

Note. AT+FBT = Art Therapy + Family Based Treatment; CRT+FBT = Cognitive Remediation Therapy + Family Based Treatment; BMI = Body mass index; %EBW = Percentage of Estimated Body Weight; WASI full scale IQ = Wechsler Abbreviated Scale of Intelligence full scale Intelligence Quotient; OCD = Obsessive Compulsive Disorder; EDE = Eating Disorder Examination; CY-BOCS = Children's Yale-Brown Obsessive-Compulsive Scale; YBC-ED = Yale-Brown-Cornell eating disorder scale; BDI = Beck Depression Inventory; BAI = Beck Depression Inventory; WCST = Wisconsin Card Sorting Test; RCFT = Rey Complex Figure Test.

Table 2

Mean difference pre-to-post treatment in secondary outcome measures within each treatment group.

Variable	Treatment group	N at BL	N at EOT	Change score	p value	Effect size (Cohen d + 95% CI)
BMI	AT+FBT	15	11	2.10 (1.38)	.001	1.51 [0.50, 2.51]
	CRT+FBT	15	12	1.51 (0.95)	<.001	1.59 [0.62, 2.55]
%EBW	AT+FBT	15	11	8.77 (6.22)	.001	1.41 [0.42, 2.39]
	CRT+FBT	15	12	6.39 (5.10)	.001	1.25 [0.32, 2.17]
EDE Global	AT+FBT	15	11	-0.08 (0.05)	<.001	1.61 [0.58, 2.63]
	CRT+FBT	15	12	-0.03 (0.03)	.004	1.05 [0.15, 1.94]
CY-BOCS	AT+FBT	15	11	-8.72 (7.29)	.003	1.19 [0.23, 2.14]
	CRT+FBT	15	12	-3.66 (6.22)	.06	0.58 [-0.27, 1.43]
YBC-ED	AT+FBT	15	11	-9.82 (6.37)	<.001	1.54 [0.57, 2.50]
	CRT+FBT	15	12	-6.17 (8.75)	.03	0.70 [-0.16, 1.56]
BDI	AT+FBT	14	9	-10.66 (11.09)	.02	0.96 [-0.08, 2.0]
	CRT+FBT	13	10	-4.50 (12.96)	.35	0.34 [-0.59, 1.27]
BAI	AT+FBT	13	9	-3.62 (9.30)	.30	0.38 [-0.60, 1.36]
	CRT+FBT	14	10	-1.30 (11.51)	.72	0.11 [-0.81, 1.03]
WCST – perseverative errors	AT+FBT	14	10	7.44 (6.9)	.01	1.07 [0.07, 2.06]
	CRT+FBT	15	12	3.33 (13.23)	.40	0.25 [-0.58, 1.08]
RCFT- central coherence index	AT+FBT	15	10	0.34 (0.74)	.17	0.46 [-0.47, 1.39]
	CRT+FBT	13	11	-0.21 (0.54)	.28	-0.38 [-1.26, 0.50]

Note. Standard deviations appear in parenthesis. BL = Baseline; EOT = End of Treatment; CI = Confidence Interval; AT+FBT = Art Therapy + Family Based Treatment; CRT+FBT = Cognitive Remediation Therapy + Family Based Treatment; BMI = Body mass index; %EBW = Percentage of Estimated Body Weight; EDE = Eating Disorder Examination; CY-BOCS = Children's Yale-Brown Obsessive-Compulsive Scale; YBC-ED = Yale-Brown-Cornell eating disorder scale; BDI = Beck Depression Inventory; BAI = Beck Depression Inventory; WCST = Wisconsin Card Sorting Test; RCFT = Rey Complex Figure Test.

Table 3

Mean different between the treatment groups (change score from baseline to end of treatment) in secondary outcome measures.

Variable	AT+FBT	CRT+FBT	p value	Effect size (Cohen d + 95% CI)
BMI	2.10 (1.38)	1.51 (0.95)	.24	0.5 [−0.37, 1.36]
%EBW	8.77 (6.22)	6.39 (5.10)	.32	0.44 [−0.42, 1.30]
EDE Global	−0.08 (0.05)	−0.03 (0.03)	.03	1.21 [0.27, 2.15]
CY-BOCS	−8.72 (7.29)	−3.66 (6.22)	.08	0.74 [−0.14, 1.63]
YBC-ED	−9.82 (6.37)	−6.17 (8.75)	.26	0.47 [−0.39, 1.34]
BDI	−10.66 (11.09)	−4.50 (12.96)	.30	0.51 [−0.45, 1.47]
BAI	−3.62 (9.30)	−1.30 (11.51)	.65	0.22 [−0.73, 1.17]
WCST – perseverative errors	7.44 (6.9)	3.33 (13.23)	.40	0.38 [−0.49, 1.27]
RCFT- central coherence index	0.34 (0.74)	−0.21 (0.54)	.08	0.85 [−0.07, 1.77]

Note. Standard deviations appear in parenthesis. CI = Confidence Interval; AT+FBT = Art Therapy + Family Based Treatment; CRT+FBT = Cognitive Remediation Therapy + Family Based Treatment; BMI = Body mass index; %EBW = Percentage of Estimated Body Weight; EDE = Eating Disorder Examination; CY-BOCS = Children's Yale-Brown Obsessive-Compulsive Scale; YBC-ED = Yale-Brown-Cornell eating disorder scale; BDI = Beck Depression Inventory; BAI = Beck Depression Inventory; WCST = Wisconsin Card Sorting Test; RCFT = Rey Complex Figure Test.