Word Count (excluding abstract, tables and references): 5,467

Cognitive behavior therapy for co-morbid Obsessive-Compulsive Disorder in high functioning Autism Spectrum Disorders: A Randomized Controlled Trial

[a] Russell, A.J*.,[b] Jassi, A.,[c] Fullana, M.A., [b] Mack, H., [ab]Johnston, K.,[d] Heyman, I., Murphy, [e]DGM and [ac] Mataix-Cols, D.

*Corresponding author

[a] Dept. of Psychology, Kings College London, Institute of Psychiatry

[b] South London and Maudsley NHS Trust

[c] Dept. of Psychosis Studies, Kings College London, Institute of Psychiatry

[d] Child and Adolescent Psychiatry, Kings College London, Institute of Psychiatry

[e] Dept. of Forensic and Neurodevelopmental Science, Kings College London, Institute of Psychiatry

Acknowledgements/Funding statements

This study was in part funded by NIHR-RP-PG-0606-1045

Dr Fullana was funded by a Marie Curie fellowship from the European Union (no. 039668)

We would like to thank the South London and Maudsley NHS Foundation Trust for their support in carrying out this study.

Address for corresponding author: W6 University of Bath, Claverton Down, Bath BA2 7AY a.j.russell@bath.ac.uk

Abstract

Background: High rates of anxiety disorders, particularly Obsessive Compulsive Disorder (OCD) are reported in people with Autism Spectrum Disorders (ASD). Group cognitive behavioural (CBT) treatment has been found effective for anxiety in young people with ASD but not been OCD specific. One uncontrolled pilot study of individual CBT for OCD for adults with ASD showed good treatment efficacy.

Methods: Forty-six adolescents and adults (mean age 26.9 years, 35 Males) with ASD and comorbid OCD were randomized to CBT for OCD or Anxiety Management (AM), a plausible control treatment. Treatments were matched in duration (mean of 17.4 sessions CBT; 14.4 sessions AM), the Yale Brown Obsessive Compulsive Severity Scale (YBOCS) as primary outcome measure and evaluations blind to treatment group. Treatment response was defined as >25% reduction in YBOCS total severity scores.

Results: Both treatments produced a significant reduction in OCD symptoms, within-group effect sizes of 1.01 CBT group and 0.6 for the AM group. There were no statistically significant differences between the two groups at end of treatment, althoughmore responders in the CBT group (45% vs 20%). Effect sizes for self-rated improvement were small (0.33 CBT group; -0.05 AM group). Mild symptom severity was associated with improvement in the AM but not the CBT group. Family/carer factors were important for both groups,

in that increased family accommodation was associated with poorer outcome.

Conclusions: Evidence-based psychological interventions, both anxiety management and CBT were effective in treating comorbid OCD in young people and adults with ASD

The study was registered as a controlled trial (ISRCTN87114880).

Introduction

Autism Spectrum Disorder (ASD) is characterized by qualitative impairments in social communication and a restricted, repetitive pattern of interests and behaviors, emerging in early childhood and enduring across the lifespan. High rates of anxiety disorders have been reported in both young people[1] and adults[2,3] with Autism Spectrum Disorders (ASD). Rates of disorders in childhood range from 11-84% and a selective pattern of anxiety disorders, namely Social Anxiety, Obsessive Compulsive Disorder (OCD) and specific Phobias has been reported[4,5].

Childhood anxiety reduces social interactions, self-esteem and impoverishes social skills in typically developing children[6] thereby exacerbating problems characteristic of ASD. Furthermore, behavioural problems have been noted to be more likely related to fears in children with ASD than other groups[7].

Co-morbid OCD has been reported to occur in 30% of young people with ASD[3,8] and high rates of OCD have also been reported in adults with ASD both with and without intellectual disability[9,10]. OCD has considerable impact on quality of life for both sufferers and carers and is listed in the World Health Organisation's top 20 leading causes of years lived with disability among individuals aged 15-44[11]. OCD is a treatable anxiety disorder with good evidence for the effectiveness of empirically based psychological treatments such as Cognitive Behaviour Therapy (CBT)[12].

There is emerging evidence that CBT may be effective in ameliorating distressing and debilitating anxiety in people with ASD. Trials of Group CBT interventions for anxiety symptoms[5] and anxiety disorders[13,14,15] adapted for children with ASD have reported promising results.

To date, most adult treatment studies of CBT in ASD have been confined to single case reports – for example its effectiveness for depression[16] and social anxiety disorder[17]. More recently, we reported[18] preliminary evidence from an uncontrolled pilot study of CBT for OCD in 24 adults with ASD and co-morbid OCD: we found that of the 12 adults who received CBT for OCD, 7 (58%) showed a good treatment response in comparison to 2 (16%) in the Treatment as Usual (TAU) group with a standardized effect size (Cohen's d) for CBT of 1.01. This is reasonably consistent with published treatment response rates for behavior therapy (59%) and CBT (67%) in adults with OCD without ASD[19].

In summary, there is evidence of high rates of anxiety disorders, particularly co-morbid OCD, in both young people and adults with ASD. Results of both individual and group systematic psychological treatment evaluations for anxiety disorders in children and adolescents with ASD have been promising, but to date none have been OCD-specific. There is preliminary evidence that CBT may be effective for OCD in ASD as compared to TAU but this requires replication and comparison with other potentially effective approaches for this group.

The aims of the present study were to systematically evaluate CBT for OCD adapted for people with ASD via a RCT comparing the new intervention with a plausible control treatment.

METHODS

Participants

Participants were recruited from specialist ASD clinics, specialist adult and pediatric OCD clinics and generic child and adult mental health services. Participants were individuals with a confirmed diagnosis of an ASD, Verbal IQ > 70 and co-morbid Obsessive Compulsive Disorder (OCD) aged between 14 and 65 years. Participants were excluded if they had current psychotic symptoms, a current episode of major depression, uncontrolled epilepsy or current substance misuse. Participants were included only if psychiatric medication was stable in the 6 weeks prior to study entry and if they had a baseline Yale Brown Obsessive Compulsive Scale (YBOCS) severity rating of >16, typically used for inclusion in clinical trials[20]. Diagnosis of ASD was confirmed using the Autism Diagnostic Interview (ADI). Diagnostic information was supplemented by the Autism Diagnostic Observation Schedule (ADOS)[21] for all participants. Assessment of other co-morbid psychiatric diagnoses and to confirm the presence of OCD was carried out using the MINI 5.0 neuropsychiatric interview[22].

Delineating anxiety based obsessions and compulsions from the repetitive routines and behaviors and circumscribed interests characteristic of ASD was completed using the YBOCS-Symptom Checklist (YBOCS-SCL) and according to the procedures developed in an earlier phenomenological study[10] which were detailed in the study manual. In brief, at the start of each clinical interview care was taken to ensure that the participant was cogniscent of the phenomena to be rated, that the discomfort and anxiety basis for each potential OC symptom was clearly established using visual tools if necessary. Eliciting of symptoms was achieved if needed by enquiring about daily routines in total before gathering further phenomenological information. Communication style and preferences of each individual were also taken into account when administering the Y-BOCS. The presence of obsessions/compulsions was not recorded unless the ego-dystonic basis for unwanted internal phenomena and a resistance to/recognition of the excessive nature of compulsions could be established.

All participants read an information sheet and signed consent forms to take part in the study with developmentally appropriate information and assent forms for participants aged 14-16 years.

The study was registered as a controlled trial (ISRCTN87114880) with ethical approval granted by the local ethics committee.

Study design

A manual outlining ASD specific adaptations to standard CBT for OCD was developed on the basis of a case note review of the pilot study[18], expert recommendations[23,24] and the literature on cognitive and neuropsychological function in ASD where deficits in emotion recognition and executive function are reported. Standard cognitive behavior therapy (CBT) for OCD was adapted by (i) ensuring the building blocks for treatment (i.e. understanding and differentiating emotions, particularly anxiety, and making links between thoughts, feelings and behaviors) were in place, (ii) If required, educational sessions about understanding and rating anxiety were provided before moving on to present the rationale for treatment, (iii) visual tools and concrete/special interest related analogies were used to convey psychological concepts and (iv) a structured and therapist-directed approach to sessional and homework content was taken.

The CBT treatment was predominantly Exposure and Response Prevention (ERP) based and this was conducted in the usual hierarchal fashion both in sessions and as homework. Post-hoc review of the treatment records identified that an average of 10 (s.d. = 5.4) ERP homework tasks were set and the compliance rate for ERP homework tasks was 79%. Cognitive methods were also used to help individuals test out OCD and anxiety related beliefs if appropriate. Post-hoc review identified that a mean of 2.7 (s.d = 3.2) sessions contained some cognitive techniques in the CBT group.

