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Title: Emotional Skills Training for Patients with Anorexia Nervosa with Autistic Symptoms, Group or Individual Format?

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Abstract:

Objective: The aim of this study was to examine the effectiveness of CREST interventions in individual and group formats for adult anorexia nervosa. Furthermore, analyse whether patients with high levels of autistic symptoms respond differently.

Methods: Participants' self-report measures were taken before and after individual and group interventions (N=66; N=62, respectively). Mixed effects analysis was used to analyse overall response to both formats and assess interaction with autism symptoms.

Results: Significant improvements were observed for patients' alexithymia in individual format and motivation increased for participants in both interventions. Significant interactions were observed between alexithymia, social anhedonia and autism symptoms in individual format and alexithymia in group format. No interactions between autism and time were observed for either format.

Conclusions: CREST in both formats offers participants improvements in social-emotional and motivational domains. Patients with high levels of autism symptoms also score high on both social anhedonia and alexithymia measures, but this does not affect their response to treatment.

Keywords: anorexia nervosa, autism spectrum disorder, social anhedonia, alexithymia, emotions.

Introduction

Current theoretical models suggest that in addition to weight restoration, eating disorder treatment should target other processes that are believed to contribute to the maintenance of the disorder, such as social-emotional difficulties (Treasure & Schmidt, 2013). A large body of experimental work has demonstrated that people with anorexia nervosa (AN) have difficulties in a number of social-emotional processes, including elevated alexithymia and social anhedonia (Harrison, Mountford, & Tchanturia, 2014; Tchanturia et al., 2012; Westwood, Kerr-Gaffney, Stahl, & Tchanturia, 2017). Furthermore, AN is characterised as an egosyntonic condition, whereby the condition is valued and therefore patients have low motivation to recover (Gregertsen, Mandy, & Serpell, 2017). Emotional difficulties more broadly within AN have been targeted using the Maudsley Model of Anorexia Nervosa Treatment for Adults (MANTRA). MANTRA has been developed to target maintaining factors in AN including social-emotional and emotional regulation difficulties (Schmidt et al., 2015). However, MANTRA has only been trialled in outpatient settings and currently there are no recommended psychological interventions for inpatient AN adults that conform to the new National Institute for Health and Care Excellence (NICE) guidelines of brief admissions (NICE, 2017). Therefore, further research is needed to develop effective interventions targeting social-emotional difficulties in AN within inpatient settings as well as improve patients' motivation for recovery.

Interestingly, similar social-emotional difficulties are frequently reported in autism spectrum disorder (ASD), which has an elevated prevalence among patients with AN

(Huke, Turk, Saeidi, Kent, & Morgan, 2013; Westwood & Tchanturia, 2017). Despite increased prevalence of ASD symptoms in AN, the impact of these symptoms on treatment outcome is less clear. A recent naturalistic clinical audit study suggested that patients with AN and high levels of ASD symptoms, as measured by the short version autism quotient questionnaire, had a more severe clinical presentation on admission to inpatient hospital treatment (Tchanturia, Adamson, Leppanen, & Westwood, 2017). Furthermore, presence of high levels of ASD symptoms may have a negative impact on response to group cognitive remediation therapy (CRT) (Tchanturia, Larsson, & Adamson, 2016) suggesting that treatment outcome could be mediated by levels of ASD symptoms. Further research is still needed to explore if comorbid ASD symptoms influence response to clinical interventions specifically designed to target social-emotional difficulties.

