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Supplementary material

Effectiveness of multimodal treatment for young people with body dysmorphic disorder in two specialist clinics

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ABSTRACT

Body dysmorphic disorder (BDD) typically originates in adolescence and is associated with considerable adversity. Evidence-based treatments exist but research on clinical outcomes in naturalistic settings is extremely scarce. We evaluated the short- and long-term outcomes of a large cohort of adolescents with BDD receiving specialist multimodal treatment and examined predictors of symptom improvement. We followed 140 young people (age range 10-18) with a diagnosis of BDD treated at two national and specialist outpatient clinics in Stockholm, Sweden (n=96) and London, England (n=44), between January 2015 and April 2021. Participants received multimodal treatment consisting of cognitive behaviour therapy and, in 72% of cases, medication (primarily selective serotonin reuptake inhibitors). Data were collected at baseline, post-treatment, and 3, 6, and 12 months after treatment. The primary outcome measure was the clinician-rated Yale-Brown Obsessive-Compulsive Scale Modified for BDD, Adolescent version (BDD-YBOCS-A). Secondary outcomes included self-reported measures of BDD symptoms, depressive symptoms, and global functioning. Mixed-effects regression models showed that BDD-YBOCS-A scores decreased significantly from baseline to post-treatment (coefficient [95% confidence interval]=-16.33 [-17.90 to -14.76], p<0.001; within-group effect size (Cohen's d)=2.08 (95% confidence interval, 1.81 to 2.35). At the end of the treatment, 79% of the participants were classified as responders and 59% as full or partial remitters. BDD symptoms continued to improve throughout the follow-up. Improvement was also seen on all secondary outcome measures. Linear regression models identified baseline BDD symptom severity as a predictor of treatment outcome at post-treatment, but no consistent predictors were found at the 12-month follow-up. To conclude, multimodal treatment for adolescent BDD is effective in both the short- and long-term when provided flexibly within a specialist setting. Considering the high personal and societal costs of BDD, specialist care should be made more widely available.

Keywords: Body dysmorphic disorder; dysmorphophobia; cognitive-behaviour therapy; treatment outcomes; adolescents

INTRODUCTION

Body dysmorphic disorder (BDD) is characterised by a preoccupation with perceived defects in physical appearance, as well as avoidance and repetitive behaviours, causing distress and impairment (American Psychiatric Association, 2013). BDD generally has an adolescent onset (Bjornsson et al., 2013), and prevalence estimates in this age group are around 2% (Schneider et al., 2017; Veale et al., 2016). BDD significantly impacts the young person's education and social development, and is associated with high levels of psychiatric comorbidity, poor insight, psychiatric treatment refusal, and suicidality (Albertini & Phillips, 1999; Rautio et al., 2022).

Cognitive behaviour therapy (CBT) is the first-line treatment for both adolescents and adults with BDD (Harrison et al., 2016; NICE, 2005), although the evidence supporting its efficacy in young people is very scarce, originating from a case series (*n*=6) (Krebs et al., 2012), an open trial (*n*=13) (Greenberg et al., 2016), and a randomised controlled trial (RCT) (*n*=30) (Mataix-Cols et al., 2015). The benefit of CBT for adolescent BDD seems durable at least up to one year after treatment (Krebs et al., 2017). Nonetheless, the outcomes are modest. Only about 40% of the patients were classified as responders in the only paediatric RCT to date (50% at the 12-month follow-up) (Krebs et al., 2017; Mataix-Cols et al., 2015). One strategy to improve outcomes is to combine CBT with selective serotonin reuptake inhibitors (SSRIs), which has some empirical support in adult BDD (Phillips et al., 2016), but no paediatric studies are available. There is also a paucity of data from clinical settings. Naturalistic studies are important to evaluate to what extent results of clinical trials translate into 'real life' settings.

It would also be clinically useful to be able to identify individuals who may not respond to initial evidence-based treatment, in order to guide clinical decisions. At present, there are no reliable clinical predictors of outcome in adolescent BDD (Harrison et al., 2016; Krebs et al., 2017). In adult BDD, previous research on potential predictors of treatment outcome is also limited to only a handful of studies (Harrison et al., 2016). These studies have identified several variables as predictors of better outcome (including greater working alliance, treatment credibility, expectancy of improvement, and presence of obsessive-compulsive personality disorder) or worse outcome (including use of serotonin reuptake inhibitors [SRI] at baseline, poorer BDD-related insight, longer duration of BDD, and greater BDD and depression symptom severity). Unfortunately, none of these findings have been consistently replicated (Flygare et al., 2020; Greenberg et al., 2019; Phillips et al., 2021; Phillips et al., 2013).

We analysed data from a uniquely large sample of youths with BDD (Rautio et al., 2022) treated at two specialist clinics with an updated version of the CBT treatment manual used in Mataix-Cols et al. (2015), but also medicated at the discretion of the respective multidisciplinary teams. Our aims were to evaluate the short- and long-term (1-year) clinical outcomes of these young people with BDD, and to use the available data to explore potential predictors of treatment outcome. We hypothesised that manualized CBT, with or without concomitant SRI medication, would lead to a significant reduction in BDD symptoms and that the therapeutic gains would be maintained up to one year after treatment. Based on the limited literature on predictors of treatment outcome in BDD, we regarded this aim as exploratory.

METHODS

The Stockholm Regional Ethical Review Board and the South London and Maudsley Child and Adolescent Mental Health Service Audit Committee approved the study. In the

Stockholm site, informed consent was provided by all participants and their parents/legal guardians. In the London site, informed consent was not required because the study was part of an audit of routinely collected clinical data.

Settings and procedures

We have previously described the baseline characteristics of 172 children and adolescents with BDD (Rautio et al., 2022). Of these, 140 who had received treatment and had been assessed at least at one follow-up time point were included in the current study. The remaining 32 participants had been referred to other services (*n*=15), mainly because of administrative reasons, or had prematurely dropped out of treatment without providing any post-treatment or follow-up data (*n*=17) (**Figure 1**).

All participants had a primary diagnosis of BDD as per the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5; American Psychiatric Association, 2013). Participants had been referred to one of two national and specialist paediatric obsessive-compulsive and related disorders outpatient clinics, namely the OCD and Related Disorders Clinic for Children and Adolescents in Stockholm, Sweden (*n*=96) or the National and Specialist OCD, BDD, and Related Disorders Clinic for Young People at the Maudsley Hospital in London, England (*n*=44). The Stockholm clinic accepts all referrals from patients from the Stockholm region (and occasionally other parts of Sweden and the Nordic countries), regardless of symptom severity. By contrast, most patients referred to the London clinic tend to be complex cases that have often already received care in regular child and adolescent mental health services.

At both clinics, assessments consisted of a 3-hour assessment where participants completed a series of semi-structured and clinical interviews. In Stockholm, this included the

Mini International Neuropsychiatric Interview for Children (Sheehan et al., 1998), supplemented with additional modules for obsessive-compulsive and related disorders. In London, the Development and Well-Being Assessment (Goodman et al., 2000) was completed as a screening tool prior to the assessment. Interviews were administered by experienced clinical psychologists and assessments were discussed in a multidisciplinary team including child and adolescent psychiatrists.

Initial assessments were performed between January 2015 and January 2020. Follow-up data were collected until April 2021. All assessments and CBT sessions were generally face-to-face. However, for the period coinciding with the Covid-19 pandemic (i.e., from March 2020 to April 2021) sessions could be held via a secure video-application if needed, although this only affected a small number of sessions and assessments.

Measures

The following measures were administered at both sites at baseline, after completion of the CBT programme (post-treatment), and 3, 6, and 12 months post-treatment, unless otherwise specified.

The Yale-Brown Obsessive-Compulsive Scale Modified for BDD – Adolescent version (BDD-YBOCS-A) is a widely-used 12-item clinician-administered, semi-structured interview that rates BDD symptom severity during the past week (Phillips et al., 1997). The BDD-YBOCS-A contains 12 Likert-type items ranging from 0 to 4: five questions on obsessions, five on compulsions, one about insight, and one to measure avoidance behavior. The total BDD severity score ranges from 0 to 48, higher scores denoting higher symptom severity. The adult version is nearly identical to the adolescent version and has good shown excellent interrater and test-rest reliability, high internal consistency, good sensitivity to change and good convergent and discriminant validity (Phillips et al., 2014).

The Appearance Anxiety Inventory (AAI) is a self-reported measure that assesses typical BDD-related cognitive processes and behaviours. It consists of 10 items scored on a 0-4 Likert scale, yielding a total score ranging from 0 to 40, higher scores denoting higher symptom severity. It includes two subscales: avoidance and threat monitoring. It has good convergent validity, high internal consistency, and correlates well with the clinician-administered BDD-YBOCS (Veale et al., 2014).

Self-reported depressive symptoms were assessed by means of different measures. In Stockholm, the Children's Depression Inventory–Short Version (CDI–S), a 10-item instrument, was first used and then replaced by the Short Mood and Feeling Questionnaire, child version (SMFQ-C), a 13-item measure. During the whole time period, the Stockholm site also used the 13-item parent-reported version of the SMFQ (SMFQ-P). In the London site, the Mood and Feeling Questionnaire, child version (MFQ-C), a 33-item measure, was used throughout the whole inclusion period and no parent-reported measures were applied. A *z*-transformation was done to standardise scores from the different depression measures for analyses. All measures of depressive symptoms have shown good psychometric properties, including satisfying to good internal consistency as well as good convergent, concurrent and criterion validity and sensitivity to change (Allgaier et al., 2012; Burleson Daviss et al., 2006; Rhew et al., 2010; Thabrew et al., 2018).

In Stockholm only, the self-reported Work and Social Adjustment Scale–Youth (WSAS-Y) and Parent (WSAS-P) versions were used to assess functional impairment in five areas (i.e., school/work, daily situations, social activities, leisure activities, and relationships) as a result of the participants' BDD symptoms. Total scores range from 0 to 40, higher scores denoting more impairment. The instruments have demonstrated excellent psychometric properties, with high internal consistency, good convergent and divergent validity, and sensitivity to change (Jassi et al., 2020).

The Children's Global Assessment Scale (CGAS) is a clinician-rated measure of global functioning that comprises one item (ranging from 1 to 100; higher scores indicate better functioning). The CGAS has shown high reliability as well as discriminant and concurrent validity (Shaffer et al., 1983).

Treatment

The CBT protocol was an expansion of the manual developed for the Mataix-Cols et al. (2015) RCT. The updated version involves 20 sessions as standard, rather than the initial 14. This is because the RCT concluded that a considerable proportion of youth with BDD may require more than 14 sessions to achieve symptom relief. The developmentally tailored protocol is heavily based on exposure with response prevention (ERP) techniques. The protocol includes varying degrees of parental/carer involvement, depending on the case formulation. Sessions 1 to 2-3 focus on psychoeducation about BDD and anxiety, perception, self-focused attention, and on developing an ERP hierarchy; sessions 3-4 to 18 primarily focus on graded ERP (both therapist-assisted *in vivo* ERP and as between-session assignments); and sessions 19-20 include strategies for relapse prevention and maintenance of gains. The original manual also included optional modules (e.g., mirror retraining, attention retraining) (Mataix-Cols et al., 2015) whereas the updated version of the manual also included additional modules on self-focused attention and motivational interviewing approaches to address ambivalence towards treatment.

Typically, sessions last approximately one hour and are usually conducted weekly. However, as this is a naturalistic study, the multidisciplinary teams had the possibility to flexibly offer enhanced treatment options to patients who needed them, such as longer therapy sessions, home visits, and/or an extended treatment duration (i.e., more than 25 sessions). These clinical decisions were often made mid-treatment, based on the patient's

initial response to treatment and the clinic's available resources. At both sites, CBT was delivered by clinical psychologists with extensive experience in the treatment of BDD or by clinical psychology trainees under close supervision.