The control or comparison treatment was specified as Anxiety Management (AM) to ensure that any treatment effects were solely due to the adapted CBT for OCD rather than therapist contact, psycho-education about anxiety and general anxiety reduction techniques. Furthermore, the general lack of access to psychological treatment services for adults with ASD suggested that TAU or a no-treatment condition would unfairly advantage the experimental treatment and would not represent an adequate test of effectiveness.

The AM manual was developed for the present study by one of the authors (MF) and was based on previous work[25, 26]. It comprised 8 modules which were adapted for ASD by including visual aides or concrete examples. The modules included education about anxiety, diaphragmatic breathing and practice, progressive muscle relaxation education and practice, education about mood, healthy habits and problem-solving. The AM manual did not contain any of the 'active' ingredients considered important in effective treatment of OCD i.e. ERP or any cognitive strategies addressing OCD-related beliefs.

The treatments were matched for duration (up to 20 sessions) and amount of therapist contact (approximately 1 hour per session). Treatment completers were defined as attending at least 7 sessions. Treatment duration was specified as up to 20 sessions as prior experience had suggested that a longer assessment and orientation to therapy phase was necessary for

some individuals with ASD. For further details regarding the treatments, see Supplemental Material.

The treating therapists were all clinical psychologists (n=4) trained within a cognitive behavioral framework who had extensive experience in treating OCD in both young people and adults. All had received post-qualification training in CBT for OCD having attended workshops delivered by OCD specialists. All therapists delivered both treatments on a randomly allocated basis. Three pilot cases (2 young people and 1 adult with ASD) were treated with the CBT manual prior to commencing the RCT for feasibility and user perspective purposes. This also allowed the trial therapists to be trained in working more specifically with people with ASD and OCD. As therapists who had worked in specialist OCD clinics, they had previous experience of working with people with ASD. A consultant clinical psychologist with expertise in both adult and pediatric cases (DMC) provided supervision for the CBT cases.

Randomization procedure

Participants were randomized to the CBT or AM groups using a table of random numbers (1:1 ratio) managed by an investigator who was part of the Trial Management Committee but not a treating therapist.

Review of the study protocol by the ethics committee recommended that the 'other' treatment should be offered to participants on completion of the first treatment. Thus, participants were informed via the study information sheet

that they could try the other treatment at or after 1 month follow-up following completion of the first treatment if they wished.

Treatment Fidelity and Therapist Allegiance

A random proportion of cases (20%) were audio recorded to ensure treatment fidelity. All treatment sessions were recorded and 20 percent of these recordings were then randomly selected and rated by an independent therapist, blind to treatment condition and outside of the clinical trial, as to whether the session contained OCD targeted interventions such as ERP or exploration of OCD-related beliefs. There was no evidence of cross-contamination on the recordings i.e. none of the AM sessions were recorded as containing any elements of CBT for OCD.

Outcome Measurement

Symptom Ratings were made by assessors blind to treatment group prior to commencing treatment (i.e. no more than 4 weeks before the 1st treatment session), end of treatment (1 week after the final treatment session), and at 1, 3, 6 and 12 month follow-up. Assessors were all trained clinicians experienced in administering the YBOCS and interviewing people with ASD. In order to address the validity of the blinding procedure, blind assessors were asked to complete a questionnaire at each assessment point noting which they thought was the randomization group and if this was (a) a random decision, (b) revealed by the participant or (c) due to clinical improvement[27]. Of the treatment completers, this section was not completed in 8 (20%) of cases. None of the assessors were ‘unblinded’ to treatment

group (i.e. cited (b) as the reason for their choice of treatment group). Blind assessors were accurate in their assignment of treatment group in 24 (60%) of cases. They described their choice as 'random' in 30 (75%) of cases. In 18 (45%) of cases clinical improvement was also cited as a reason for group assignment.

Primary Outcome

The Yale Brown Obsessive Compulsive Scale (YBOCS)[27] total severity rating was the primary outcome measure. In addition to the 10 item severity scale, the insight item from the Y-BOCS (Y-BOCS item 11) was also included with the interviewer being asked to document '*what is the worst thing that the patient worries will happen if she/he did not respond to obsessive thoughts or urges to perform compulsions?'* and then rating the extent to which the patient is certain that the feared consequence is reasonable and will actually occur ranging from (0) 'certain that the feared consequence will happen' to (5) 'certain that the feared consequence will not happen'.

A reduction of at least 25% on the YBOCS severity rating scale is considered to be a sensitive but not specific measure of treatment response[28]. A YBOCS total score of ≤ 12 for 1 week or more was used to define remission[28] with remission lasting for longer than 1 month being defined as recovery.

Secondary Outcome

A broad range of outcome measures, including assessment of other anxiety disorders was employed.

Clinical Global Impression (CGI) and CGI Improvement (CGIi) Rating Scales[29]

Dimensional Yale Brown Obsessive Compulsive Scale (D-YBOCS)[30]

The D-YBOCS is a semi-structured interview to ascertain the presence and severity of 6 symptom dimensions of OCD. Each symptom dimension is rated for severity (0-15) with a global rating considering severity overall and global impairment (0-30).

Self-Report (Adult) – Measures comprised the Obsessive Compulsive Inventory-Revised (OCI-R)[31]; Beck Depression Inventory (BDI)[32], Beck Anxiety Inventory (BAI)[33]; Liebowitz Social Anxiety Scale (LSAS)[34], and the Work and Social Adjustment Scale (WSAS)[35] .

Self-Report (Youth ages 14-18) – OCI-R, BDI-Youth[36]; WSAS, and the Spence Children's Anxiety Scale (SCAS)[37].

Treatment Satisfaction - All participants were asked to rate their satisfaction with the treatment they had received on an 8-point visual analogue scale ranging from (0) 'not at all satisfied' to (8) 'very much satisfied'.

Informant report (all participants) – A person who knew the participant well such as parent, carer or spouse was asked to complete the Children's Obsessive Compulsive Inventory-Parent Version (PR-CHOCI-R)[38] at each measurement point. Severity scores can be obtained by summing up the item responses to give 'compulsions impairment (0-24), obsessions impairment (0-24) and total impairment (0-48). Informants were also asked to complete the Family Accommodation Scale-Parent Report (FAS-PR)[39] where 13 items relating to the provision of reassurance, modification of home routines etc are rated on a 5 point scale with a possible maximum score of 52. A total score of 13 is generally used as a cut-off to indicate clinically meaningful accommodation of OCD symptoms and this has been associated with treatment outcome in pediatric OCD[40] .

Correspondence between self-administered, clinician-administered and informant-administered measures of symptom content and severity

There were modest but significant correlations between self and informant reports of symptom severity and clinician-administered pre-treatment measures. Furthermore, the sub-scales of the OCI-R were associated with the relevant symptom dimensions on the D-YBOCS (see Table 1).

-Table 1 about here-

Power analysis

Based on the data from the pilot study[18] a sample size calculation showed that in order to detect statistically significant differences between the groups on the primary outcome measure (YBOCS total severity rating) at alpha 5% and 80% power, 19 participants would be required for each randomization group. We recruited 23 participants in each group, allowing for 4 dropouts in each treatment arm.

Data Analysis

Independent t-tests and χ^2 tests were used to consider any pre-treatment differences between the groups on symptom measures and demographics.

Analysis of covariance (ANCOVA) were carried out on the primary outcome measure controlling for baseline symptom severity to investigate any difference between the two groups at the end of treatment. Repeated measures analyses of variance were used to detect pre-post treatment changes in the AM and CBT groups. Effect sizes were calculated using Cohen's d. All of the analyses were intention to treat and where outcome data was not available, pre-treatment scores were not carried forward [41].

Results

Participant flow

Seventy-five people were referred to the study, 8 (10.7%) were self-referrals, 24 (32%) were referred from community mental health services, 21 (28%) were referred by specialist ASD services, 11 (14.7%) were referred by specialist anxiety disorder clinics, 4 (5.3%) were referred by voluntary sector services and referral information was missing for 7 (9.4%). Seventeen (22.6%) of these 75 individuals did not meet eligibility criteria for the study (see Figure 1), 2 people were eligible but geography prevented participation and 10 people did not consent to take part.

Twenty three people were randomized to each of the 2 treatment groups (AM and CBT) with 20 treatment completers in each group.

Figure 1 about here

Participants in the treatment groups were involved in the treatment arm of the study for equivalent periods of time. The mean number of weeks between pre-treatment and end-of-treatment ratings were: AM group = 23.74 (sd=10.37); CBT group =27.06 (sd=10.27). The mode or most usual length of treatment in weeks was 25.

Demographics and Clinical features

Independent samples t-tests revealed no differences between the groups for the mean domain and total scores on the ADOS, Verbal IQ, age, or pre-treatment symptom scores (see Table 2).