Cognitive remediation and emotional skills training (CREST) has been developed to target social-emotional difficulties in severe enduring AN (Tchanturia, Doris, & Fleming, 2014; Tchanturia, Doris, Mountford, & Fleming, 2015). CREST specifically targets patients' social-emotional functioning including their inability to identify and describe their own emotions and express their needs in a safe way, it can be delivered in both group and individual format (Davies et al., 2012; Tchanturia et al., 2014, 2015). CREST in individual format contains 8 sessions whilst the group format is delivered over 5 sessions. Although the principles of the delivery are the same (a balance between discussion, experiential exercises and psychoeducational materials based on state of the art research) the length of the sessions and overall number is different (group sessions last approximately an hour whilst individual sessions typically last 40-45 minutes). CREST in group format has been shown to significantly

improve patients self-reported social anhedonia and has received positive feedback from both patients and clinicians (Tchanturia et al., 2014). Similar improvements in social anhedonia and in alexithymia have been reported following CREST in individual format with small effect sizes (Tchanturia et al., 2015). However, the current literature on CREST consists of only a few studies with small sample sizes and, to date, no studies have explored the impact of comorbid ASD symptoms on response to either format of the CREST intervention.

Emotional skills interventions are highly valued in the autism literature and various therapeutic programmes have been suggested however, little is known about tailored approaches when patients have both conditions (Kinnaird, Norton, & Tchanturia, 2017). The aim of this study was to provide an update on the effectiveness of both CREST interventions, in group and individual format, with a larger case series. We also aimed to explore how AN patients who report higher comorbid ASD symptoms respond to CREST compared to those who do not. We hypothesised that there would be an overall improvement in social anhedonia in both individual and group CREST, with individual CREST additionally targeting alexithymia. We additionally, hypothesised that AN patients who report high levels of ASD symptoms may show a different response to CREST.

Table 1. Summary of all available CREST studies.

Methods

CREST is offered in both group and individual formats as part of the specialist inpatient national treatment programme. All patients admitted to the inpatient ward are offered the opportunity to attend group and individual CREST. The treatment programme also includes other individual and group therapy interventions such as cognitive remediation therapy. All the data in the present study was obtained during routine service evaluation and audit. Permission to audit patient data was obtained from the South London and Maudsley governance committee.

Participants

The CREST Individual sample consisted of 66 individuals and the CREST Group sample consisted of 62 individuals. All participants included in the present study had a diagnosis of Anorexia Nervosa according to DSM (American Psychiatric Association, 2013). Diagnosis was made by a consultant psychiatrist.

CREST Individual

CREST as an individual intervention is an eight-session standardised individual therapy facilitated by the inpatient treatment programs psychology team, all supervised by the consultant psychologist (KT). CREST in individual format is a manualised intervention lasting 40 minutes. Because of the nature of the treatment programme, patients receive cognitive remediation therapy as well as CREST (in cases where a patient starts with CREST, the first two sessions focus on targeting detailed and rigid thinking styles, introducing principals of remediation work (e.g focus on thinking styles and processes rather than symptoms). The following 8

sessions focus on emotional recognition, regulation and expression of emotions with a mixture of psychoeducation and experiential exercises. The outline for the intervention can be found in the clinician manual [http://www.katetchanturia.com/publications].

CREST Group

The CREST group is a 5-session standardised group therapy facilitated by one member of the inpatient psychology team and one other member of the ward multidisciplinary team. Sessions normally last an hour and run on a 5-week cycle. The group intervention is optional, and participants can drop out at any time.

The CREST group is based around 5 themes; the power of positive emotions, the nature and function of emotions, how do we identify emotions, emotion expression vs emotion suppression and emotions and needs.

Assessment

Self-report measures are taken at the start of the first session and at the end of the last session in both interventions, including qualitative feedback. Both assessments include the revised Social Anhedonia Scale (RSAS) (Chapman, Chapman, & Raulin, 1976) and the Toronto Alexithymia Scale (TAS-20) (Bagby, Parker, & Taylor, 1994) and qualitative feedback as part of the time 2 questionnaires. Although CREST targets other social-emotional processing problems we routinely only administer these two questionnaires. Participants' motivation was also measured using the

motivational ruler 2 item Likert scale (Miller & Rollnick, 2002). The scale assesses participants' perceived ability to change and importance to change using a scale from 0-10, with higher scores indicating more motivation.