Participants could also receive pharmacological treatment for their BDD and other comorbid symptoms/disorders, which was prescribed (or modified after the intake assessment or during treatment) by experienced child and adolescent psychiatrists at the respective clinics, according to treatment guidelines (BUP Stockholm, 2021; NICE, 2005) and clinical judgement.

After finishing the CBT programme, all participants were offered three follow-up appointments (3, 6, and 12 months after treatment) to measure symptom severity and assess the potential need for additional treatment. If deemed necessary (e.g., insufficient response), participants were offered booster sessions. These booster sessions were most commonly weekly one-hour sessions, but some patients received more intensive approaches similar to those described above.

Statistical analyses

Mixed-effects regression models for repeated measures with maximum likelihood estimation of parameters were implemented. All models included fixed effects of time and a random intercept for each subject. To address the main treatment effects, the first model included the baseline and post-treatment time points. To evaluate the effect of treatment site and medication for BDD, two further models including a time by site interaction and a time by medication interaction were also fitted. Further, we fitted a model which only included participants receiving CBT, but no medication.

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To investigate treatment durability, a model was fitted including the post-treatment, 3-, 6-, and 12-month follow-up time points. Lastly, a model including all five time points (baseline to 12-month follow-up) was fitted for graphical representation purposes.

Bootstrapped within-group effect sizes (Cohen, 1988) derived from the mixed-effects regression models were calculated. Treatment response was defined as a reduction ≥30% on the BDD-YBOCS-A from baseline, while full or partial remission was defined as a total score ≤16 on the BDD-YBOCS (Fernández de la Cruz et al., 2019).

Linear regression models were used to identify significant baseline predictors of BDD-YBOCS-A scores at post-treatment and at the 12-month follow-up. These analyses followed a two-step procedure where each predictor was first evaluated separately in a univariate model, and predictors that achieved a level of significance $p<.05$ were included together in a multiple regression model. Only participants with BDD-YBOCS-A scores at post-treatment (n=135) and at the 12-month follow-up (n=101) were included in the analyses at these respective time points. Values for predictor variables with missingness between 0.71% and 20% were imputed. Variables with more than 20% missingness or a variance of less than 5% were not included as predictors. Multicollinearity was measured by variance inflation factors (VIF) and values of tolerance. A VIF value exceeding 2.5 or value of tolerance below 0.4 would indicate multicollinearity (Johnston et al., 2017).

Alpha levels (two-tailed) were set to $p<.05$. All analyses were performed using Stata 15.1 (StataCorp LLC), except for the imputation for the linear regression models which was performed in R 4.0.5 (R Core Team, 2021) using the missForest package (Stekhoven & Bühlmann, 2012).

RESULTS

Participant and treatment characteristics

Participant characteristics, for the whole cohort and by study site, are presented in **Supplementary Tables 1** and **2**. In sum, the majority of participants were girls (*n*=111, 79.3%), the mean age at intake was 15.6 (SD=1.4, range 10-18), and the self-reported age of BDD onset was 12.7 (SD=2.3, range 4-17). A total of 98 (70.0%) adolescents met diagnostic criteria for at least one additional psychiatric disorder, most commonly major depressive disorder (*n*=65, 46.4%).

There were some site differences at baseline, which we have documented previously (Rautio et al., 2022). Briefly, a significantly higher percentage of boys were seen in the London clinic (31.8% vs. 11.4%; χ^2=7.83, p=0.005). The Stockholm clinic had a significantly higher proportion of participants with attention-deficit/hyperactivity disorder (14.6% vs. 2.3%; χ^2=4.78, p=0.029), while the London clinic had a higher proportion of patients who had a history of suicide attempts (25.7% vs. 5.2%; χ^2=11.30, p=0.001).

Figure 1 shows the study participants' flow. The median number of CBT sessions received was 15 (mean=17.2, SD=10.4, range 2-80) (**Supplementary Figure 1**). Only the Stockholm site reported on missing sessions (i.e., sessions that were scheduled but not attended). Only 15 (15.6%) of the participants attended all planned sessions, 22 (22.9%) missed between 1 and 2 sessions, and 59 (61.5%) missed 3 or more sessions. Of the participants who missed at least one session, the median number of missed sessions was 5 (mean=5.5, SD=4.6, range 1-28). A total of 37 participants (26%) from both clinics received some kind of enhanced treatment at some point during the duration of the CBT, consisting of sessions longer than one hour (*n*=12), home visits (*n*=14) or extra sessions (*n*=14). **Supplementary Table 3** shows the baseline differences between those who received vs. those that did not receive enhanced treatment. Because the vast majority (34 out of 37; 91.9%) of participants receiving enhanced treatment were from the Stockholm clinic, these calculations

were only done at the Stockholm site. In general, the participants receiving enhanced treatment tended to be more severe and complex cases.

During the one-year follow-up, 34 participants (33.7%) received one or more booster-sessions. Among those who received booster sessions, the median number of booster sessions was 11 (mean=11.3, SD=9.4, range 1-30). Of the 34 participants who received booster-sessions, 31 (91.2%) were from the Stockholm clinic. Site differences regarding enhanced treatment and booster sessions can be attributed to administrative differences between the clinics, rather than clinical characteristics, with the Stockholm clinic being more flexible to offer intensive approaches.

Ninety-seven participants (72.4%) received medication for their BDD at some point during treatment. Of those, 86 (68.8%) received treatment with an SSRI and 14 (11.2%) with an antipsychotic drug. In 10 of these 14 cases, the antipsychotic was prescribed as an SSRI augmentation strategy, and as monotherapy in the other 4 cases. Furthermore, 32 patients (25.6%) were on melatonin, 20 (16%) on antihistamines, and 9 (7.2%) on stimulant ADHD medication. The vast majority of the participants (*n*=86/114; 75.4%), received medication for their BDD at some point during the follow-up year. At the final time-point (12-month follow-up), 59.6% (*n*=56/94) of participants were on medication for their BDD. Compared to the participants from the Stockholm site, a significantly higher proportion of the participants from the London site received medication during treatment (*n*=62, 65.3% vs. *n*=35, 89.7%, respectively; χ^2=8.29, p=.004).

Treatment outcomes at post-treatment

Raw means and standard deviations for all measures at each time point are shown in **Supplementary Table 4**. A mixed-effects regression analysis showed a significant reduction on the BDD-YBOCS-A from baseline to post-treatment (coefficient [95% confidence

interval]=-16.33 [-17.90 to -14.76], p<0.001) (**Table 1**). In separate models, there were no significant time by site interaction effects (3.14 [-0.26 to 6.54], p=0.070) or time by BDD medication interaction (-2.43 [-6.02 to 1.16], p=0.185) effects. Therefore, these variables were dropped from all subsequent models. A mixed-effects regression analysis including only the participants receiving CBT alone (n=37) showed a significant reduction on the BDD-YBOCS-A, similar to that in the main model (-14.80 [-17.31 to -12.29], p<0.001).

The within-group effect size (Cohen's d) for the BDD-YBOCS-A between pre- and post-treatment was 2.08 (95% confidence interval, 1.81 to 2.35) (**Table 1**). Furthermore, at post-treatment, 79.3% (n=107/135) of the participants were classified as treatment responders and 59.3% (n=80/135) as full or partial remitters.

The mixed-effects regression analyses at post-treatment showed a significant reduction on self-reported BDD symptoms, measured by the AAI, depressive symptoms, both in the z-transformed self-reported measures and in the parent-reported SMFQ-P, functional impairment, measured by the WSAS-Y and the WSAS-P, and global functioning, measured by the CGAS (**Table 1** and **Supplementary Figures 2-7**).

Treatment outcomes at follow-up

Mixed-effects regression analyses showed a significant further improvement between post-treatment and the 12-month follow-up on the BDD-YBOCS-A (-2.38 [-3.70 to -1.05], p<0.001) (**Table 2**). **Figure 2** depicts improvements on the clinician-rated BDD-YBOCS-A across the five measurement points.

Within-group effect sizes (Cohen's d) for the BDD-YBOCS-A between post-treatment and the subsequent follow-ups are shown in **Table 2**. The effect size at the 12-month follow-up, compared to post-treatment, was 0.23 (95% confidence interval, 0.06 to 0.40). At the 3-, 6-, and 12-month follow-up, 82.7% (n=86/104), 82.2% (n=88/107), and

82.2% (*n*=83/101) of the available participants, respectively, were classified as treatment responders and 63.8% (*n*=67/105), 71.3% (*n*=77/108), and 68.3% (*n*=69/101), respectively, were in full or partial remission.

There was a continued significant improvement between the post-treatment and the 12-month follow-up on the WSAS-Y, the WSAS-P, and the CGAS, and results were maintained for the AAI, the *z*-transformed self-reported depression scores, and the SMFQ-P (**Table 2** and **Supplementary Figures 2-7**).

Predictors of BDD symptom improvement

Thirty-five baseline variables (demographic and clinical characteristics and baseline scores in all measures) were used as predictors and were first evaluated in separate univariate models (**Supplementary Table 5**). Baseline variables that were excluded from the analysis due to missing data included 'previously medicated with SSRI' and 'number of missed sessions'. Baseline variables that were excluded from the analysis due to low variance included comorbid 'oppositional defiant disorder', 'borderline personality disorder', 'gender dysphoria', and 'tic disorder', as well as medicated with 'other antidepressants', 'bupropion', 'mirtazapine', 'buspirone', 'diazepam', and 'beta blockers'.

The 35 univariate regression analyses performed to predict BDD-YBOCS-A scores both at post-treatment and at the 12-month follow-up showed significant results for six and seven variables at each of those time points, respectively (**Table 3**). The variable 'SSRI medication' was excluded from both multivariate analysis as it correlated highly with the variable 'BDD medication' (*r*=.96). The multivariate regression performed for the prediction of BDD-YBOCS-A scores at post-treatment was statistically significant, with predictor variables together explaining 12% of the variance in outcome (adjusted R^2=0.12, F(6, 128)=4.09, p<0.000). However, only the BDD-YBOCS-A total score at baseline contributed

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significantly to the model (B=0.45, p=0.029). As for the 12-month follow-up results, the multivariate regression was statistically significant, with predictor variables together explaining 17% of the variance in outcome (adjusted R^2=0.17, F(7, 93)=4.02, p<0.000). None of the seven predictors contributed significantly to the model (**Table 3**). Both final multivariate regression models met assumptions of normality of residuals and homoscedasticity. In addition, values of tolerance and VIF were ≥ 0.40 and ≤ 2.5, respectively, indicating no multicollinearity.

DISCUSSION

This is the first formal evaluation of the short- and long-term effectiveness of CBT, with and without medication, for adolescents with BDD treated in specialist settings and the first to examine a large number of potential predictors of BDD symptom improvement in this population. Multimodal treatment delivered by highly specialised teams was associated with a significant reduction of BDD symptoms, with a large within-group effect size (d=2.08). The number of participants classified as responders at post-treatment was 79%, and the number of full or partial remitters was 59%. Large improvements were also observed on depressive symptoms, global functioning, and impairment. Analyses focusing on a small sub-cohort of unmedicated patients revealed very similar results. The gains were not only maintained at 1-year post-treatment, but BDD symptom severity and global functioning continued to improve throughout the follow-up.