The treatment groups did not differ with respect to gender distribution (AM group 69.6%, CBT group 82.6% male), or the proportion of those under the age of 18 (AM group n=6 (26.1%), CBT group n=3 (13%) youth protocol).

Table 2 about here

The groups did not differ significantly in respect of OCD symptom dimensions with Contamination Obsessions and related compulsions reported by 18 (78.2%) of the AM group and 20 (86.9%) of the CBT group, Aggressive/Harm obsessions by 17 (73.9%) of the AM group and 14 (60.8%) of the CBT group, Sexual/Religious obsessions by 5 (21.7%) of the AM group and 9 (39.1%) of the CBT group; Symmetry obsessions by 16 (69.5%) of the AM and 15 (65.2%) of the CBT group; Hoarding obsessions by 9 (39.1%) of the AM and 14 (60.8%) of the CBT group and miscellaneous obsessions/compulsions endorsed by 10 (43.3%) of the AM group and 9 (39.1%) of the CBT group. The AM and CBT groups endorsed a mean of 3.1 (sd=1.2) and 3.3 (sd=1.4) OCD symptom dimensions respectively.

Number of Sessions

The mean number of treatment sessions was marginally greater in the CBT (17.43; sd=4.3) than in the AM condition (14.43; sd=5.3) (t=-2.022, df=42, p=.05, 95% C.I. -5.98 to -.006).

Treatment Response (acute phase)

Table 3 shows, for blind clinical assessor, self and informant ratings, the means and standard deviations for each measure at pre, post and 1 month follow-up treatment, percent improvement change between pre- and post-treatment and pre-treatment and 1 month follow-up, the mean difference, 95% confidence intervals and within-group effect sizes. In terms of missing data, Y-BOCS and D-YBOCS ratings were available for all participants in both groups at the start of treatment, 20 in the CBT group and 20 in the AM group at the end of treatment, and 18 in the CBT and 17 in the AM group at 1 month follow-up. For the self-report measures, the OCI-R was completed by 20, 17 and 17 in the CBT group and 19, 17 and 17 in the AM group at the start, end and 1 month post treatment respectively. There was a similar rate of completion with the other self-report measures. The Informant measures were completed by 15, 14 and 11 in the CBT group and 14, 11 and 9 in the AM group at the start, end and 1 month post treatment respectively.

Table 3 about here

ANCOVA, controlling for pre-treatment YBOCS severity ratings, detected no significant differences between the treatment groups on the primary outcome

measure (YBOCS total severity scores) at end of treatment ($F_{1,37,}$=1.127, p=0.295).

In the CBT group, univariate repeated measures ANOVAS established significant changes in YBOCS total severity scores from pre-treatment to end of treatment ($F_{1,19,}$=15.089, p=.001). In the AM group, there were also significant changes in YBOCS total severity ratings from pre-treatment to end of treatment ($F_{1,19,}$=20.169, p<.0001).

Within-group treatment effect sizes on the YBOCS were large and could be considered clinically meaningful in the CBT group (1.15) and medium in the AM group (0.6).

There were more treatment responders (i.e. had a >25% reduction in YBOCS total severity ratings) in the CBT group as compared to the AM group (9/20 (45%) vs 5/20 (20%) respectively). However this difference in response rate was not statistically significant (X^2=1.72, df=1, p=.160). When a more stringent rating of treatment response i.e. a CGI 'much or very much improved' combined with a >35% reduction in YBOCS total severity ratings was considered, 6/20 (30%) of the CBT group achieved treatment response compared with 2/20 (10%) of the AM group. Again the groups did not differ significantly in the proportion of treatment responders. Slightly more participants in the CBT group were classified as remitted cases (i.e. with a YBOCS total severity rating of ≤ 12 1 week after treatment ended) as compared with the AM group (5/20 (20%) vs 3/20 (15%)) but this difference

was not statistically significant.

Standardized effect sizes to further compare the 2 treatments were calculated for end of treatment primary outcome ratings using Cohen's d (mean CBT – mean AM/σ_{pooled}). Effect sizes were 0.4 for the YBOCS total severity rating, 0.4 for YBOCS obsessions severity, 0.2 for YBOCS compulsions and 0.3 for Clinical Global Impression, all indicating a small advantage for CBT over AM after treatment.

Treatment Satisfaction

There were no differences between the 2 treatment groups as to their reports of satisfaction with the treatments they had received: AM Group mean satisfaction score=5.60 (sd=2.131); CBT Group mean satisfaction score=4.9 (sd=2.3), t=.809(df=27) p=.425.

Maintanance of gains at long term follow-up

In the CBT group, there were significant changes in YBOCS total severity scores from pre-treatment to 1-month follow-up ($F_{1,17,}$=10.530, p=.005), 3-month follow-up (n=10; $F_{1,9,}$=11.602, p=.008), 6-month follow-up (n=12, $F_{1,11,}$=10.823, p=.007) and 12-month follow-up (n=11; $F_{1,10,}$=9.831, p=.011). The stability of the change over time can be seen in Figure 2.

Figure 2 about here

Cross-Over Cases

Nine (39%) participants in the AM group, compared with 3 (13%) participants in the CBT group asked to 'cross-over' or try the other treatment either at or after the 1 month follow-up point ($X^2 = 4.05$, df=1, p=.044).

Eight of the 9 participants originally randomized to AM who 'crossed-over' to CBT completed the second treatment and attended for symptom ratings (AM+CBT). One participant was not available for end of treatment ratings despite completing the treatment. There was a significant effect of this 2nd treatment ($F_{1,7}$= 7.703, p=.027) on the primary outcome measure when the end of second treatment scores were compared to pre-treatment. There was no change in YBOCS severity ratings for the 3 participants who completed AM following CBT although the individuals attended readily and qualitatively commented that they found the treatment helpful in general stress management.

Secondary Outcome Measures

Although clinician ratings of Clinical Global Impression (CGI) changed significantly between pre-and post treatment (F=29.1, df=1,34, p<.001), this did not vary by treatment group (F=2.28, df=1,34, p=.140). Figure 3 depicts the percentage of participants in each group rated as 'much or very much improved' and 'minimally improved, unchanged or worse' on the CGI improvement scale. On the basis of this dichotomous rating, the treatment

groups differ significantly in terms of the proportion of participants in each group rated as 'much or very much improved' (CBT group n=11; AM group n=5; (χ^2=3.886 (df=1), Fisher's exact test p=0.050).

Figure 3 about here

Regarding self-report measures, neither of the groups showed significant differences between pre-, post- and 1 month follow-up mean scores on any of the self-ratings (See table 3). Informant ratings differed significantly between pre- and post-treatment only for the AM group.

Moderating Factors

Symptom Severity

The 5 participants classified as treatment responders in the AM group had significantly lower YBOCS severity ratings pre-treatment (mean=21.20, sd=3.2) when compared to the non-responders in the AM group (mean=26.8, sd=4.8; t=2.37 (df=17); p=.029, 95% C.I. 0.6-10.6). This was not the case in the CBT group where responders and non-responders were equivalent with respect to symptom severity before starting treatment (CBT responder mean =24.8, sd=3.2; CBT non-responder mean =24.1, sd=4.4; t=-.41 (df=16), p=.687). Similarly, treatment responders in the AM group had a significantly lower CGI rating pre-treatment than non-responders (AM responders mean=3.2, sd=.5; AM non-responders mean=4.5, sd=.6; t=3.56, df=15, p=.003, 95% C.I. 0.5-2.0). The AM responders did not differ in terms of number of OC symptoms from non-responders.

Age

Age was not significantly associated with treatment outcome. The main outcome analysis was also repeated excluding those participants who entered the Youth protocol (Age 14-16) and this did not affect the pattern of results.

Other variables

Other variables purported to be of interest as potential moderators of treatment including Verbal IQ, ADOS scores and performance on executive function measures were investigated in terms of their association with treatment response i.e. the percentage change in total YBOCS severity scores. None of these factors showed any association.

However, the group categorized as treatment responders (i.e. >25% reduction in YBOCS ratings) differed significantly from non-responders on the Family Accommodation Scale (FAS) at baseline (Mean treatment responder FAS=18.22, s.d.=15.91; Mean treatment non-responder FAS score=29.53, s.d.=12.30; t=2.015, df=24, p=.055, 95% C.I. of the difference -.275-22.89). The treatment responder and non-responder groups did not differ on the FAS at the end of treatment. There was a wide range of scores on the FAS in the treatment response group at baseline and this reduced by the end of treatment suggesting that family factors may have changed over the course of treatment.

In terms of insight as ascertained by the Y-BOCS, 33 (71.7%) of all participants could identify a specific feared consequence if they did not respond to the obsessive thoughts or compulsive urges. Certainty about the feared consequences differed post-treatment according to treatment response at the trend level (responder mean rating=1.00 (sd=1.15), non-responder mean rating=1.95 (sd=1.07); t=2.00 (df=26), p=.056), indicating that non-responders tended to have worse insight scores.