All patients admitted to the inpatient unit are asked to complete an AQ-10 as part of their admission assessment audit. AQ-10 is a short, reliable measure of autistic symptoms (Allison, Auyeung, & Baron-Cohen, 2012; Westwood et al., 2016). AQ-10 scores were treated using binary coding with those scoring below 6 classified as '0' or low autistic symptoms and those scoring 6 and above classified as '1' or high autistic symptoms (Allison et al., 2012). Participants without an AQ-10 score were excluded from the analysis. All measures were assessed for internal reliability, at both time points, using Cronbach's Alpha (α) with scores ranging from .804 to .932.

Data screening

Data was screened for non-AN cases, missing data and AQ-10 Score. We worked on an intend to treat basis and therefore all cases with complete data at either time point were included in the analysis. For those participants who attended the group more than once, only their first group scores were kept, any subsequent scores were removed before analysis.

Statistical analysis

All data was analysed using R (R Development Core Team, 2006). The effectiveness of CREST in both individual and group formats and how ASD

symptoms interact with any change was analysed using linear mixed-effects models using the lme4 package (Bates, Mächler, Bolker, & Walker, 2015). In all models' time (before CREST, after CREST) and presence of ASD symptoms as measured on the AQ-10 (meeting published cut-off, not meeting cut-off) were entered as fixed effect variables along with a random intercept. Additionally, BMI was entered as a covariate of no interest to control for changes in the outcome variables that could be attributed purely to changes in BMI. The following variables were used as outcome variables to explore the effectiveness of CREST: alexithymia as measured with TAS, social anhedonia as measured with SAS, and motivation as measured by ability and confidence to change.

Results

Patient Characteristics

For the patients attending the group intervention, their mean age was 25.5 years old, range 18-63 years. Their mean duration of illness (taken at the start of the group) was 7.6 years (SD 8.3) and their mean BMI at the start was 14.8 (SD 1.4). All participants were female and their demographics were comparable in both interventions. In the individual intervention, their mean age was 25.8 years old, range 18-53. Their mean duration of illness was 8 years (SD 8.5) and their mean BMI was 14.8 (SD 1.3). For the CREST group 41 (66%) of patients scored below cut-off on the AQ-10 and 21 (34%) scored above cut-off. For CREST Individual 45 (68%) of patients scored below cut-off and 21 (32%) of patients scored above cut-off.

Outcome Measures

The outcomes from the univariate analysis of the CREST Group and the CREST individual are reported in Table 2. For the CREST group, there was a significant effect of ASD symptoms on TAS scores, with those who scored high on the AQ-10 also having high alexithymia scores. There was a significant effect of time on both motivation ability score, patients' ability to change increased by the end of the group intervention. BMI was not a significant covariate in any of the analyses.

For the CREST individual intervention there was a significant effect of ASD symptoms on both SAS and TAS scores, such that those who scored high on the AQ-10 also scored high on social anhedonia and alexithymia measures. There was also a significant reduction in TAS scores over time for the whole group, indicating an improvement after individual therapy. Self-reported Motivational Ability significantly increased for the whole group from the beginning to the end of intervention. BMI was not a significant covariate in any of the analyses.

Insert Table 2 Here – Mixed effects results.

Discussion

This study aimed to further evaluate the effectiveness of CREST interventions as part of the inpatient treatment programme for AN, in both group and individual formats, and to evaluate how AN patients with high levels of ASD symptoms respond to each intervention. This was assessed using patients' self-reported alexithymia,

social anhedonia and motivation scores. Although CREST is designed to target many areas of social-emotional processing, this report focused on these three areas. The present findings revealed that in group format CREST generally improved patients' motivation but did not significantly impact self-reported social anhedonia or alexithymia. In individual format, on the other hand, CREST led to an improvement in both alexithymia and confidence. However, there was no statistically significant change in social anhedonia or importance to change. Finally, the present study did not find any significant interactions with time and presence of self-reported ASD symptoms, suggesting that CREST can be a useful intervention even if ASD symptoms are present and stable over time.