The effect sizes in the current study were larger than those of the only RCT on paediatric BDD (BDD-YBOCS-A within-group effect size post-treatment in the CBT arm: d=1.47) (Mataix-Cols et al., 2015). However, the different designs of these two studies call for cautious comparison. Further, the participants in the RCT were slightly more severe on average. More importantly, the current study used a treatment protocol which was

substantially updated both in content and duration, and the treatment delivery was much more flexible than that allowed in an RCT. For example, about a quarter of the patients in the current study received some kind of enhanced treatment (e.g., longer sessions, home visits). Concurrent interventions were also allowed, with the vast majority of participants (72%) being on medication for their BDD at some point during CBT and/or the follow-up. Importantly, 61.5% of the participants at the Stockholm site missed 3 or more sessions (data were not available for the London site), which reflects the difficulty to engage this patient group in treatment, and the need for clinicians to be flexible and to reschedule missed sessions when needed, which may not always be allowed in an RCT. Additionally, about one third of the participants in the current study received booster sessions during the follow-up. Our results thus confirm that BDD is a complex mental disorder which requires specialist, flexible, and multidisciplinary input.

While we found evidence that more severe BDD symptoms at intake predicted poorer outcomes at post-treatment, this result did not extend to the 12-month follow-up. Two studies in adults with BDD also found that BDD symptom severity predicted poorer outcome (Flygare et al., 2020; Phillips et al., 2013). On the other hand, we were not able to replicate other predictors inconsistently reported in literature, including depressive symptoms, BDD-related insight, BDD duration, and SRI use (Flygare et al., 2020; Greenberg et al., 2019; Phillips et al., 2021; Phillips et al., 2013). This suggests that, even when using a large sample like ours, it is currently difficult to accurately predict who will benefit from treatment. Perhaps large samples encompassing less variability than ours, as well as new methods of analysis, such as data-driven machine learning algorithms, may be of help to improve treatment prediction in the future. For the time being, we suggest that CBT (and SSRI medication, if required) should continue to be offered to all young people with BDD, irrespective of their baseline characteristics. Further understanding of who is more likely to

benefit from monotherapy vs. combined treatment, as well as how treatment characteristics (e.g., length, intensity, homework compliance, parental involvement) impact outcome is also relevant. To increase access to treatment, future research should investigate feasible ways to disseminate evidence-based interventions (e.g., using digital health interventions). Finally, more effective ways to train a larger number of professionals in the delivery of specialised treatment for BDD is warranted.

This study had some limitations. Because of the lack of a control group, we cannot conclude that the observed improvements were exclusively due to the evaluated multimodal treatment. However, we know that minimal or no improvements are to be expected without treatment (Harrison et al., 2016). The data used in the study were collected over a period of more than six years, which likely resulted in some heterogeneity in the data collection and data loss in different parts of the process. For example, some of the assessments took place during the Covid-19 pandemic and were done digitally. Further, the exploratory nature of the predictor analysis and the relatively small sample size limited its statistical power and may be a reason for the inconclusive results. Finally, our results may not generalise to non-specialist clinics.

CONCLUSIONS

Multimodal treatment for adolescent BDD is effective and has durable effects when provided flexibly within a specialist setting. Considering the high personal and societal costs of BDD, specialist care should be made more widely available.

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Data statement:

Daniel Rautio and Martina Gumpert had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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Table 1. Model estimates for all measures from baseline to post-treatment from the linear mixed-effect models.

Measure	M (SE)[a]	Within-group difference Coefficient (95% CI)	Within-group effect size Cohen's *d* (95% CI)[b]
BDD-YBOCS-A			
Baseline (*n*=139)	31.63 (.66)		
Post (*n*=135)	15.30 (.67)	-16.33 (-17.90, -14.76) ***	2.08 (1.81, 2.35)
AAI			
Baseline (*n*=112)	27.50 (.82)		
Post (*n*=87)	13.82 (.92)	-13.67 (-15.75, -11.60) ***	1.54 (1.24, 1.84)
MFQ-C/SMFQ-C/CDI-S[c]			
Baseline (*n*=114)	0.35 (.09)		
Post (*n*=83)	-.43 (.10)	-.78 (-.98, -0.58) ***	.85 (.59, 1.12)
SMFQ-P[d]			
Baseline (*n*=89)	14.63 (.62)		
Post (*n*=69)	8.35 (.69)	-6.28 (-7.70, -4.86) ***	1.06 (.75, 1.37)
WSAS-Y[d]			
Baseline (*n*=89)	21.66 (.69)		
Post (*n*=69)	11.36 (.78)	-10.30 (-12.10, -8.51) ***	1.58 (1.23, 1.94)
WSAS-P[d]			
Baseline (*n*=88)	21.77 (.76)		
Post (*n*=70)	13.57 (.85)	-8.20 (-10.20, -6.20) ***	1.14 (.82, 1.46)
CGAS			
Baseline (*n*=135)	44.11 (.76)		
Post (*n*=123)	57.35 (.79)	13.24 (11.43, 15.04) ***	-1.51 (-1.71, -1.30)

* $p<0.5$; ** $p<0.01$; *** $p<.001$

Note: [a] Estimated means and standard errors from the mixed-effects regression model; [b] Bootstrapped effect sizes (*d*) are derived from the mixed-effects regression model; [c] Results from the MFQ-C, the SMFQ-C, and the CDI-S were transformed into *z*-scores for analysis; [d] Only data from the Stockholm site.

Abbreviations: BDD, body dysmorphic disorder; AAI, Appearance Anxiety Inventory; BDD-YBOCS-A, Yale-Brown Obsessive-Compulsive Scale, modified for BDD – Adolescent version; CDI-S, Children's Depression Inventory – Short Version; CGAS, Children´s Global Assessment Scale; SMFQ-C, Short Mood and Feeling Questionnaire, Child Version; SMFQ-P, Short Mood and Feeling Questionnaire, Parent Version; MFQ-C, Mood and Feeling Questionnaire, Child Version; WSAS-Y, Work, Social and Adjustment Scale–Youth Version; WSAS-P, Work, Social and Adjustment Scale – Parent Version; M, mean; SD, standard deviation; CI, confidence interval.

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Table 2. Model estimates for all measures from post-treatment to the 12-month follow up from the linear mixed-effect models.

Measure	M (SE)[a]	Within-group difference[b] Coefficient (95% CI)	Within-group effect size Cohen's *d* (95% CI)[c]
BDD-YBOCS-A			
Post (*n*=135)	15.70 (.89)		
3FU (*n*=105)	13.91 (.93)	-1.80 (-3.10, -.49) **	.19 (.08, .29)
6FU (*n*=108)	13.43 (.93)	-2.27 (-3.57, -.98) **	.23 (.10, .36)
12FU (*n*=101)	13.33 (.94)	-2.38 (-3.70, -1.05) ***	.23 (.06 to .40)
AAI			
Post (*n*=87)	14.18 (.93)		
3FU (*n*=63)	13.46 (1.01)	-0.72 (-2.47, 1.03)	.05 (-0.12, .22)
6FU (*n*=65)	12.41 (1.01)	-1.77 (-3.51, -0.03) *	0.21 (.01, .40)
12FU (*n*=50)	13.15 (1.09)	-1.03 (-2.98, .91)	.20 (-.15, .54)
MFQ-C/SMFQ-C/CDI-S[d]			
Post (*n*=83)	.11 (.10)		
3FU (*n*=61)	-.06 (.11)	-.17 (-.38, .04)	0.17 (-.04, .34)
6FU (*n*=65)	-.09 (.11)	-.20 (-.41, .00)	.17 (-.03, .39)
12FU (*n*=46)	-.07 (.12)	-0.18 (-.41, .57)	0.15 (-.14, .45)
SMFQ-P[e]			
Post (*n*=69)	8.56 (.72)		
3FU (*n*=49)	7.48 (.82)	-1.08 (-2.76, .60)	.16 (-.10, .41)
6FU (*n*=46)	8.70 (.84)	.15 (-1.56, 1.85)	-.04 (-.33, .25)
12FU (*n*=36)	9.29 (.93)	.74 (-1.14, 2.61)	-.15 (-.57, .27)
WSAS-Y[e]			
Post (*n*=69)	11.54 (.80)		
3FU (*n*=48)	10.00 (.93)	-1.54 (-3.49, .41)	.22 (-.07, .50)
6FU (*n*=51)	7.87 (.91)	-3.67 (-5.59, -1.74) ***	.56 (.25, .86)
12FU (*n*=39)	7.27 (1.01)	-4.27 (-6.37, -2.17) ***	.70 (.31, 1.09)
WSAS-P[e]			
Post (*n*=70)	13.38 (.93)		
3FU (*n*=49)	12.76 (1.06)	-.63 (-2.81, 1.56)	.10 (-.14, .34)
6FU (*n*=46)	11.37 (1.09)	-2.01 (-4.23, .21)	.24 (-.07, .55)
12FU (*n*=37)	9.76 (1.19)	-3.62 (-6.01, -1.23) **	.48 (.02, .97)
CGAS			
Post (*n*=123)	57.17 (.95)		
3FU (*n*=98)	60.18 (1.04)	3.01 (.97, 5.05) **	-.26 (-.50, -.04)
6FU (*n*=100)	60.11 (1.03)	2.93 (.90, 4.97) **	-.25 (-.50, -.00)
12FU (*n*=92)	60.75 (1.07)	3.58 (1.49, 5.66) **	-.33 (-.62, -.04)

* $p<0.5$; ** $p<0.01$; *** $p<.001$

Note: [a] Estimated means and standard errors from the mixed-effects regression model; [b] Coefficients at the 3-month, 6-month, and 12-month follow-up compare with the post-treatment time point; [c] Bootstrapped effect sizes (*d*) are derived from the mixed-effects regression model; [d] Results from the MFQ-C, the SMFQ-C, and the CDI-S were transformed into *z*-scores for analysis; [e] Only data from the Stockholm site.

Abbreviations: BDD, body dysmorphic disorder; AAI, Appearance Anxiety Inventory; BDD-YBOCS-A, Yale-Brown Obsessive-Compulsive Scale, modified for BDD–adolescent version; CDI-S, Children's Depression Inventory – Short Version; CGAS, Children´s Global Assessment Scale; SMFQ-C, Short Mood and Feeling Questionnaire, Child Version; SMFQ-P, Short Mood and Feeling Questionnaire, Parent Version; MFQ-C, Mood and Feeling Questionnaire, Child Version; WSAS-Y, Work, Social and Adjustment Scale – Youth Version; WSAS-P, Work, Social and Adjustment Scale – Parent Version; M, mean; SD, standard deviation; CI, confidence interval.

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Table 3. Significant univariate linear regression predictors and multivariate linear regression predictors of BDD-YBOCS-A scores at post-treatment and at the 12-month follow-up.