Discussion

This is the first clinical trial to provide evidence for the effectiveness of CBT for co-morbid OCD in young people and adults with ASD. The effect of CBT treatment in the present study was comparable to clinical trials of OCD in people without ASD where aggregated effect sizes of 1.12 and 1.45 have been reported from meta-analyses of CBT trials in adult[42] and pediatric[43] OCD studies respectively Importantly, the treatment gains were sustained over a 12-month follow-up period.

Unexpectedly, Anxiety Management, a plausible control treatment, was also effective in bringing about a reduction in OCD symptoms in people with ASD, particularly those with milder symptoms. It was not possible to separate the two treatment groups at the end of treatment in terms of symptom severity, although there were twice as many responders in the CBT than in the AM

group. Comparison between the effect sizes of the two treatments afforded some small advantage for ERP-based CBT over AM.

This advantage for CBT was greater for ratings of obsessions. In an earlier uncontrolled pilot study[18] where CBT was compared with treatment as usual, we noted an overall advantage for CBT, with a significant change in obsessions severity ratings but not compulsions. It is possible that measurement issues and in particular difficulties in disentangling ASD preferred routines and stereotyped behaviours from anxiety based compulsions has a role to play here. Alternatively, unwanted intrusive thoughts/images/impulses may be associated with greater distress and thus motivation for treatment than compulsive rituals where a preference for routine and sameness in ASD may infer greater tolerance of these symptoms. Further, outcome for adults with ASD is known to be poor with low levels of employment and independent living. In the absence of full-occupation, compulsive rituals may not present with a high level of daily interference.

Significantly more patients in the AM group requested crossover to the CBT group than did CBT patients to the AM group after the 1-month follow-up than, indicating that the AM treatment although receiving similar satisfaction ratings, was not perceived as being as potentially useful as the ERP based treatment. The 8 patients who crossed over from AM to CBT and provided data at the 1-month follow-up point achieved statistically significant

reductions in OCD severity, whereas those who crossed over from CBT to AM (n=3) did not improve.

Setting aside the not inconsequential issues of sample size and statistical power (discussed below), it is worth considering why AM might have performed relatively well in people with ASD and co-morbid OCD, particularly those with mild symptoms.

First, this is not an unprecedented finding. For example, Whittal et al. (2010)[44] in a study investigating Cognitive Therapy for obsessions found that Stress Management (a credible control treatment) was also helpful in reducing obsessions with equivalent pre-post effect sizes for both treatments on the primary outcome measure. Unexpectedly, changes in OCD related cognitions and threat appraisals occurred in the control group. In an internet-based trial of self-help for panic and phobias[26], a similar anxiety management control group did as well as the exposure therapy group on some outcome measures. In an ASD specific study of group treatment for anxiety in children, a social recreational programme was found to have a similar effect on anxiety symptoms as CBT[45]. Thus, under certain circumstances, non-specific interventions can lead to clinically significant improvements in disorder-specific measures. In the current trial, it is important to note that patients who responded to the control treatment had significantly less severe OCD.

Second, it is important to consider that OCD is not the only commonly occurring anxiety disorder in ASD. There is evidence that processing and identification of emotions may be impaired in this group[46] and the AM intervention in the present study (with its focus on education about anxiety and teaching of relaxation techniques), may have made anxiety a more predictable and manageable emotion for some individuals. Risk factors for anxiety disorders such as increased intolerance of uncertainty and anxiety sensitivity may be elevated in people with ASD who have a preference for routine and sameness and this may represent a pathway to OCD. Increasing an individual's capacity to manage the emotional consequences brought about by uncertainty and anxiety may thus bring about a reduction in OCD symptoms.

Further, the non-specifics of therapy may be more potent in this group who can be socially isolated and lack support. The majority of clinical trials in people with ASD have to date employed a wait list or treatment as usual comparison condition. However, an RCT evaluating CBT for anxiety versus a Social Recreational Program in young people with ASD had similar difficulties to the present study in significantly separating the treatments in terms of their effects on anxiety[45].

There were no therapist effects in terms of numbers of treatment responders. Prior to their work on the present study, the majority of the therapists had gained some experience of working with people with ASD as part of generic anxiety/OCD clinic work. Only one of the therapists had

previously worked in an ASD-specific service. Thus the results should be generalizable to clinicians and psychological therapists trained in treating OCD.

Self-report of OCD and other anxiety symptoms were correlated with clinician and informant ratings at pre-treatment but not at follow-up suggesting they were not sensitive to change. Nonetheless, it is of benefit to know that self-report measures can be used as an assessment tool to accurately assess the content of anxiety related problems in young people and adults with ASD and this is consistent with findings from other studies[47]. It is also important to note that many of the participants in the study had good insight into their OCD and that OC related beliefs were prevalent.

There was some indication that family factors (family accommodation) were associated with treatment outcome in the present study and this is consistent with findings of other anxiety intervention studies in ASD[5] and outcome in general pediatric OCD treatment studies[40] . Group and individual psychological interventions for anxiety disorders in this group should then seek the engagement of relevant care-giving/supportive individuals in treatment.

Limitations

While the study was well powered to detect within-group changes in symptom severity, it may have lacked statistical power to detect a difference

between the two treatment groups. The power calculation was based on an earlier pilot study where treatment was compared to no-treatment[18]. As discussed above, the AM intervention clearly had some modest effect, particularly in individuals with mild OCD symptoms. This indicates that larger sample sizes will be needed to detect a statistically significant difference between the groups. The results of the current trial will be useful to help more accurate power calculations for future trials. However, the main message of the current study is that standard CBT for OCD can be successfully adapted for ASD participants who are traditionally perceived as difficult to treat.

The disproportionally high number of participants who endorsed hoarding symptoms in the CBT (60%) vs. the AM (40%) groups may also have contributed to the lack of clearly significant differences between the groups because hoarding symptoms are usually considered difficult to treat with conventional CBT for OCD[48]. Given the current proposals to separate hoarding from OCD in DSM-5[49], future treatment studies would probably benefit from excluding any severe hoarding individuals from their samples.

The wide ranges of age and symptom severity may have had an impact on the findings. Rounsaville et al. (2001)[48] recommend reducing therapist and participant heterogeneity and choosing narrow parameters with which to define the treatment setting, participants and therapists in order to optimize the power available in a small pilot trial. However, we felt that as a proof of concept trial, it would be important to recruit a wide range of individuals.

The lack of follow-up information on the AM group is a weakness imposed by our design, as it was unethical to withhold the evidence based treatment (CBT) for longer than the 1-month follow-up and these patients had to be offered the option of a cross-over. A further limitation was the absence of detailed information about homework compliance and its association with treatment response.

Not everyone did well as a result of treatment. A proportion of participants in both groups (15% AM and 10% CBT) were rated as minimally or much worse at 1 month follow-up on the Clinical Global Impressions Scale, one of the secondary outcome measures. In addition to the lack of longer term follow-up previously mentioned in the AM group, just over 50% of the treatment completers in the CBT group remained in follow-up for 12 months. It is possible that those lost to follow-up may also have deteriorated during that period and thus the positive effects of the intervention may have been limited to just those who stayed in the study.

In summary, psychological treatments for OCD can be successfully adapted for comorbid ASD and OCD. Further testing of these promising interventions with larger, more homogeneous samples is now required.

References

1. White, S.W., Oswald, D., Ollendick, T. and Scahill, L. Anxiety in children and adolescents with autism spectrum disorders. *Clin Psychol Rev* 2009*;* 29**:** 216-229.

2. Bakken, T.L., Helverschov, S.B., Eilertsen, D., *et al.* Psychiatric disorders in adolescents and adults with autism and intellectual disability: A representative study in one county in Norway. Res Dev Disabil 2010; 31:1669-77.

3. Szatmari, P., Bartolucci, G., & Bremner, R. Asperger's syndrome and autism: Comparison of early history and outcome. Dev Med Child Neurol 1989; 31: 709-720.

4. Ollendick, T.H., King, N.J. and Muris, P. Fears and phobias in children: phenomenology, epidemiology and aetiology. Child Adolesc Ment Health 2002; 7:98-106.

5. Sofronoff, K., Attwood, T. & Hinton, S. A randomized controlled trial of a CBT intervention for anxiety in children with Asperger syndrome. J Child Psychol Psychiatry 2005; 46 (11): 1152-1160.

6. McLoone, J., Hudson, J.L. & Rapee, R. Treating anxiety disorders in a school setting. Educ Treat Children 2006; 29: 219-242.

7. Evans, D.W., Canavera, K., Kleinpeter, F.L. *et al.* The fears, phobias and anxieties of children with autism spectrum disorders and Down syndrome: Comparisons with developmentally and chronologically age matched children. Child Psychol Human Devel 2005; 36: 3-26.