The findings from the present study partially agree with previous literature examining the effectiveness of CREST as an intervention with severe AN adult patients. Both CREST formats demonstrated an improvement across most self-report measures by the end of the interventions. Significant improvements were seen in the CREST group with both motivation scores showing improvements for the whole group, suggesting that patients feel more able to change and are better able to understand the importance to change. Contrary to what previous smaller scale research has demonstrated, the present findings revealed no significant change in social anhedonia in either CREST format (Tchanturia et al., 2014, 2015). However, the present study did find a significant improvement in patients' alexithymia scores in CREST Individual format, suggesting that the individual format may be helpful in improving patients' ability to recognise and describe their own emotions. One explanation could be that the intervention is longer (8 vs 5 sessions) with a more

personalised approach, allowing the patient to explore their own emotions more than in a group setting.

Patients with Anorexia Nervosa are known to be ambivalent about recovery and difficult to motivate, often because they lack insight into the severity of their symptoms and have reasons to hold onto the illness (Gregertsen et al., 2017; Hötzel, von Brachel, Schlossmacher, & Vocks, 2013). In the current study both individual and group formats led to a significant improvement in one or both measures of motivation. Motivation has only been examined twice before within the CREST literature, with group format showing no significant differences but the individual format showing significant improvements in ability to change scores (Tchanturia et al., 2014, 2015). The significant findings in the current study suggest that an intervention targeting social-emotional functioning can also have a significant impact on motivation. Perhaps the low intensity of the intervention allows for patients to experience small improvements in their social-emotional ability and therefore feel more motivated and optimistic about recovery; future research should further explore this relationship.

Our second objective was to evaluate how AN patients with high levels of ASD symptoms, as measured by the AQ-10, respond to both interventions. The results are largely in line with recent research suggesting that those who score high for ASD also score high for other psychopathology measures (Tchanturia et al., 2017). A visual inspection of the means In the CREST Individual sample shows that those who reported high incidence of ASD symptoms also reported significantly more social anhedonia and alexithymia, while in the CREST Group sample those who

reported high levels of ASD symptoms also reported higher scores of alexithymia across time points. There were however no differences on either motivation measures on either intervention, suggesting those with high levels of ASD symptoms have similar motivational levels to those with low ASD symptoms. Interestingly, there were no interactions between time and ASD symptoms on clinical symptom change suggesting that although social anhedonia and alexithymia may be higher among AN patients with high levels of ASD symptoms, CREST may still be an effective intervention. This finding is of particular importance considering recent reports that presence of ASD symptoms has a negative impact on treatment response among those with AN (Tchanturia et al., 2016; Westwood & Tchanturia, 2017).

There are a few limitations with this study that should be addressed in future publications. Firstly, current literature for CREST as an intervention in the treatment of AN largely comes out of the same research group as demonstrated in table 1, this makes it difficult to assume generalisability across treatment centres. Secondly, further research with larger samples are needed. The SAS and TAS used in the present study assess trait levels of social anhedonia and alexithymia, which may mean it is more difficult to detect reliable changes in these measures without a very large sample and long periods of time between assessments. Finally, randomised controlled trials are needed to ascertain that the improvements seen in the present study are due to the interventions under investigation and not simply an effect of time or the inpatient protocol itself. In conclusion, there is an identified clinical need for interventions in eating disorders that are effective for those that also have ASD symptoms (Kinnaird et al., 2017), evaluating current interventions in a similar way to this study is a useful step forward.

Availability of data:

Data is available, please contact the corresponding author for all data requests.

Authors Contributions:

JA managed the data, led the writing of the manuscript and was involved in the analysis. JL led the statistical analysis and contributed to the writing and editing of the manuscript. MM contributed to the editing of the manuscript. KT devised the intervention with the clinical team, supervised the research and contributed to the writing and editing of the manuscript.

Competing Interests:

All authors declare that they have no competing interests.

Approvals:

The data for this study was obtained through routine clinical audit as part of the inpatient treatment Programme. This audit is covered under the NHS Ethics Committee reference of (14/LO/2131).

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Table 1: Summary of published CREST literature to date.