	Post-treatment (*n*=135)							
	Univariate models				**Multivariate model**			
Baseline predictors	***B***[a]	***SE* (*B*)**	***t* (95%CI)**	***p***	***B***[a]	***SE* (*B*)**	***t* (95% CI)**	***p***
Age of BDD onset	-.72	.36	-2.02 (-1.43, -.01)	.046	-.60	.35	-1.76 (-1.29, .08)	.081
BDD medication[b]	3.68	1.67	2.21 (.39, 6.99)	.029	2.32	1.70	1.37 (-1.04, 5.70)	.174
SSRI medication	3.54	1.67	2.11 (.23, 6.85)	.036	-	-	-	
Desire for cosmetic procedure	3.34	1.67	2.00 (.03, 6.63)	.048	1.43	1.66	.87 (-1.84, 4.71)	.389
Severe to extreme avoidance due to BDD[c]	5.52	1.66	3.33 (2.25, 8.80)	.001	1.97	2.28	.86 (-2.54, 6.48)	.389
BDD-YBOCS-A	.60	.15	4.06 (.31, .89)	.000	.45	.20	2.22 (.05, .85) *	.028
CGAS	-.33	.11	-3.06 (-.54, -.12)	.003	.05	.15	.32 (-.25, .35)	.747
	12-month follow-up (*n*=101)							
	Univariate models				**Multivariate models**			
Baseline predictors	***B***[a]	***SE* (*B*)**	***t* (95% CI)**	***p***	***B***[a]	***SE* (*B*)**	***t* (95% CI)**	***p***
Family history of depression	4.64	2.11	2.21 (.48, 8.82)	.030	3.00	2.01	1.49 (-.99, 6.99)	.140
BDD medication[b]	5.89	2.07	2.83 (1.76, 10.01)	.006	3.94	2.08	1.90 (-.19, 8.06)	.061
SSRI medication	6.77	2.07	3.27 (2.66, 10.87)	.001	-	-	-	
Poor or absent insight/delusional beliefs[d]	5.80	2.08	2.84 (1.78, 10.02)	.005	1.65	2.29	.72 (-2.89, 6.20)	.472
Severe to extreme avoidance due to BDD[c]	5.52	1.66	3.33 (2.25, 8.80)	.003	1.91	2.72	.70 (-3.49, 7.32)	.483
BDD-YBOCS-A	.76	.19	4.01 (.39, 1.14)	.000	.43	.29	1.50 (-.14, .99)	.138
AAI	.29	.15	2.01 (.00, .58)	.048	.15	.14	1.08 (-.13, .43)	.284
CGAS	-.47	.13	-3.55 (-.73, -.21)	.001	-.03	.19	-.16 (-.40, .35)	.877

Note: [a]Negative correlations denote better treatment outcomes given that higher baseline level variables predicted greater reduction in symptoms; [b]Defined as receiving medication prescribed specifically for BDD; [c]Defined as 3 or 4 on the avoidance item of the BDD-YBOCS-A; [d]Defined as 3 or 4 on the insight item of the BDD-YBOCS-A.

Abbreviations: B, unstandardized beta; CI, confidence interval; SE, standard error; BDD, body dysmorphic disorder; SSRI, selective serotonin reuptake inhibitors; BDD-YBOCS-A, Yale-Brown Obsessive-Compulsive Scale, modified for BDD – Adolescent version; AAI, Appearance Anxiety Inventory; CGAS, Children´s Global Assessment Scale.

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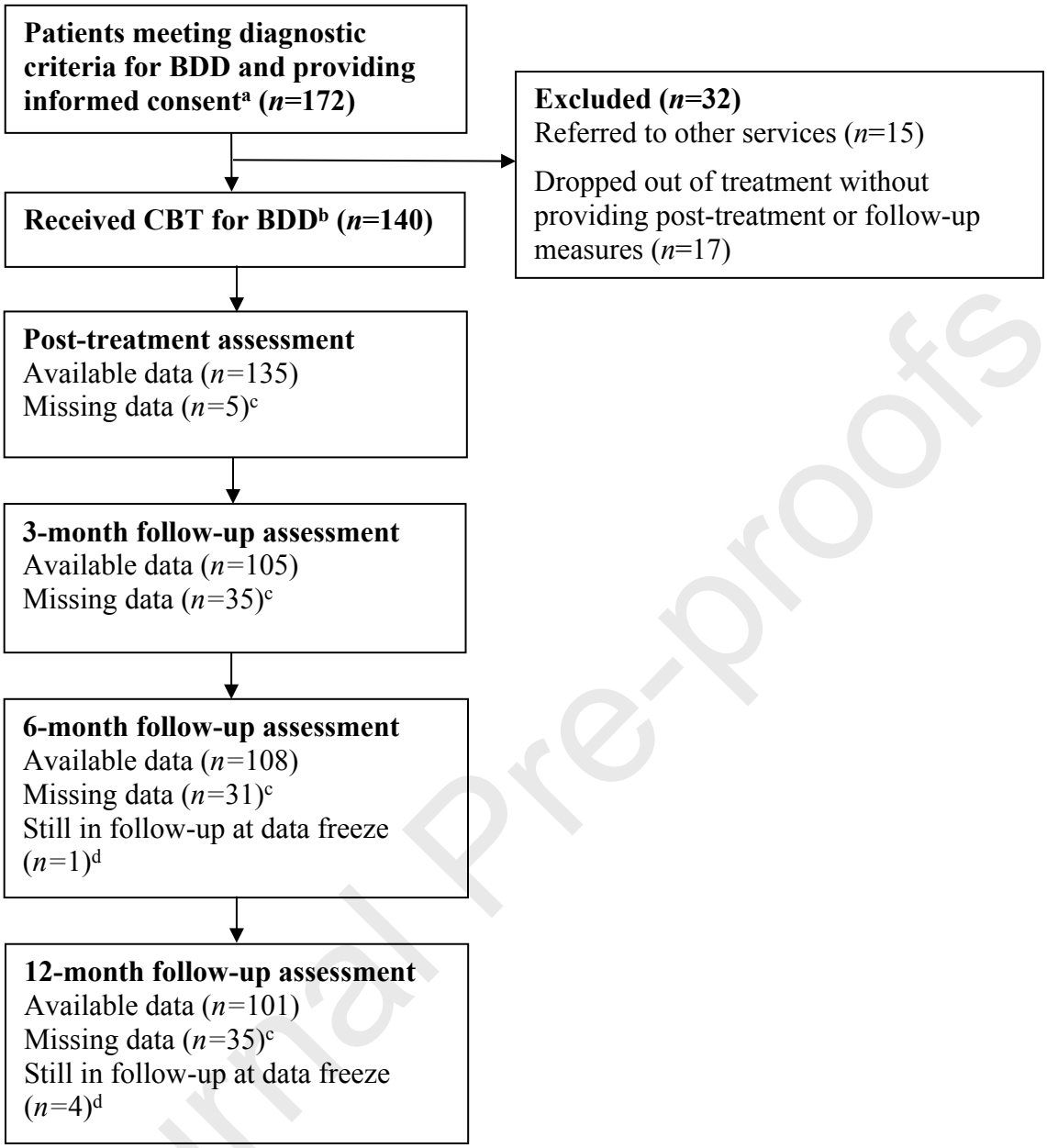

Note: [a] Informed consent was only required at the Stockholm site; [b] Participants were included if they provided a measure on the BDD-YBOCS-A on at least one of the time points after baseline; [c] Data were listed as missing if the BDD-YBOCS-A was missing at the specified time point; [d] Participants were still in follow-up at the time of the data freeze, hence they never reached this time point. *Abbreviations:* BDD, body dysmorphic disorder; CBT, cognitive behaviour therapy; BDD-YBOCS-A, Yale-Brown Obsessive-Compulsive Scale, modified for BDD – Adolescent version; SSRI, selective serotonin reuptake inhibitors.

Figure 1. Study participants' flow.

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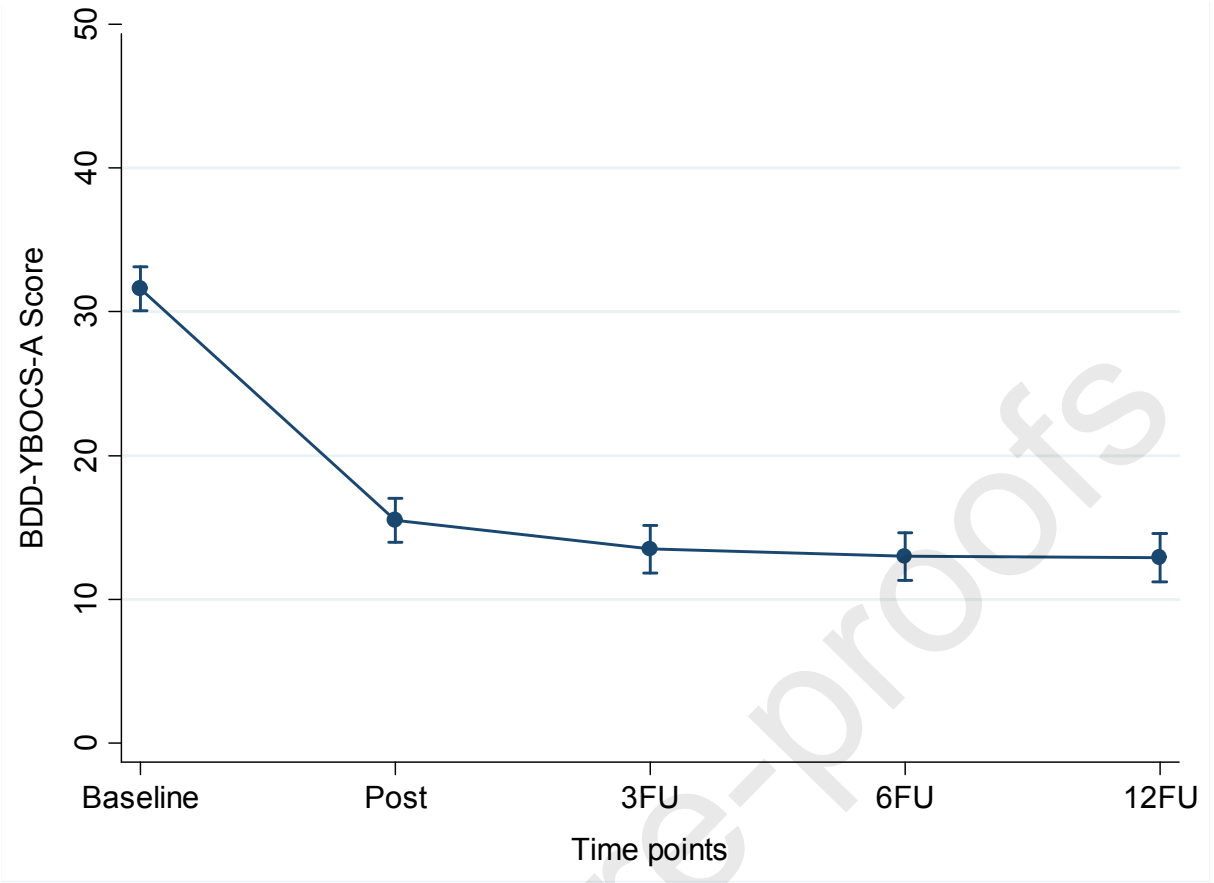

Note: Error bars indicate 95% confidence intervals. *Abbreviations:* BDD-YBOCS-A, Yale-Brown Obsessive-Compulsive Scale, modified for BDD – Adolescent version; 3FU, 3-month follow-up; 6FU, 6-month follow-up; 12FU, 12-month follow-up.

Figure 2. Estimated means on the BDD-YBOCS-A from a mixed-effects regression model including all five time points.

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Highlights

- The largest effectiveness study of young people with BDD to date
- CBT delivered flexibly, in combination with SSRIs, is effective for adolescent BDD
- Treatment gains were maintained up to one year after treatment
- BDD symptoms continued to improve throughout the follow-up
- No consistent baseline predictors of BDD treatment outcome were identified

Effectiveness of multimodal treatment for young people with body dysmorphic disorder in two specialist clinics
SUPPLEMENTARY MATERIAL

Table S1. Baseline demographic and clinical characteristics (*N*=140).