8. South, M., Ozonoff, S., & McMahon, W.M. Repetitive Behavior Profiles in Asperger Syndrome and High-Functioning Autism. J Autism Dev Disord 2005; 35(2): 145-158.

9. McDougle, C.J., Kresch, L.E., Goodman, W.K. *et al.* A Case-Controlled Study of Repetitive Thoughts and Behavior in Adults with Autistic Disorder and Obsessive-Compulsive Disorder. Am J Psychiatry 1995; 152(5): 772-777

10. Russell, A.J., Mataix-Cols, D., Anson, M., and Murphy, D.G.M. Obsessions and Compulsions in Asperger syndrome and high-functioning Autism. Br Psychiatry 2005; 186: 525-528.

11. Kohn, R., Saxena, S., Levav, I. & Saraceno, B. (2004) The treatment gap in mental health care. Bulletin of the World Health Organization; 82(11): 858-864.

12. Van Oppen, P., de Haan, E., van Balkom, A.J. *et al.* Cognitive therapy and exposure *in vivo* in the treatment of obsessive compulsive disorder. Behav Res Therapy 1995; 33: 379-390.

13. Chalfant, A.M., Rapee, R. and Carroll, L. Treating Anxiety Disorders in Children with High Functioning Autism Spectrum Disorders: A Controlled Trial. J Autism Devel Disord 2007; 37: 1842-1857.

14. Wood, J.,J., Drahota, A., Sze, K. *et al.* Cognitive behavioural therapy for anxiety in children with autism spectrum disorders: a randomized controlled trial. J Child Psychol Psychiatry 2009; 50(3): 224-234.

15. Reaven, J.,Blakeley-Smith, A., Culhane-Shelburne, K. and Hepburn, S. Group cognitive behavior therapy for children with high-functioning autism spectrum disorders and anxiety: a randomized trial. J Child Psychol Psychiatry 2012; 53(4): 410-419.

16. Hare, D.J. The use of cognitive-behaviour therapy with people with Asperger syndrome: a case study. Autism 1997; 1: 215-225.

17. Cardaciotto, L.A. and Herbert, J.D. Cognitive behaviour therapy for social anxiety disorder in the context of Asperger's syndrome: A single subject report. Cog Behav Pract 2004; 11(1): 75-81.

18. Russell, A.J., Mataix-Cols, D., Anson, M.A. & Murphy, D.G.M. Psychological Treatment for Obsessive Compulsive Disorder in People with Autism Spectrum Disorders – A Pilot Study. Psychother Psychosom 2009; 78: 59-61.

19. Whittal, M.L., Thordarson, D.S. & McLean, P.D. Treatment of obsessive compulsive disorder: cognitive behavior therapy vs exposure and response prevention. Behav Res Ther 2005; 43: 1559-1576.

20. The Clomipramine Collaborative Group (1991) Clomipramine in the treatment of patients with Obsessive Compulsive Disorder. Arch Gen Psychiatry; 48:730-738.

21. Lord, C., Rutter, M., Goode, S. and Le Couteur, A. Autism Diagnostic Observation Schedule: a standardized observation of communicative and social behaviour. J Autism Devel Disord 1989; 19: 185-212.

22. Sheehan, D..V. and LeCrubier, Y. (2000) *MINI International Neuropsychiatric Interview English Version 5.0 DSM-IV.* www.medical-outcomes.com.

23. Attwood, T. (1999) Modifications to Cognitive Behaviour Therapy to Accommodate the Cognitive Profile of People with Asperger's Syndrome. [online] http://www.tonyattwood.com/paper2.htm

24. Anderson, S. and Morris, J. Cognitive Behaviour Therapy for People with Asperger Syndrome. Behav CognPsychother 2006; 34: 293-303.

25. Cautela, J. R., & Groden, J. *Relaxation: A comprehensive manual for adults, children, and children with special needs.* Champaign, IL: Research Press, 1978

26. Schneider, A., Mataix-Cols, D., Marks, I.M. and Bachofen, M. Intenet guided self-help with or without Exposure Therapy for Phobic and Panic Disorders. Psychother Psychosom 2005; 74: 154-164.

27. Goodman, W.K., Price, L.H., Rasmussen, S.A. et al. The Yale-Brown Obsessive Compulsive Scale I. Development and Reliability. Arch Gen Psychiatry 1989; 46: 1006-1011.

28. Simpson, H.B., Huppert, J.D., Petkova, E. Response versus Remission in Obsessive-Compulsive Disorder. J Clin Psychiatry 2006; 67(2):269-276.

29. Guy, W. *Clinical Global Impression ECDEU Assessment Manual for Psychopharmacology-Revised.* Rockeville: National Institute of Mental Health, 1976.

30. Rosario-Campos, M.C., Miguel, E.C., Quatrano, S. *et al.* The Dimensional Yale-Brown Obsessive-Compulsive Scale (DY-BOCS): an instrument for assessing obsessive-compulsive symptom dimensions. Mol Psychiatry 2006; 11: 495-504**.**

31. Foa, E.B., Huppert, J.D., Leiberg, S. *et al.* The Obsessive-Compulsive Inventory: Development and Validation of a Short Version. Psychol Assess 2002; 14(4): 485-496.

32. Beck, A.T., Steer, R.A. & Brown, G.K. Beck Depression Inventory Manual 2nd Edition. San Antonio, Texas: The Psychological Corporation, 1996.

33. Beck, A.T., Epstein, N., Brown, G., Steer, R.A. An inventory for measuring clinical anxiety: psychometric properties. J Consult Clin Psychol 1998; 56(6): 893-897**.**

34. Liebowitz, M.R., Gorman, J.M., Fyer, A.J., Klein, D.F. Social phobia: review of a neglected disorder. Arch General Psychiatry 1985; 42: 729–736.

35. Mundt, J.C., Marks, I.M., Greist, J.H. & Shear, K. The work and social adjustment scale: a simple accurate measure of impairment in functioning. Br J Psychiatry 2002;180: 461-464.

36. Beck, J.S., Beck, A.T. and Jolly, J.B. Beck Youth Inventories. San Antonio, Texas: Psychological Corporation, 2001.

37. Spence, S.H. A measure of anxiety symptoms among children. Behav Res Ther 1998; 36: *545-566.*

38. Shafran, R., Frampton, I., Heyman, I. *et al.*The preliminary development of a new self-report measure for OCD in young people J Adoles 2003; 26: 137-142.

39. Storch, E.A., Merlo, L.J. & Geffken, G.R. The Family Accommodation Scale –Parent Report. Unpublished Manuscript, Gainsville: University of Florida, 2005.

40. Merlo, L.J., Lehmkuhl, H.D., Geffken, G.R., and Storch, E.A. Decreased Family Accommodation associated with improved therapy outcome in pediatric obsessive-compulsive disorder. J Consult Clin Psychol 2009; 77(2): 355-360.

41. Everitt, B.S. Analysis of drop-out data in treatment trials. Br J Psych 1998; 173: 271.

42. Rose-Alcazar, A.I., Sanchez-Meca, J., Gomezx-Conesa, A. and Marin-Martinez, F. Psychological treatment of obsessive-compulsive disorder: A meta-analysis. Clin Psychol Rev 2008; 1310-1325

43. Watson, H.J. and Rees, C.S. Meta-analysis of randomized, controlled treatment trials for pediatric obsessive-compulsive disorder. J Child Psychol Psych 2008; 49(5): 489-498.

44. Whittal, M.L., Woody, S.R., McLean, P.D. *et al.* Treatment of obsessions: A Randomized controlled trial. Behav Res Ther 2010; 48: 295-303.

45. Sung, M., Ooi, Y.P., Goh, T.J., Pathy, P., Fung, D.S.S., Ang, R.P., Chua, A. and Lam, C.M. Child Psych Hum Dev 2011; 42:634-649.

46. Hill, E., Berthoz, S. and Frith, U. Cognitive processing of own emotions in individuals with autism spectrum disorders and their relatives. J Autism Devel Disord 2004; 4: 229-35.

47. White, S.W., Schry, A.R. and Maddox, B.B. The assessment of anxiety in high-functioning adolescents with Autism Spectrum Disorder. J Autism Devel Disord 2012; 42:1138-1145.

48. Pertusa, A., Frost, R.O., Fullana, M.A., Samuels, J., Steketee, G., Tolin, D., Saxena, S., Leckman, J.F. & Mataix-Cols, D. (2010). Refining the diagnostic boundaries of compulsive hoarding: A critical review. Clin Psychol Review 2010; 30(4): 371-386.