Study			Aims	Participants		Measurements	Results	Conclusions
Authors	**Year**	**Title**		**N**	**Age**			
Tchanturia K, Doris E, Mountford V, Fleming C.	2015	Cognitive Remediation and Emotion Skills Training (CREST) for anorexia nervosa in individual format: self-reported outcomes.	Investigate magnitude of improvement of self-reported social anhedonia, alexithymia and motivation to change through individual CREST (10 sessions, revised version)	52 started, **33** completed CREST and post-intervention measures	24.5 (8.2)	- RSAS - TAS-20 - Motivational Ruler: Importance to change Ability to change	Reduced Reduced Same Increased	Clinically significant decrease in social anhedonia and alexithymia through CREST. Significant increase in ability to change.
Tchanturia K, Doris E, Fleming C.	2014	Effectiveness of cognitive remediation and emotion skills training (CREST) for anorexia nervosa in group format: a naturalistic pilot study.	To investigate feasibility of **group** format (five 1-hour sessions), magnitude of change in motivation and social anhedonia; examine qualitative feedback of patients and therapists	71 started, **36** completed CREST and post-intervention measures	27.9	- RSAS - Motivational Ruler - Qualitative feedback	Significant decrease from pre- to post intervention. Increased but insignificant perceived importance and ability to change. "Sharing and discussing" and "talking and learning about emotions" most important. Improve: more practical exercises to deal with emotions	Patients perceived group format as positive, very important for social interaction (although improvements might also be partially explained by increases in BMI).
Davies H, Fox J, Naumann U, Treasure J, Schmidt U, Tchanturia K.	2012	Cognitive remediation and emotion skills training for anorexia nervosa: an observational study using neuropsychological outcomes	Investigate changes in cognitive flexibility, central coherence and emotion processing	CREST + TAU: 46 started, 35 completed CREST, **30** completed follow up	CREST: 26.1 (7.6) TAU: 26 (7.9)	- Brixton Test - Wisconsin Card Sorting Test - Fragmented pictures task - Group embedded figures task	No significant between group differences on these measures. Both groups improved in set-shifting, CREST also in global-processing	Hot cognition may be harder to address than cold cognition.

				TAU: 34 started, **25** completed follow up		- Reading the Mind in the Eyes Task - Pictorial Emotional Stroop Task		
Money C, Genders R, Treasure J, Schmidt U, Tchanturia K.	2011	A brief emotion focused intervention for inpatients with anorexia nervosa: a qualitative study.	Qualitative exploration of patients' experiences with CREST	28 started, **17** of those completed CREST	25 (range 13-40)	"end of therapy reflection" form - What have you learned about yourself? - Any aspects which were particularly helpful? - Any aspects particularly unhelpful? - What could be improved? - What strategies have you learned to use in the future?	To identify and express emotions Learning new strategies to manage emotions and about their function Little. Some: too structured. More sessions, managing/communicating emotions Expression of emotions; having a positive attitude; emotional awareness	CREST is an acceptable intervention, helpful for early, low-intensity inpatient treatment.
Money C, Davies H, Tchanturia K	2011	A Case Study Introducing Cognitive Remediation and Emotion Skills Training for Anorexia Nervosa Inpatient Care	Description of the ten CREST sessions using the example of one AN patient: 1+2: "thinking about thinking" 3-8: function of emotions; label and identify emotions; Communicative function of emotions; practice to accept, tolerate and express emotions.	1	19	- EDE-Q - DASS - TAS-20 - Patient Satisfaction Questionnaire - Motivational Ruler.	Improve in BMI, EDE-Q, Reappraisal, Emotional identifying emotions. Worsened in anxiety, depression, suppression, probably due to more awareness. CREST helped to better know herself, to motivate and show the need for further treatment	Preliminary support for acceptability and effectiveness of CREST.