Ages (n)	**M**	**SD**
Age at assessment (136)	15.6	1.4
Age of BDD onset (136)	12.7	2.3
Number of preoccupations (140)	10.5	6.4
Clinical characteristics[a] (n)	***N***	**%**
Gender (140)		
Female	111	79.3
Male	25	17.8
Transgender	4	2.9
Any comorbid psychiatric disorder (140)	98	70.0
Depression	65	46.4
Anxiety disorders[b]	27	19.3
OCD	9	6.5
ADHD	15	10.7
ASD	20	14.3
Eating disorder	14	10.0
Family history (1st and 2nd degree relatives) of OCDRD (131)	41	31.3
Family history of depression (135)	77	57.0
Previous CBT for BDD (138)	16	11.6
Previous SSRI (44)[c]	13	29.6
On pharmacological treatment at baseline (140)	79	56.4
SSRI	65	46.4
Antipsychotics	9	6.4
Antihistamines	13	9.3
Melatonin	18	12.9
ADHD medication	9	6.4
Poor or absent insight/delusional beliefs (136)[d]	68	50.0
Severe to extreme avoidance due to BDD (139)[e]	57	41.0
Desire for cosmetic procedure (130)	68	52.3
Conducted cosmetic procedure (130)	11	8.5
Any suicidal or self-harm behaviour (131)	91	69.5
Past or current suicide thoughts	78	59.5
Past or current self-harm	69	52.6
History of suicide attempts	14	10.7
School attendance (138)		
Full attendance	43	31.2
Partial attendance	55	39.9

No attendance	40	29.0

Note: [a] Current, unless otherwise specified; [b] Includes social phobia, specific phobia, panic disorder or anxiety disorders not otherwise specified; [c] Only data from the London site; [d] Defined as 3 or 4 on the insight item of the Yale-Brown Obsessive-Compulsive Scale, modified for BDD–adolescent version (BDD-YBOCS-A); [e] Defined as 3 or 4 on the avoidance item of the BDD-YBOCS-A.
Abbreviations: BDD, body dysmorphic disorder; OCD; obsessive compulsive disorder; ADHD, attention-deficit/hyperactivity disorder; ASD, autism spectrum disorder; OCRD, obsessive-compulsive and related disorders; CBT, cognitive behaviour therapy; SSRI, Selective serotonin reuptake inhibitors; M, mean; SD, standard deviation.

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Table S2 Demographic and clinical characteristics of a sample of adolescents with body dysmorphic disorder, by site (*N*=140)

	Stockholm (*n*=96)		**London (*n*=44)**		**Statistics**	
Ages (n)	**M**	**SD**	**M**	**SD**	***t***	***p***
Age at assessment (140)	15.5	1.5	15.8	1.9	-1.30	0.197
Age of BDD onset (136)	12.8	1.9	12.7	3.1	0.08	0.937
Clinical characteristics[a] (n)	***N***	**%**	***N***	**%**	χ^2	***p***
Gender (140)					9.84	0.007**
Girls	81	84.4	30	68.2	7.83	0.028*
Boys	11	11.4	14	31.8	8.53	0.004**
Transgender	4	4.2	0	0	1.29	0.257
Any comorbid psychiatric disorder (140)	72	75.0	26	59.1	3.63	0.057
Depression	49	51.0	16	36.4	2.61	0.106
Anxiety disorders[b]	8	8.3	3	6.8	0.10	0.757
OCD	5	5.2	4	9.1	0.76	0.385
ADHD	14	14.6	1	2.3	4.78	0.029*

ASD	13	13.5	7	15.9	0.14	0.710
Eating disorder	7	7.3	6	13.6	1.44	0.230
Family history (1st and 2nd degree relatives) of OCDRD (131)	30	31.9	11	29.7	0.06	0.808
Family history of depression (135)	43	45.3	34	85.0	18.14	0.000**
Previous CBT for BDD (138)	9	9.6	7	15.9	1.17	0.279
On pharmacological treatment at baseline (140)	46	47.9	35	79.5	12.38	0.000**
SSRI	31	32.3	34	77.3	24.54	0.000**
Antipsychotics	5	5.2	4	9.1	0.76	0.385
Antihistamines	13	13.5	0	0	6.57	0.010*
Melatonin	17	17.7	1	2.3	6.42	0.011*
ADHD medication	9	9.4	0	0	4.41	0.036*
Poor or absent insight/delusional beliefs[c] (136)	44	46.3	24	58.5	1.71	0.191
Severe to extreme avoidance due to BDD (139)[d]	32	33.7	25	56.9	6.65	0.010*
Desire for cosmetic procedure (130)	43	45.3	25	71.4	7.02	0.008**
Conducted a cosmetic procedure (130)	7	7.4	4	11.4	0.54	0.461
Any suicidal or self-harm behavior (131)	66	68.8	25	71.4	0.09	0.768
Past or current suicide thoughts	53	55.2	25	71.4	2.80	0.094
Past or current self-harm	53	55.2	16	45.7	0.93	0.336
History of suicide attempts	5	5.2	9	25.7	11.30	0.001**
School attendance (138)					17.49	0.000**
Full attendance	24	25.3	19	44.2	4.94	0.026*
Partial attendance	49	51.6	6	14.0	17.48	0.000**
No attendance	22	23.2	18	41.9	5.03	0.025*
Enhanced treatment[e] (139)	34	35.8	3	6.8	12.92	0.000**
Longer sessions	12	12.6	0	0	6.08	0.014*
Home visits	14	14.7	0	0	7.21	0.007**
More than 25 sessions	11	11.6	3	6.8	0.75	0.386
Received booster sessions during follow-up (95)	31	43.1	3	13.4	6.83	0.009**
Received medication for BDD[f] **during CBT** (97)	62	65.3	35	89.7	8.29	0.004**
Received medication for BDD[f] **during follow-up** (86)	63	74.1	23	82.7	0.75	0.388

* Significant at 0.05; ** significant at 0.01

Note: [a] Current, unless otherwise specified; [b] Includes social phobia, specific phobia, panic disorder or anxiety disorders not otherwise specified; [c] Defined as 3 or 4 on the insight item of the BDD-YBOCS-A; [d] Defined as 3 or 4 on the avoidance item of the BDD-YBOCS-A; [e] Longer sessions, home visits, and/or an extended number of sessions (i.e., more than 25); [f] Defined as receiving medication prescribed specifically for BDD.

Abbreviations: BBD, body dysmorphic disorder; OCD; obsessive compulsive disorder; ADHD, attention-deficit/hyperactivity disorder; ASD, autism spectrum disorder; CBT, cognitive behavior therapy; OCRD, obsessive-compulsive and related disorder; SSRI, Selective serotonin reuptake inhibitors; M, mean; SD, standard deviation.

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Table S3 Demographic and clinical characteristics and baseline symptom severity of a sample of adolescents with body dysmorphic disorder from the Stockholm site, receiving standard vs. enhanced treatment[a] (*N*=95)

	Standard treatment (*n*=61)		**Enhanced treatment[a] (*n*=34)**		**Statistics**	
	M	**SD**	**M**	**SD**	***t***	***p***
Ages (n)						
Age at assessment (95)	15.4	1.5	15.6	1.5	-0.67	0.505
Age of BDD onset (93)	12.7	2.1	12.8	1.6	-0.18	0.572
Number of preoccupations (95)	10.1	6.3	11.5	6.5	-1.00	0.322
Clinical characteristics[b] (n)	***N***	**%**	***N***	**%**	χ^2	***p***
Gender (95)					2.33	0.311
Girls	50	82.0	30	88.2	0.65	0.422
Boys	7	11.5	4	11.8	0.00	0.966
Transgender	4	6.6	0	0	2.33	0.127
Any comorbid psychiatric disorder (95)	43	70.5	28	82.4	1.63	0.202
Depression	25	41.0	23	67.6	6.21	0.013*
Anxiety disorders[c]	6	9.8	2	5.9	0.44	0.506
OCD	5	8.2	0	0	2.94	0.086
ADHD	8	13.1	6	17.6	0.36	0.550
ASD	11	18.0	2	5.9	2.73	0.099
Eating disorder	5	8.2	2	5.9	0.17	0.679
Family history (1st and 2nd degree relatives) of OCDRD (93)	20	33.9	9	26.5	0.55	0.456
Family history of depression (95)	31	50.8	11	32.4	3.28	0.070
Previous CBT for BDD (93)	2	3.4	7	20.6	7.30	0.007**
On pharmacological treatment at baseline (95)	25	41.0	21	61.8	3.38	0.052
SSRI	15	24.6	16	47.1	5.01	0.025*
Antipsychotics	2	3.3	3	8.8	1.35	0.246
Antihistamines	8	13.1	5	14.7	0.05	0.829
Melatonin	11	18.0	6	17.6	0.00	0.962
ADHD medication	5	8.2	4	11.8	0.32	0.569
Poor or absent insight/delusional beliefs[d] (94)	21	35.0	23	67.6	9.29	0.002**
Severe to extreme avoidance due to BDD (95)[e]	14	23.0	18	52.9	8.47	0.004**
Desire for cosmetic procedure (94)	23	38.3	20	58.8	3.67	0.055
Conducted a cosmetic procedure (94)	5	8.3	2	5.9	0.19	0.664
Any suicidal or self-harm behavior (95)	39	63.9	27	79.4	2.47	0.116
Past or current suicide thoughts	29	47.5	24	70.6	4.70	0.030*
Past or current self-harm	30	49.2	23	67.6	3.02	0.082
History of suicide attempts	3	4.9	2	5.9	0.04	0.840
School attendance (94)					7.10	0.029*
Full attendance	20	33.3	3	8.8	7.05	0.008**
Partial attendance	28	46.7	21	61.8	1.98	0.159
No attendance	12	20.0	10	29.4	1.07	0.300
Baseline symptom severity (n)	**Mean**	**SD**	**Mean**	**SD**	***t***	***p***
BDD-YBOCS-A (94)	29.88	5.19	32.18	4.96	-2.12	0.038*
AAI (84)	26.63	8.17	29.40	5.14	-1.90	0.061
CDI-S/SMFQ-C[f] (85)	0.31	0.91	0.53	0.80	-1.13	0.263
SMFQ-P (88)	13.80	6.02	16.00	5.76	-1.71	0.092
WSAS-Y (88)	20.33	6.54	23.79	6.45	-2.42	0.018*

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WSAS-P (87)	19.80	7.27	25.00	6.07	-3.58	0.001**
CGAS (94)	47.53	6.03	43.12	7.08	3.06	0.003**
Received medication and/or booster sessions (n)	**Mean**	**SD**	**Mean**	**SD**	***t***	***p***
Received booster sessions during follow-up (71)	19	40.4	12	50.0	0.59	0.442
Received medication for BDD[g] during CBT (94)	36	60.0	26	76.5	2.62	0.105
Received medication for BDD[g] during follow-up (84)	40	74.1	23	76.7	0.07	0.739

* Significant at 0.05; ** significant at 0.01

Note: [a] Longer sessions, home visits, and/or an extended number of sessions (i.e., more than 25); [b] Current, unless otherwise specified; [c] Includes social phobia, specific phobia, panic disorder or anxiety disorders not otherwise specified; [d] Defined as 3 or 4 on the insight item of the BDD-YBOCS-A; [e] Defined as 3 or 4 on the avoidance item of the BDD-YBOCS-A.[f] Results from the SMFQ-C, and the CDI-S were transformed into z-scores for the analysis; [g] Defined as receiving medication prescribed specifically for BDD.

Abbreviations: BBD, body dysmorphic disorder; OCD; obsessive compulsive disorder; ADHD, attention-deficit/hyperactivity disorder; ASD, autism spectrum disorder; CBT, cognitive behavior therapy; OCRD, obsessive-compulsive and related disorder; AAI, Appearance Anxiety Inventory; BDD-YBOCS-A, Yale-Brown Obsessive-Compulsive Scale, modified for BDD – Adolescent version; CDI-S, Children's Depression Inventory – Short Version; CGAS, Children´s Global Assessment Scale; SMFQ-C, Short Mood and Feeling Questionnaire, Child Version; SMFQ-P, Short Mood and Feeling Questionnaire, Parent Version; WSAS-Y, Work, Social and Adjustment Scale – Youth Version; WSAS-P, Work, Social and Adjustment Scale – Parent Version; M, mean; SD, standard deviation.