49. Mataix-Cols, D., Frost, R.O., Pertusa, A., Clark, L.A., Saxena, S., Leckman, J.F., Stein, D.J., Matsunaga, H., Wilhelm, S. (2010). Hoarding disorder: a new diagnosis for DSM-V? Depress Anxiety 2010; 27(6): 556-572.

50. Rounsaville, B.J., Carroll, K.M. and Onken, L.S. A Stage Model of Behavioural Therapies Research: Getting Started and Moving on From Stage I. Clin Psychol: Science Pract 2001; 8(2):133-142.

Figure 1: Consort Flow Diagram

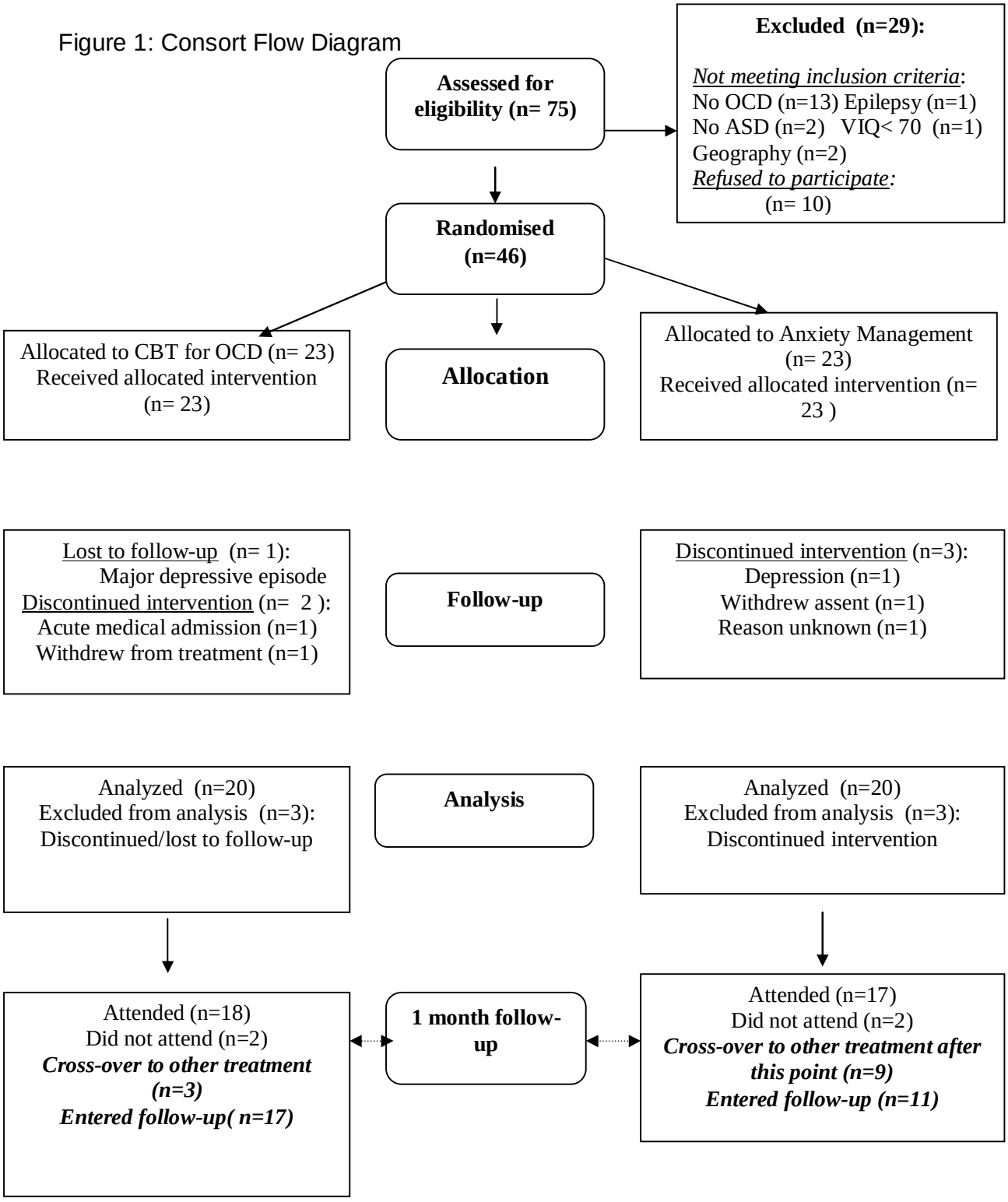


Table 1: Correlations of Clinician, Informant and Self-report severity ratings of OC symptoms

Rating	Informant Obsessions severity	Informant Compulsions severity	Informant total severity	Clinician total severity	Self-report Washing	Self-report Hoarding	Self-report Ordering	Self-report Obsessing	Self-report Neutralising
Clinician Obsessions severity	.481 p=.020 n=23								
Clinician Compulsions Severity		.276 p=.155 n=28							
Clinician total severity			.576 p=.001 n=28						
Self-report total severity			.482 p=.015 n=25	.265 p=.108 n=38					
Clinician Contamination severity					.468 p=.003 n=39				
Clinician Hoarding severity						.394 p=.014 n=38			
Clinician Symmetry severity							.374 p=.019 n=39		
Clinician Aggression Obs severity								.419 p=.01 n=37	.462 p=.003 n=38

Table 2: Age, ADOS, Verbal IQ and Symptom Measures at pre-treatment

	Anxiety Management Group Mean (SD)	CBT Group Mean (SD)	t (df)	p
Age in years	25.2 (13.5) Min=14 max=65	28.6 (11.3) Min=14 max=49	-.93 (44)	1.00
ADOS Comm and RSI total	9.9 (4.7)	10.7 (4.2)	-.49 (33)	.621
WAIS/WISC Verbal IQ	97.3 (15.2)	102.5 (16.7)	-.91 (30)	.367
Clinician administered				
YBOCS Obsessions severity	12.4(3.1)	11.6 (2.7)	.90(39)	.370
YBOCS Compulsions severity	12.9(2.8)	13.2(1.5)	-.47(39)	.638
YBOCS total severity	25.1(5.2)	24.8(3.7)	.20(39)	.839
DYBOCS Global severity	20.4(5.1)	20.6(3.7)	-.15(41)	.880
CGI	4.2(0.8)	4.1(0.7)	.35(37)	.725
Self-Report				
OCI-R:				
Checking sub-scale	5.8(3.6)	6.4(3.7)	-.37(33)	.708
Hoarding sub-scale	5.1(3.6)	5.2(3.6)	-.19(33)	.849
Neutralising sub-scale	2.8(3.4)	3.3(3.0)	-.58(33)	.566
Obsessing sub-scale	6.6(3.6)	6.4(4.0)	.26(32)	.790
Ordering sub-scale	6.6(3.2)	5.3(4.4)	.16(34)	.256
Washing sub-scale	4.3 (4.1)	3.8(3.8)	.16(34)	.869
OCI-R Total	30.9(13.7)	30.5(15.9)	.09(34)	.929
Beck Depression Inventory	16.9(12.0)	17.3(13.5)	-.11 (38)	.912
Beck Anxiety Inventory	15.4 (10.9) N=15	16.2(11.6) N=17	-.19 (37)	.725
Spence Children's Anxiety Scale Total Score	27.8(4.7) N=5	28.3(20.3) N=3	-.05 (6)	.955
Liebowitz Social Anxiety Scale Total Score	76.8(26.1)	67.5(33.5)	.82(26)	.418
Work and Social Adjustment Scale	18.5(9.5)	18.8(10.9)	-.069 (30)	.946
Parental/Carer Report				
CHOCI Symptom Total	14.7(8.1)	14.4(6.0)	.11(25)	.908
CHOCI Impairment Total	28.9(12.5)	27.9(11.6)	.21(25)	.832
Family Accommodation Scale (n=27)	24.1(13.5)	27.3(15.1)	-.58(25)	.562

ADOS Comm and RSI total: Autism Diagnostic Observation Schedule Communication and Reciprocal Social Interaction domains scores total
WAIS: Wechsler Adult Intelligence Scales
WISC: Wechsler Intelligence Scales for Children

Table 3; Pre and post treatment and 1 Month Follow-up clinician, self and informant ratings by group