CREST: Cognitive Remediation and Emotion Skills Training; BMI: Body Mass Index; DASS: Depression, Anxiety and Stress Scale; EDE-Q: Eating Disorder Examination – Questionnaire; RSAS: Revised Social Anhedonia Scale; TAS-20: Toronto Alexithymia Scale; TAU: Treatment as usual

Table 2. Mixed-effect analysis for both CREST interventions.

CREST Group	Time	AN + ASD symptoms Mean (SD)	AN no ASD symptoms Mean (SD)	F statistic, p value
SAS	Baseline	18.70 (7.10)	15.97 (8.16)	Time: $F(1,51) = 0.87$, $p = 0.36$
	End of treatment	16.87 (7.65)	14.56 (8.59)	ASD: $F(1,54) = 1.26$, $p = 0.27$ Time x ASD: $F(1,36) = 0.27$, $p = 0.61$ BMI: $F(1,92) = 1.02$, $p = 0.32$
TAS	Baseline	65.45 (11.74)	58.32 (11.90)	Time: $F(1,48) = 1.67$, $p = 0.20$
	End of treatment	62.71 (13.13)	59.58 (9.54)	ASD: $F(1,51) = 4.56$, $p = 0.04$* Time x ASD: $F(1,34) = 0.85$, $p = 0.36$ BMI: $F(1,79) = 0.47$, $p > 0.5$
MR Importance	Baseline	6.68 (2.24)	7.49 (2.58)	Time: $F(1,49) = 2.81$, $p = 0.10$
	End of treatment	7.13 (2.36)	8.30 (2.11)	ASD: $F(1,57) = 1.78$, $p = 0.19$ Time x ASD: $F(1,35) = 0.68$, $p = 0.42$ BMI: $F(1,88) = 0.34$, $p = 0.56$
MR Ability	Baseline	3.58 (2.71)	4.70 (2.95)	Time: $F(1,48) = 4.57$, $p = 0.04$*
	End of treatment	4.57 (2.44)	4.59 (2.30)	ASD: $F(1,55) = 0.75$, $p = 0.39$ Time x ASD: $F(1,34) = 2.08$, $p = 0.16$ BMI: $F(1,87) = 0.02$, $p = 0.88$
CREST Individual				
SAS	Baseline	19.19 (6.68)	13.78 (8.22)	Time: $F(1,46) = 0.79$, $p = 0.38$
	End of treatment	20.40 (8.38)	12.21 (8.92)	ASD: $F(1,65) = 11.53$, $p > 0.01$** Time x ASD: $F(1,33) = 2.99$, $p = 0.09$ BMI: $F(1,91) = 0.49$, $p = 0.49$
TAS	Baseline	64.48 (12.16)	56.64 (13.09)	Time: $F(1,47) = 6.84$, $p = 0.01$*
	End of treatment	59.60 (15.24)	53.50 (11.64)	ASD: $F(1,67) = 6.54$, $p = 0.01$* Time x ASD: $F(1,34) = 0.10$, $p = 0.75$ BMI: $F(1,92) = 0.80$, $p = 0.38$
MR Importance	Baseline	7.55 (2.50)	7.57 (2.37)	Time: $F(1,42) = 0.04$, $p = 0.84$
	End of treatment	6.93 (3.20)	7.31 (2.15)	ASD: $F(1,66) = 0.30$, $p = 0.59$ Time x ASD: $F(1,32) = 1.00$, $p = 0.32$ BMI: $F(1,89) = 0.21$, $p = 0.65$
MR Ability	Baseline	4.15 (2.68)	5.59 (3.11)	Time: $F(1,37) = 11.27$, $p > 0.01$**
	End of treatment	4.60 (2.41)	5.63 (2.60)	ASD: $F(1,64) = 3.31$, $p = 0.07$ Time x ASD: $F(1,27) = 0.02$, $p = 0.88$ BMI: $F(1,86) = 1.86$, $p = 0.18$

**=Significant at .01. *=Significant at .05.
SAS= Social Anhedonia Scale; TAS= Toronto Alexithymia Scale; MR= Motivational Ruler; Importance to change and Ability to change subscales. P>.05.