Table S4. Raw means and standard deviations for all measures across time points.

Measures	**Baseline**		**Post-treatment**		**3-month follow-up**		**6-month follow-up**		**12-month follow-up**	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
BDD-YBOCS-A	31.63	5.48	15.30	9.73	12.86	9.79	12.33	10.00	12.21	10.77
AAI	27.42	8.46	13.85	9.00	13.89	9.68	12.28	8.18	12.04	9.54
CDI-S/SMFQ-C/MFQ-C[a]	0.34	0.89	-0.38	0.96						
CDI-S/SMFQ-C/MFQ-C[b]			0.13	1.00	-0.04	0.97	-0.04	0.96	-0.08	1.05
SMFQ-P[c]	14.63	5.95	8.57	5.90	7.29	5.30	8.37	6.38	9.74	6.66
WSAS-Y[c]	21.66	6.66	11.55	6.55	9.77	7.62	7.75	6.60	7.05	7.04
WSAS-P[c]	21.78	7.26	13.54	7.14	12.24	7.70	11.22	8.91	9.78	8.96
CGAS	44.13	7.71	57.47	10.00	60.29	9.57	60.06	10.57	60.98	12.46

Note.[a] Results from the MFQ-C, the SMFQ-C, and the CDI-S were transformed into *z*-scores for the pre-post-analysis; [b] Results from the MFQ-C the SMFQ-C and the CDI-S were transformed into z-scores for the post-12FU-analysis. [c] Only data from the Stockholm site.

Abbreviations: BDD, body dysmorphic disorder; AAI, Appearance Anxiety Inventory; BDD-YBOCS-A, Yale-Brown Obsessive-Compulsive Scale, modified for BDD – Adolescent version; CDI-S, Children's Depression Inventory – Short Version; CGAS, Children´s Global Assessment Scale; SMFQ-C, Short Mood and Feeling Questionnaire, Child Version; SMFQ-P, Short Mood and Feeling Questionnaire, Parent Version; MFQ-C, Mood and Feeling Questionnaire, Child Version; WSAS-Y, Work, Social and Adjustment Scale – Youth Version; WSAS-P, Work, Social and Adjustment Scale – Parent Version; M, mean; SD, standard deviation.

Table S5. Baseline predictors and univariate linear regression predictors of BDD-YBOCS-A scores at post-treatment and at 12-month follow-up.

Baseline predictors (*n*=140)				**Predictors of response at post-treatment (*n*=135)**				**Predictors of response at 12-month follow-up (*n*=101)**			
	M	**SD**	**Imputed *n* (%)[a]**	***B*[b]**	***SE (B)***	***t***	***p***	***B*[b]**	***SE (B)***	***t***	***p***
Age at assessment	15.57	1.43	0 (0)	.53	.60	.88	.378	1.41	.71	1.98	.05
Age of BDD onset	12.7	2.30	4 (2.86)	-.72	.36	-2.02	.046 *	-.01	.46	-.03	.974
Number of preoccupations	9.38	6.07	4 (2.86)	.06	.14	.46	.646	-.06	.18	-.31	.759
	N	**%**	**Imputed *n* (%)[a]**	***B*[b]**	***SE (B)***	***t***	***p***	***B*[b]**	***SE (B)***	***t***	***p***
Boy	25	17.86	0 (0)	.15	2.25	.07	.945	1.84	2.80	.66	.513
Any comorbid psychiatric disorder	98	70.00	0 (0)	-2.27	1.83	-1.24	.215	1.20	2.35	.51	.612
Depression	65	46.43		-.91	1.70	-.54	.593	3.80	2.12	1.79	.076
Anxiety disorders[c]	27	19.29		-2.64	2.14	-1.23	.219	-2.78	2.74	-1.02	.312
OCD	9	6.43		-2.32	3.58	-.65	.517	-2.53	3.98	-0.64	.526
ADHD	15	10.7		-1.39	2.69	-.52	.606	-2.17	3.45	-.63	.530
ASD	20	14.29		1.21	2.43	.50	.621	.09	3.12	.03	.977
Eating disorder	13	9.29		3.77	2.85	1.32	.188	-3.48	3.97	-.88	.383
Family history (1st and 2nd degree relatives) of OCRD	42	30.00	9 (6.43)	.37	1.85	.20	.841	-.44	2.41	-.18	.857
Family history of depression	79	56.43	5 (3.57)	1.81	1.70	1.06	.289	4.64	2.11	2.21	.030 *
Previous CBT for BDD	16	11.43	2 (1.43)	4.83	2.66	1.82	.072	4.24	3.09	1.37	.173
On pharmacological treatment at baseline	79	56.43	0 (0)	3.06	1.69	1.82	.071	3.14	2.13	1.47	.145
BDD medication[d]	68	48.57		3.68	1.67	2.21	.029 *	5.88	2.08	2.83	.006 **
SSRI	65	46.43		3.54	1.67	2.11	.036 *	6.76	2.07	3.27	.001 **
Antipsychotics	9	6.43		1.00	3.59	0.28	0.781	-4.37	3.75	-1.17	.247
Antihistamines	13	9.29		3.35	2.86	1.17	.243	-2.60	3.32	-.78	.435
Melatonin	18	12.86		.37	2.55	.15	.883	-1.93	3.48	-.56	.579
ADHD medication	9	6.43		2.15	3.39	.63	.527	-.84	4.24	-.20	.844
Poor or absent insight/delusional beliefs[e]	68	48.57	4 (2.86)	2.73	1.68	1.63	.106	5.90	2.08	2.84	.006 **

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Severe to extreme avoidance due to BDD[f]	57	41.71	1 (0.71)	5.52	1.66	3.33	.001 **	6.46	2.13	3.04	.003 *
Desire for cosmetic procedure	75	53.57	10 (7.14)	3.34	1.67	2.00	.048 *	4.17	2.11	1.98	.051
Conducted cosmetic procedure	11	7.86	10 (7.14)	-2.52	3.23	-0.78	.435	-.63	3.99	-.16	.874
Any suicidal or self-harm behaviour	100	71.43	9 (6.43)	2.07	1.87	1.11	.271	2.83	2.48	1.14	.257
Past or current suicide thoughts	87	62.14		1.87	1.74	1.07	.285	3.61	2.21	1.64	.105
Past or current self-harm	76	54.29		3.07	1.68	1.83	.070	2.22	2.17	1.03	.307
History of suicide attempts	15	10.71		3.26	2.76	1.18	.241	6.11	3.73	1.64	.104
School attendance			2 (1.43)								
No school attendance	41	29.29		1.77	1.88	.94	.347	4.67	2.39	1.96	.053
No or partial school attendance	97	69.29		3.09	1.81	1.71	.090	.93	2.26	.41	.682
	M	**SD**	**Imputed *n* (%)[a]**	***B*[b]**	***SE* (*B*)**	***t***	***p***	***B*[b]**	***SE* (*B*)**	***t***	***p***
BDD-YBOCS-A	31.62	5.46	1 (0.71)	.60	.15	4.06	.000 ***	.76	.19	4.01	.000 ***
AAI	27.52	7.69	28 (20.00)	.13	.11	1.17	.244	.29	.15	2.01	.048 *
MFQ-C/SMFQ-C/CDI-S[g]	.37	.82	26 (18.57)	1.07	1.02	1.04	.298	1.79	1.33	1.34	.184
CGAS	44.09	7.6	5 (3.57)	-.33	0.11	-3.06	.003 **	-.47	0.13	-3.55	.001 **

* p<0.05; ** p<0.01; *** p<0.001.

Note: [a] Frequency of percentage of missing data that has been imputed; [b] Negative correlations denote better treatment outcomes given that higher baseline level variables predicted greater reduction in symptoms; [c] Includes social phobia, specific phobia, panic disorder or anxiety disorders not otherwise specified; [d] Defined as receiving medication prescribed specifically for BDD; [e] Defined as 3 or 4 on the insight item of the BDD-YBOCS-A; [f] Defined as 3 or 4 on the avoidance item of the BDD-YBOCS-A; [g] Results from the MFQ-C, the SMFQ-C, and the CDI-S were transformed into z-scores for the analysis.

Abbreviations: M, mean; B, unstandardized beta; SE, standard error; BDD, body dysmorphic disorder; OCD; obsessive compulsive disorder; ADHD, attention-deficit/hyperactivity disorder; ASD, autism spectrum disorder; OCRD, obsessive-compulsive and related disorders; CBT, cognitive behaviour therapy; SSRI, Selective serotonin reuptake inhibitors; BDD-YBOCS-A, Yale-Brown Obsessive-Compulsive Scale, modified for BDD – Adolescent version; AAI, Appearance Anxiety Inventory; MFQ-C, Mood and Feeling Questionnaire, Child Version; SMFQ-C, Short Mood and Feeling Questionnaire, Child Version; CDI-S, Children's Depression Inventory – Short Version; CGAS, Children´s Global Assessment Scale.

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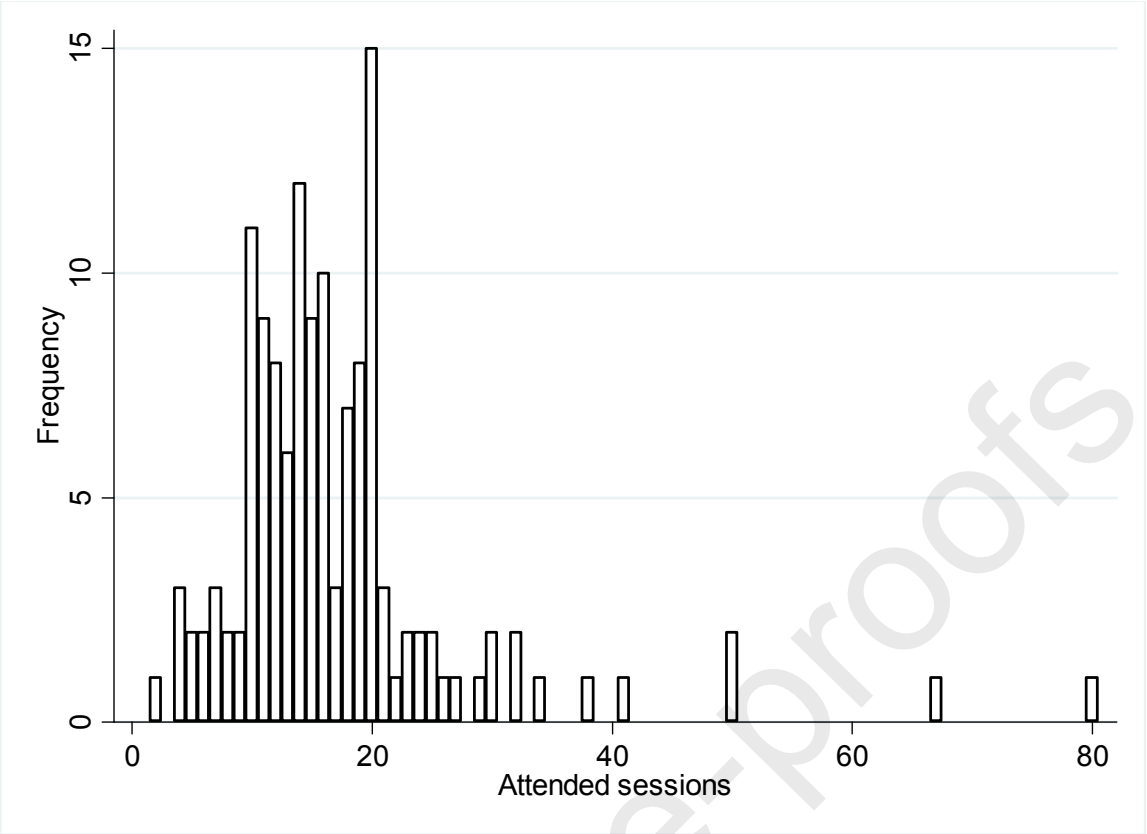

Figure S1. Histogram depicting the distribution of number of attended CBT sessions between assessment and post-treatment (*n*=137).