	Pre-Treatment Mean (SD)	Post treatment Mean (SD)	1 Month FUP Mean (SD)	Pre-Post difference Mean *95% C.I.*	Pre-1MFUP difference Mean *95% C.I.*	Pre-Post % imp. Mean (SD)	Pre-1MFUP % imp. Mean (SD)	Pre-Post effect size	Pre-1MFU Effect size
CBT: Clinician ratings									
YBOCS:									
Total severity	24.8(3.7)	17.8(8.4)	18.7(8.2)	7.0** *3.2-10.7*	5.8***. 2-*9.7*	27.8(33.2)	23.5(32.1)	1.078	.958
Obsessions severity	11.7(2.8)	8.7(4.1)	8.5(3.6)	2.9** 1.1-4.7	3.1** *1.4-4.7*	24.0(34.7)	25.2(30.9)	.854	.922
Compulsions severity	13.1(1.5)	9.0(4.6)	9.7(4.5)	4.0** *1.7-6.3*	3.2** *0.9-5.5*	29.7(36.5)	23.9(35.7)	1.198	1.013
CGI	4.2(0.8)	3.3(1.1)	3.5(1.3)	0.9***0.4-1.4	0.8** *0.2-1.4*	21.4(21.8)	19.6(25.3)	.935	.648
Dimensional YBOCS:									
Contamination	7.3(4.1)	3.9(3.8)	4.5(3.8)	3.4** 1.4-*5.3*	2.6** *0.8-4.5*	41.4(48.6)	34.2(41.3)	.860	.708
Hoarding	3.5(3.9)	1.7(2.8)	1.7(2.8)	1.7* *0.2-3.3*	2.1* *0.3-3.9*	48.8(55.7)	53.4(49.5)	.530	.530
Symmetry	5.3(4.5)	4.2(4.6)	4.6(4.4)	1.1 *-.2-2.5*	1.2 *-.3-2.8*	35.5(47.1)	34.9(48.0)	.241	.157
Aggression/Harm	3.8(4.3)	2.6(4.0)	2.2(3.5)	1.2 *-.1-2.5*	1.8* *.2-3.4*	29.9(61.7)	65.7(39.3)	.288	.408
Sexual/Religious	2.0(3.1)	1.2(2.3)	1.3(2.5)	0.8 *-.2-1.8*	0.8 *-.3-1.9*	37.3(51.4)	34.7(52.8)	.293	.248
Miscellaneous	3.2(4.1)	1.4(3.0)	1.6(3.5)	1.8* *0.4-3.1*	1.7* *.1-3.2*	60.6(45.4)	58.5(52.6)	.501	.419
Global total	20.7(3.8)	15.5(7.1)	15.8(7.0)	5.2*** *2.5-7.8*	5.0** 2.1-*7.9*	26.7(30.1)	25.4(30.9)	.913	.870
CBT: Self-Ratings:									
OCI-R total	31.5(12.7)	26.8(15.3)	29.3(12.9)	4.7 *-1.3-10.7*	1.3 *-6.9-9.7*	20.2(45.8)	-32.1(97.4)	.334	.171
BDI	16.2(13.8)	15.7(16.5)	17.5(15.1)	-.5 *-3.9-4.9*	2.0 *-2.9-6.9*	17.9(58.3)	16.4(39.1)	.032	-.089
BAI	16.4(10.6)	14.0(11.6)	13.6(10.1)	2.3 *-0.8-5.5*	*1.5* -3.8-6.9	14.1(52.9)	26.5(36.0)	.215	.270
Liebowitz total	74.7(27.1)	67.8(34.9)	66.2(35.7)	6.9 *-9.8-23.7*	-2.2*-17.6-13*	7.0(34.7)	-20.3(46.2.1)	.220	.268
Spence total	28.3(20.3)		49.0(n=1)			20.0	-28.9		-1.40
Work and Social Adjustment Scale	19.0(10.4)	22.4(11.7)	14.1(9.1)	3.4 *-7.8-1.0*	4.6 *-3.9-13.1*	-24.4(43.5)	8.4(53.5)	-.307	.501
CBT: Informant:									
CHOCI severity	30.3(11.1)	25.8(10.5)	28.8(7.0)	4.5 *2.1-11.1*	2.7-7.5-13.0	4.9(41.1)	-3.2(41.2)	.416	.161
Family Acc.	26.9(15.2)	27.9(15.0)	21.1(9.3)	-1 *-11-8.9*	6.3 *-5.8-18.4*	-33.1(90.1)	1.4(71.3)	-.066	.460

	Pre-Treatment Mean (SD)	Post treatment Mean (SD)	1 Month FUP Mean (SD)	Pre-Post difference Mean *95% C.I.*	Pre-1MFUP difference Mean *95% C.I.*	Pre-Post % imp. Mean (SD)	Pre-1MFUP % imp. Mean (SD)	Pre-Post effect size	Pre-1MFU Effect size
AM: clinician ratings									
YBOCS:									
Total severity	25.1(5.1)	20.8(7.8)	20.7(5.4)	4.7*** *2.5-6.8*	3.8*** *2.1-5.6*	20.3(23.4)	16.2(14.3)	.652	.837
Obsessions severity	12.4(3.0)	10.5(3.8)	11.9(2.3)	2.0** *0.9-3.0*	2.2*** *1.2-3.3*	17.6(21.9)	19.7(17.9)	.554	.187
Compulsions	12.9(2.8)	10.3(4.7)	10.8(3.0)	2.7** *1.1-4.3*	1.9* *0.9-3.1*	22.5(30.6)	13.1(20.8)	.672	.723
CGI	4.2(0.8)	3.7(1.1)	3.7(1.2)	0.5** *0.2-0.8*	0.6** *0.1-0.9*	13.9(18.4)	14.9(19.6)	.519	.490
Dimensional YBOCS:									
Contamination	5.8(4.3)	4.8(4.8)	4.9(4.4)	1.0 *-.5-2.5*	0.8 *-.6-2.2*	22.3(69.6)	27.6(45.0)	.219	.206
Hoarding	2.9(3.8)	2.5(3.6)	2.0(3.4)	0.3 *-1.4-2.1*	0.8 *-1.4-3.1*	54.9(36.0)	68.7(39.2)	.108	.249
Symmetry	5.4(4.3)	4.6(3.9)	3.7(3.7)	0.8 *-.6-2.2*	2.0* *.2-3.7*	21.8(40.8)	43.1(43.2)	.194	.423
Aggression/Harm	6.5(4.4)	5.3(4.6)	4.5(4.1)	1.2 *-.1-2.6*	2.1* *.27-3.9*	29.4(37.7)	36.8(41.7)	.266	.470
Sexual/Religious	1.6(3.4)	2.2(4.2)	2.2(4.2)	-.6 *-2.4-1.2*	-1.0 -2.8-.8	52.5(55.0)	19.5(14.7)	-.157	-.157
Miscellaneous	3.3(4.2)	1.6(4.7)	1.1(2.2)	1.6* *0 .2-3.0*	1.9* *-0.2-3.9*	58.9(46.8)	51.5(50.8)	.381	.656
Global total	20.3(4.7)	17.1(7.5)	17(5.9)	3.2** *1.1-5.2*	2.9** *1.3-4.5*	18.5(27.1)	15.7(14.9)	.511	.524
AM: self-ratings:									
OCI-R total	30.3(11.9)	30.9(13.4)	31.1(14.4)	-.5 *-5.2-4.2*	-.06 *-4.6-4.5*	-4.3(28.7)	-.68(23.5)	-.047	-.060
BDI	17.1(12.4)	17.5(12.0)	18.8(12.3)	-.4 *-5.2-4.3*	-1.3 *-7.2-4.6*	-10.2(60.3)	-16.7(85.9)	-.032	-.137
BAI	16.6(12.2)	17.2(12.7)	15.4(13.1)	-.5 *-5.6-4.5*	-.6 *-4.0-5.4*	-23.1(97.5)	4.3(60.2)	-.048	.094
Liebowitz total	72.4(29.1)	78.8(43.7)	76.4(37.1)	-5.7 *-29-17.6*	-3 *-15.3-19.1*	-11.0(56.9)	-0.5(30.4)	-.172	-.119
Spence total	27.5(3.5)	36.5(13.4)	36.0(14.1)	-7 *-95-81.9*	-8.5*-103-86.7*	-23.3(32.9)	-28.6(34.8)	-.919	-.827
Work and Social Adjustment Scale	17.9(9.5)	17.2(7.5)	15.7(6.3)	0.6 *-4.9-6.2*	.92 *-4.6-6.5*	-28.6(85.9)	-50.6(167.9)	.081	.272
AM: Informant:									
CHOCI severity	27.8(12.7)	21.0(13.5)	20.3(15.4)	6.8* *-.1-13.7*	4.1 *-4.4-26.6*	21.6(56.7)	19.9(48.1)	.518	.531
Family Acc.	20.8(13.1)	22.3(17.2)	17.8(17.1)	-1.5 *-9.1-6.1*	.2 *-9.7-12.2*	-7.0(50)	5.0 (55.7)	-.098	.196

AM=anxiety management, 1MFUP=one month follow-up ratings

Significance of change on 2-tailed related test *<.05, **<.01, ***<.001

Figure 2: YBOCS total severity (pre and end treatment, 1M FUP) by treatment group and 3 (n=10), 6 (n=12) and 12M (n=11) FUP for CBT group