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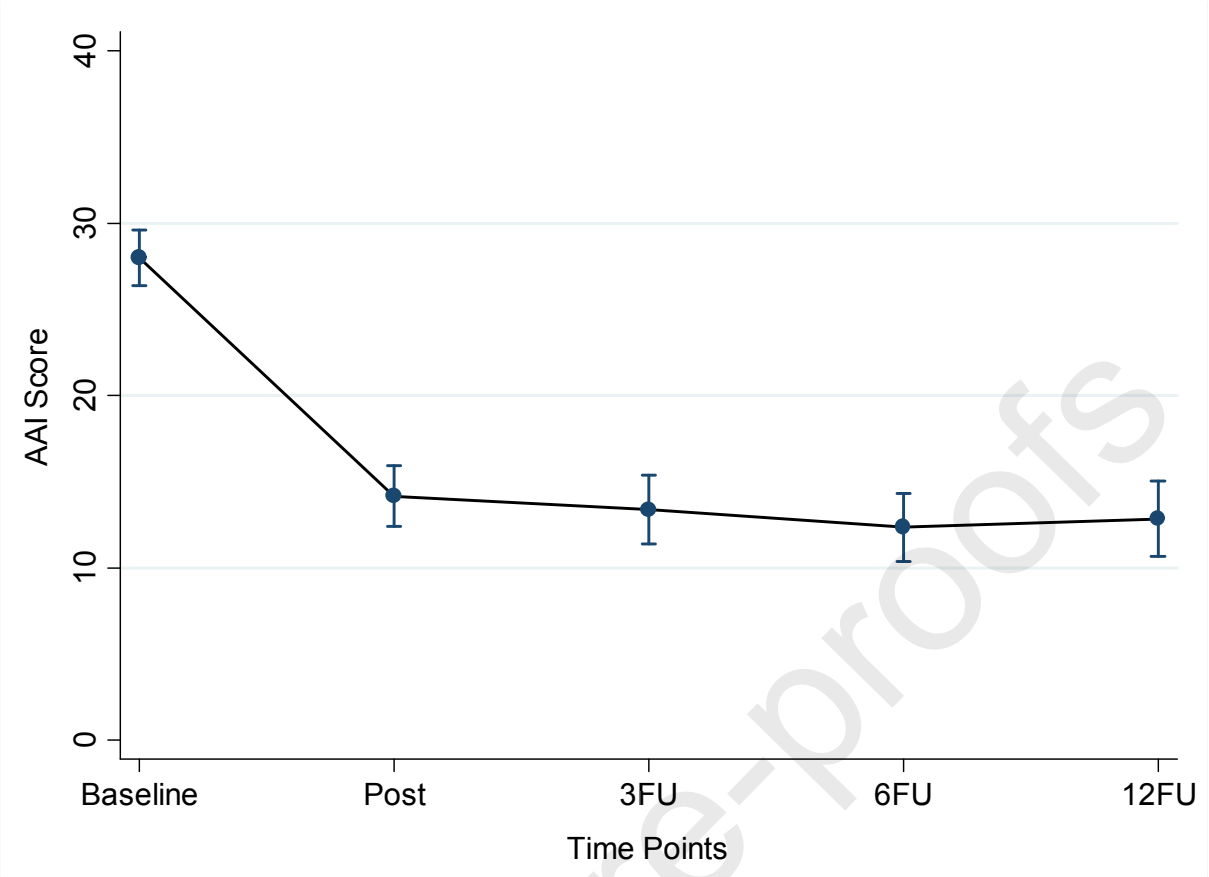

Note: Error bars indicate 95% confidence intervals. *Abbreviations:* AAI, Appearance Anxiety Inventory; 3FU, 3-month follow-up; 6FU, 6-month follow-up; 12FU, 12-month follow-up.

Figure S2. Estimated means on the AAI from a mixed-effects regression model including all five time points.

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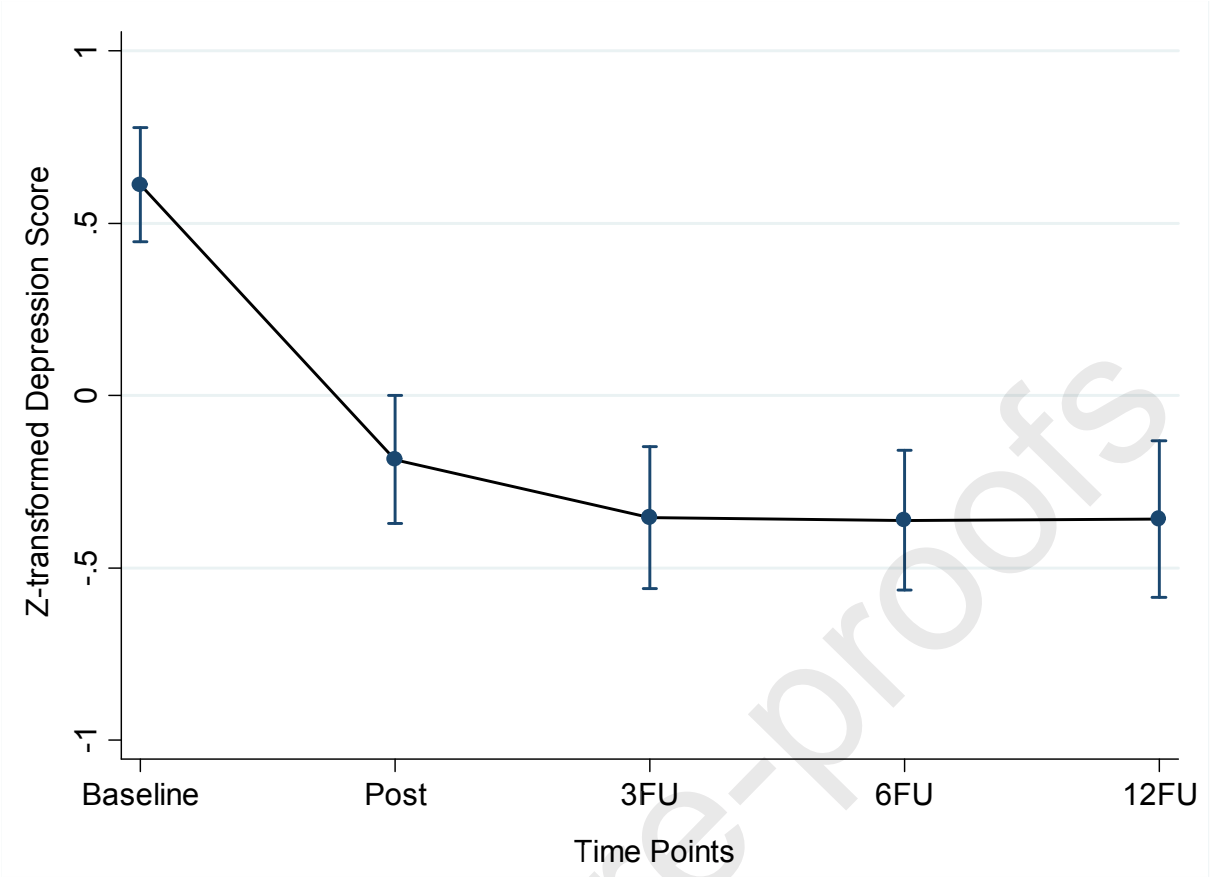

Note: Error bars indicate 95% confidence intervals. Results from the CDI-S, the SMFQ-C, and the MFQ-C were transformed into *z*-scores for analysis. *Abbreviations:* CDI-S, Children's Depression Inventory – Short Version; SMFQ-C, Short Mood and Feeling Questionnaire, Child Version; MFQ-C, Mood and Feeling Questionnaire, Child Version; 3FU, 3-month follow-up; 6FU, 6-month follow-up; 12FU, 12-month follow-up.

Figure S3. Estimated means on the Z-transformed Depression Score from a mixed-effects regression model including all five time points.

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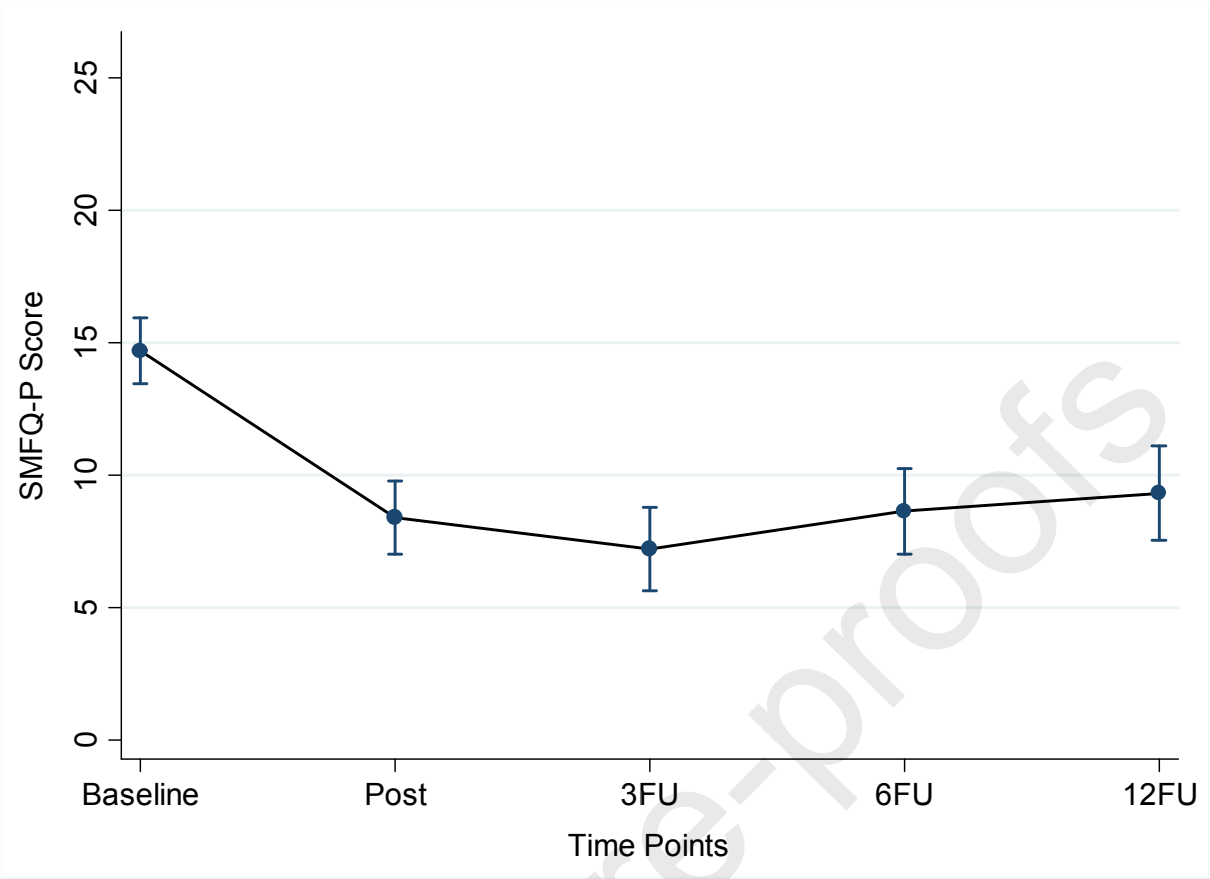

Note: Error bars indicate 95% confidence intervals. *Abbreviations:* SMFQ-P, Short Mood and Feeling Questionnaire, Parent Version; 3FU, 3-month follow-up; 6FU, 6-month follow-up; 12FU, 12-month follow-up.