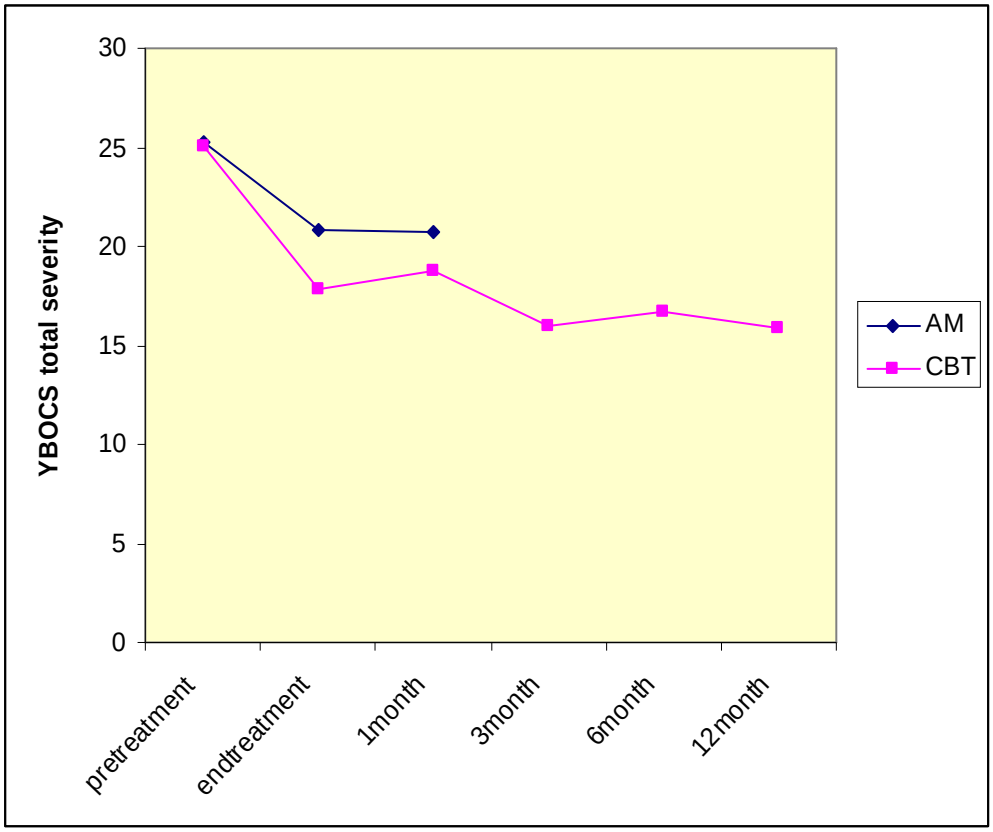
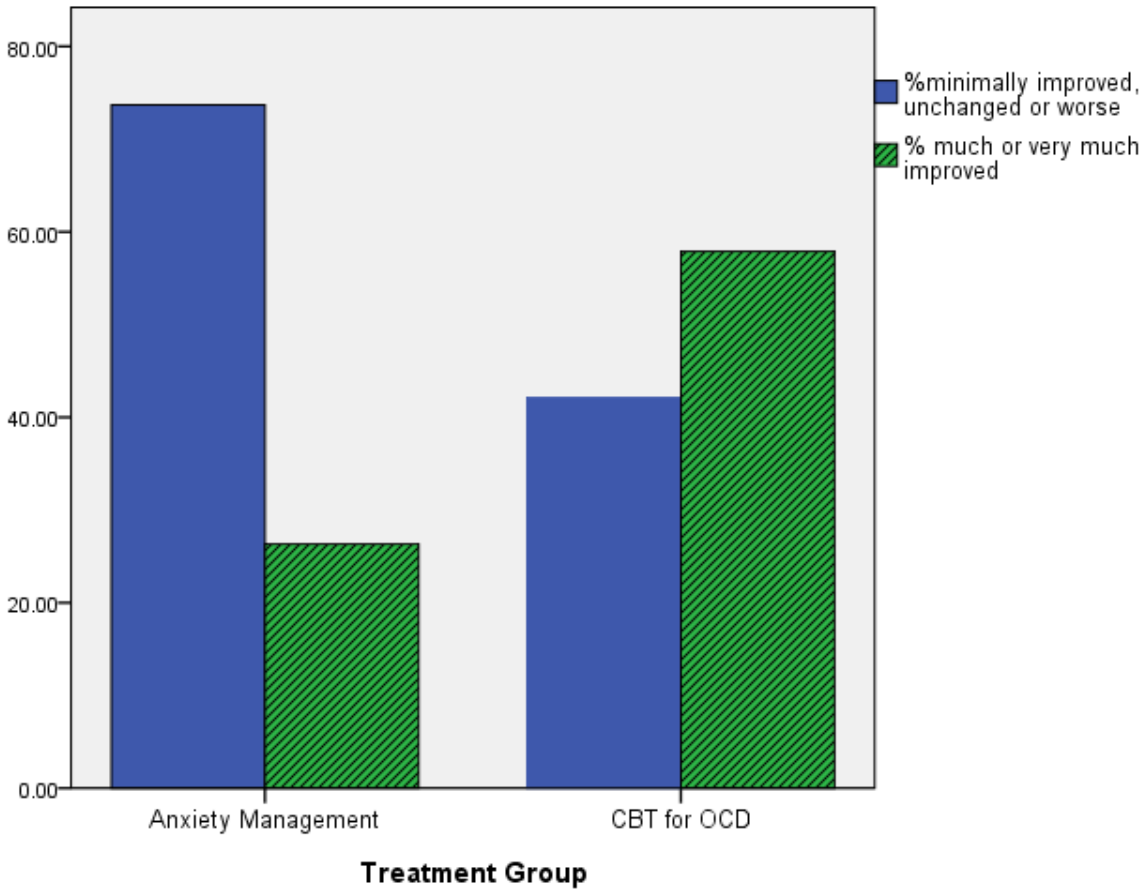


Figure 3: Percentage of participants rated as ‘minimally improved, unchanged or worse’ and ‘much or very much improved’ on the Clinical Global Improvement Scale by treatment group



Description of the treatments

CBT treatment

The duration of each session ranged from 41 to 74 minutes (mean session length=60 minutes, s.d=7.5). Homework was set at every session, which included reading materials from the session, completing OCD diaries and exposure tasks. The compliance rate for homework was 90%, although this included even partial completion of the homework tasks. On average 10 (s.d=5.4) ERP tasks were set as homework throughout treatment and the compliance rate for these was 79%. The mean compliance rate for other homework such as reading materials and keeping records was 89%. In terms of session content and how the treatment was generally structured, a mean of 2.7 sessions (s.d=1.6, range 1-6) comprised anxiety education; OCD education was included in 3 to 13 sessions (mean=5.8, s.d.=2.9); Exposure and Response Prevention (ERP) was covered in up to 16 sessions (mean=8.6, s.d.=5.3) and a mean of 2.7 sessions (s.d.=3.2) included cognitive intervention techniques. Relapse prevention took between 0 to 2 (mean=1, s.d.=0.7) sessions.

In terms of the frequency of using ASD specific modifications, work with 1 participant incorporated the use of their special interest to help convey concepts, therapists were noted on the record forms as needing to be 'more directive' in sessions for 13 (68%) of participants, 6 (32%) participants needed 'rules' to engage with the structure of the sessions (e.g. how much time to spend talking on non-OCD topics etc), 9 (47%) of participants' sessions record forms had reference to concrete examples being needed and use of visual material to convey concepts was incorporated in 11 (58%) of participants' sessions. Nine (47%) participants in the CBT group had direct involvement of parents/carers in sessions.

Anxiety management treatment

The duration of the sessions ranged from 28 to 71 minutes (mean=57 minutes, s.d.=8.3). Homework was set at every session, which included reading materials, practicing techniques learnt in the sessions and keeping records. The compliance rate for homework was 95%, which included even partial completion of the homework tasks.

With regards to content of the treatment, between 1 to 8 sessions were focused on learning and practicing breathing exercises (mean=3.9, s.d.=1.8) and between 1 to 13 sessions included relaxation practice (mean=5.5, s.d. =3.1). Sessions on mood ranged from 0 to 3 (mean=1.4, s.d.=0.82), 0 to 10 sessions were on healthy habits (mean= 3.9, s.d.= 2.7) and 0 to 4 sessions were spent on problem solving (mean =1.9, s.d.= 1.2).

In terms of modifying the AM treatment to make it suitable for people with ASD, there were no records suggesting any participants had their special interests incorporated into the session. Therapists were noted as being

‘more directive’ in sessions for 5 (25%) of participants, 1 (5%) participant needed rules for the sessions, 6 (30%) needed reference to concrete examples, 9 (45%) needed visual aids and 6 (30%) of participants’ parents/carers were directly involved in sessions.