Figure S4. Estimated means on the SMFQ-P from a mixed-effects regression model including all five time points.

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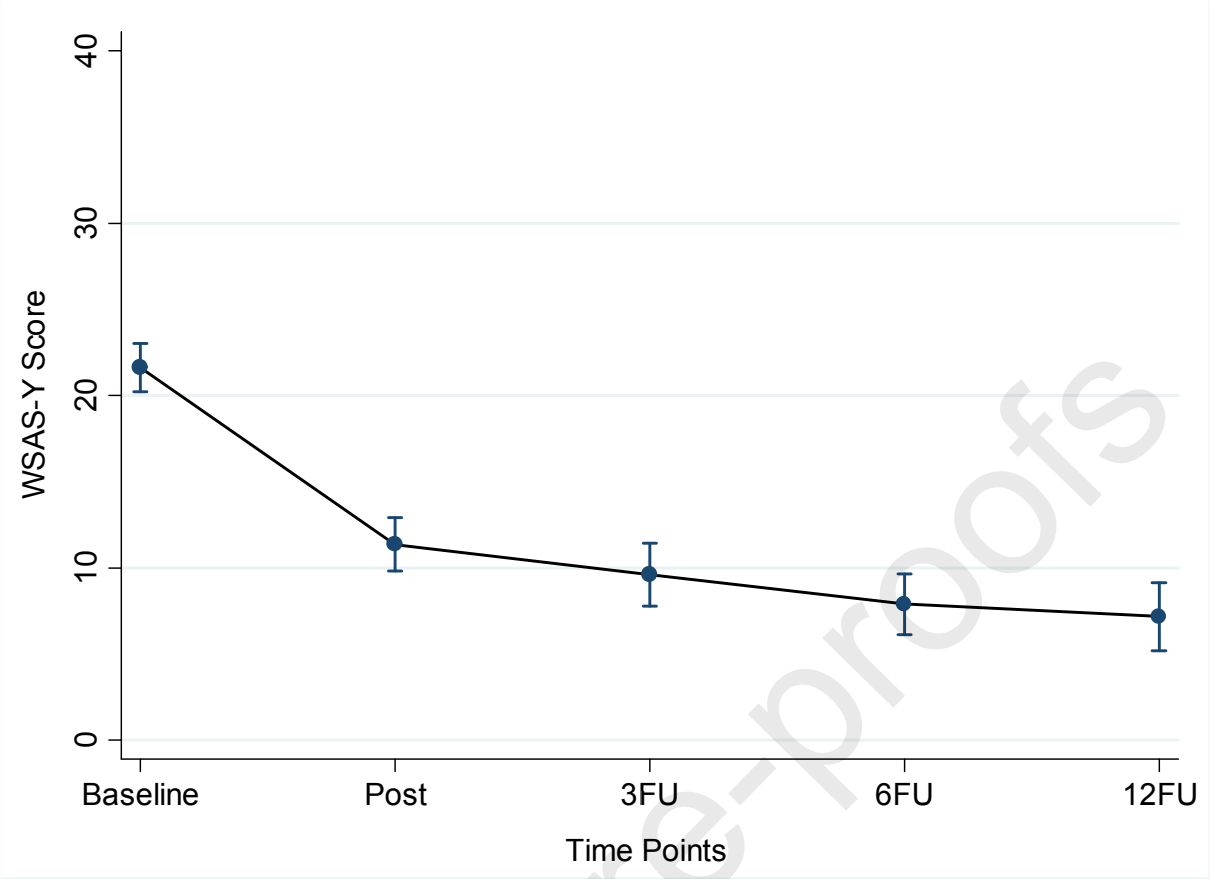

Note: Error bars indicate 95% confidence intervals. *Abbreviations:* WSAS-Y, Work, Social and Adjustment Scale – Youth Version; 3FU, 3-month follow-up; 6FU, 6-month follow-up; 12FU, 12-month follow-up.

Figure S5. Estimated means on the WSAS-Y from a mixed-effects regression model including all five time points.

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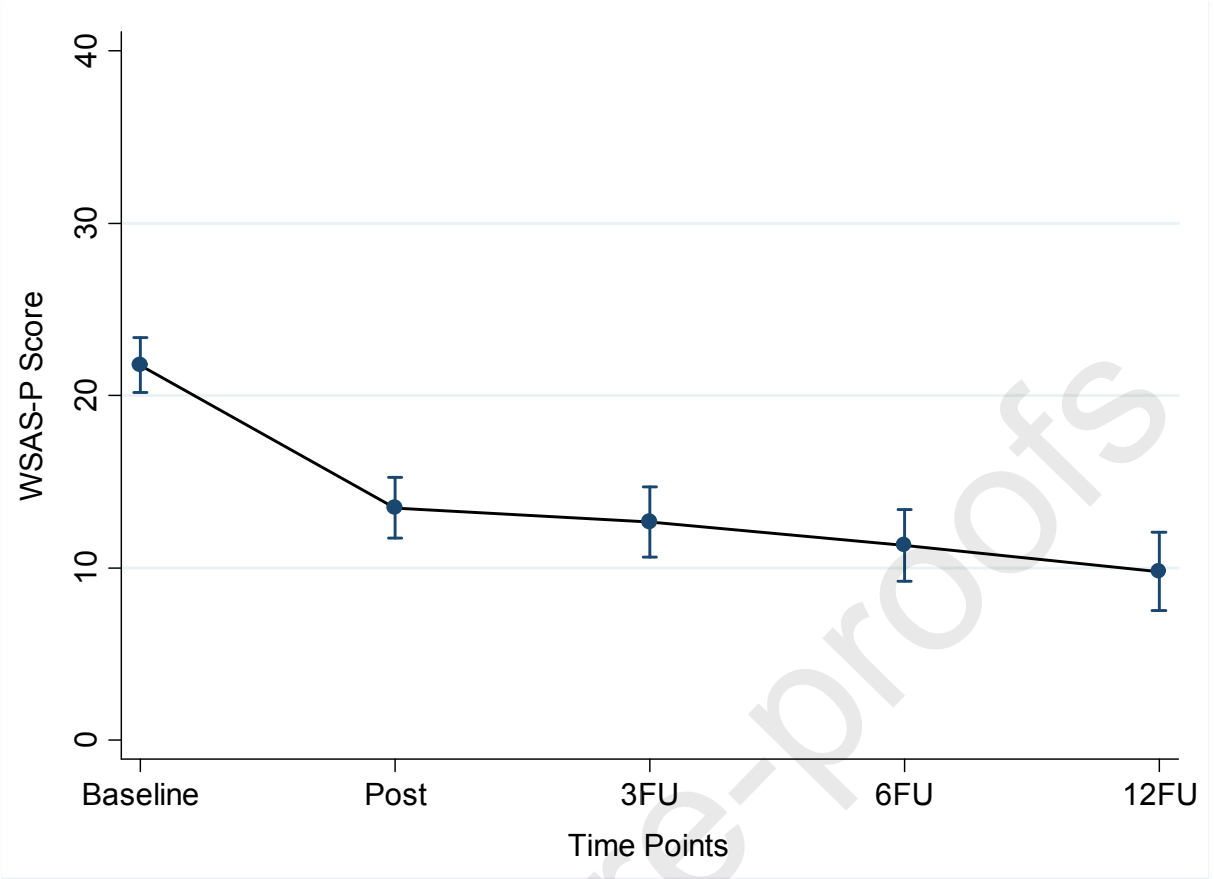

Note: Error bars indicate 95% confidence intervals. *Abbreviations:* WSAS-P, Work, Social and Adjustment Scale – Parent Version; 3FU, 3-month follow-up; 6FU, 6-month follow-up; 12FU, 12-month follow-up.

Figure S6. Estimated means on the WSAS-P from a mixed-effects regression model including all five time points.

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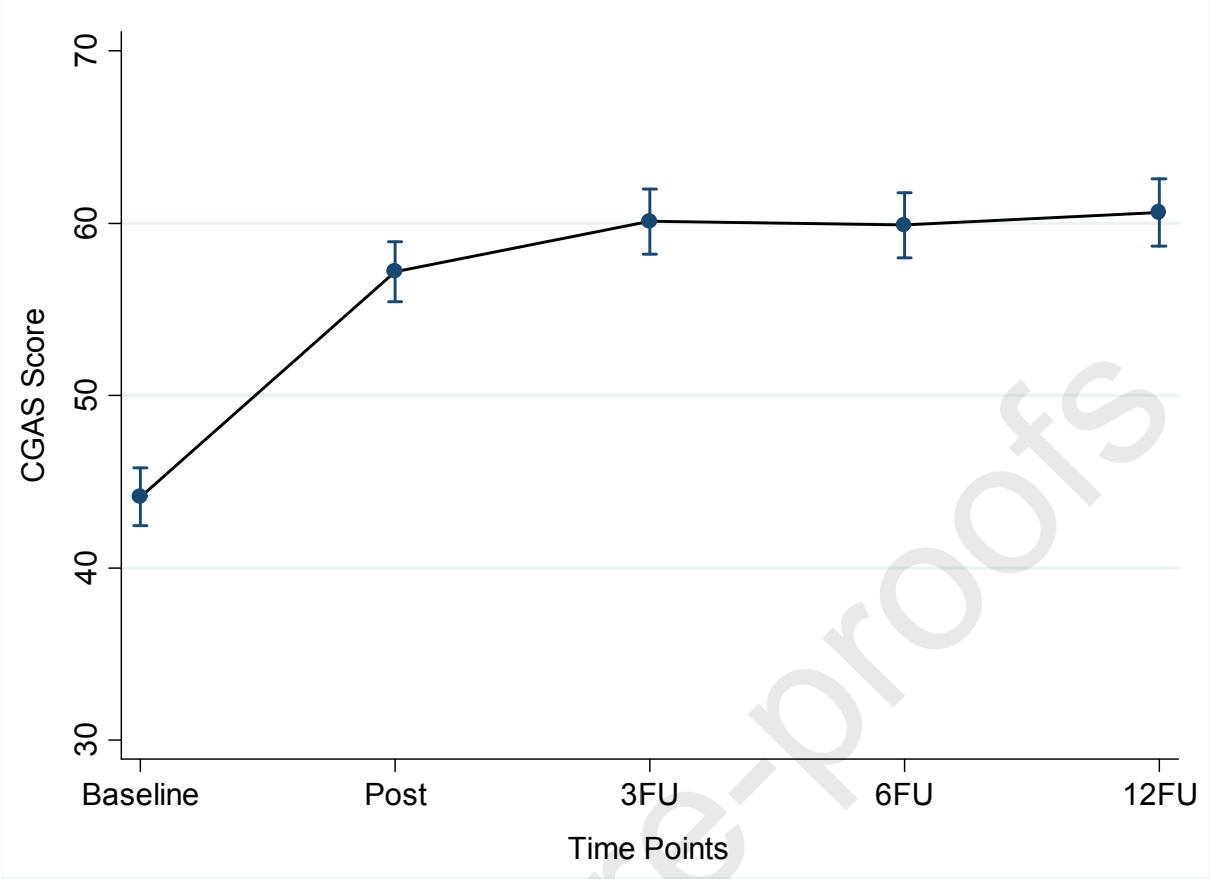

Note: Error bars indicate 95% confidence intervals. *Abbreviations:* CGAS, Children´s Global Assessment Scale; 3FU, 3-month follow-up; 6FU, 6-month follow-up; 12FU, 12-month follow-up.

Figure S7. Estimated means on the CGAS from a mixed-effects regression model including all five time points.

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