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Research Letter

Neuropsychological task performance before and after cognitive remediation in anorexia nervosa: a pilot case-series

Studies examining the neuropsychological functioning of anorexia nervosa (AN) have shown that cognitive difficulties go beyond attention/concentration impairments, but also present in set-shifting (Roberts *et al.* 2007) and an extreme attention to detail with impaired global processing (Lopez *et al.* 2008). These difficulties in neuropsychological function may decrease both treatment motivation and efficacy of psychological interventions and additionally contribute to the maintenance of the illness. Evidence from the literature in other psychiatric disorders (Wykes *et al.* 2007) indicates that cognitive remediation therapy (CRT) is an effective strategy for teaching new cognitive skills relevant to everyday functioning and has a positive impact on clinical outcomes.

We have adapted and tailored CRT for AN. This intervention targets *processes* of thinking rather than *content* and includes: practising set-shifting exercises to improve cognitive flexibility; practising looking at the 'bigger picture' rather than details; enhancing meta-cognitive abilities; reflecting on how exercises relate to real life; exploring alternative strategies in cognitive tasks; and practising behavioural tasks outside of the sessions.

A preliminary study in four adult AN patients receiving in-patient treatment showed that CRT is acceptable and feasible (Tchanturia *et al.* 2007). The pilot case-series described here was aimed at further evaluating the utility of CRT, exploring whether CRT would improve performance in neuropsychological tasks and whether these improvements were associated with clinical symptomatology. A consecutive series of adults with AN admitted to the in-patient ward between 2004 and 2007 were included in the study, provided they were physically stable and did not suffer from psychosis or head injury. Twenty-seven patients were offered 10 individual sessions of CRT (45-min duration, twice a week). Twenty-three patients completed the intervention and were included in the analysis.

The assessment was administered at baseline and at the end of the intervention. It included a battery of set-shifting tests (described in a longitudinal study of Tchanturia *et al.* 2004), the Rey–Osterrieth Complex Figure test (RCFT; described in Lopez *et al.* 2008) for global *versus* detail processing, self-report measures assessing obsessive-compulsive symptoms (Maudsley Obsessive–Compulsive Inventory; MOCI), anxiety and depression (Hospital Anxiety and Depression Scale; HADS), and body mass index [BMI (kg/m²), normal range 20–25]. A treatment satisfaction questionnaire was administered after the intervention.

Baseline and follow-up assessments were compared using neuropsychological and self-report data. Paired-sample *t* tests were used for normally distributed data and Mann–Whitney *U* tests for non-parametric data. Cohen's *d* was calculated to obtain the effect size for each variable. Associations between neuropsychological and clinical outcomes and satisfaction with treatment were explored using Pearson's correlation coefficient (r) and Spearman's rank (r_s) according to data distribution. There was an α-level of 0.005 after Bonferroni correction for multiple testing.

Participants' characteristics were: mean age 28.8 years (S.D. = 9.2), median age of onset 15 years (14–17), duration of AN 13.1 years (S.D. = 9.6), and mean IQ 112.7 (S.D. = 6.5). At the time of the first assessment, mean BMI was 14.3 (S.D. = 1.4), which significantly increased to 16.1 (S.D. = 1.5) by the time of the follow-up assessment ($t = -7.4$, df = 22, $p < 0.001$, $d = 1.25$). Four participants dropped out before completing the study.

Table 1 shows results from the cognitive performance assessments. Performance time improved in both timed set-shifting tasks (Trail B and CatBat), medium and very large effects were detected. Perseverative errors were significantly reduced in two cognitive shifting tasks (Brixton, CatBat) with very large and large effect sizes, and performance in the Haptic illusion task improved with medium effect size. The central coherence indices (Rey figure) also increased with small to large effect sizes.

Anxiety and depression symptoms were above clinical threshold (>10) in both assessments. By the time of the follow-up assessment only depression had decreased significantly ($t = 2.7$, df = 20, $p = 0.01$). No significant changes were observed on the MOCI ($z = -0.53$, $p = 0.60$) and HADS anxiety ($z = -1.77$, $p = 0.08$). There were negative relationships between depressive symptoms before CRT and improvements in the style index of the RCFT ($r_s = -0.438$, $p < 0.05$), and positive relationships between MOCI scores after CRT and improvements in number of errors in the Trail Making test ($r_s = 0.473$, $p < 0.05$).

Table 1. *Cognitive task performance before and after CRT*

	Before CRT ($n=23$)	After CRT ($n=23$)	Test statistics	p	d
Trail B shifting time[a]	40.6 (27–54)	32.9 (25–41)	−2.20	**0.026**	0.70
Trail B shifting errors[a]	0 (0–1)	1 (0–1)	−0.19	0.85	0.05
Brixton – Total[a]	13 (12–15)	10 (8–12)	−3.54	**<0.00***	**1.22**
Illusions[b]	13.9 (10.5)	8.8 (8.5)	1.99	0.06	**0.54**
CatBat – Time[a]	63.5 (50–121)	45 (32–57)	−3.50	**<0.001***	**1.21**
BAT – Time[b]	46.3 (25–82)	24.2 (18–34)	−3.35	**0.001***	**1.12**
CatBat – Errors[a]	1 (1–3)	0 (0–1)	−3.11	**0.002***	0.87
RCFT Order index[a]	2.3 (1.7–2.7)	2.3 (2.2–2.5)	−0.767	0.585	0.22
RCFT Style index[a]	1.5 (1.2–1.7)	1.7 (1.3–2)	−2.42	**0.015**	**0.75**

CRT, Cognitive remediation therapy; RCFT, Rey–Osterrieth Complex Figure test.

[a] Mann–Whitney U test for non-normally distributed data; median and upper and lower quartiles (Q25–Q75) reported.

[b] Two-tailed paired-sample t tests were used; mean (S.D.) are presented in the table.

* Remains significant after Bonferroni correction.

Improvements on speed in two cognitive tasks were moderately correlated with aspects of satisfaction with treatment, e.g. Trail B and perceived effectiveness of CRT ($r_s=0.470$, $p<0.05$) and transferable skills to everyday activities ($r_s=0.549$, $p<0.05$). Speed in the cognitive paragraph (CatBat) was associated with effectiveness of CRT ($r_s=0.650$, $p=0.001$), and transferable skills ($r_s=0.626$, $p<0.005$). Improvements in style index of RCFT was related to the perceived expectations met with the treatment ($r_s=0.626$, $p<0.005$). There was no association between changes in BMI and improvements in any neuropsychological test.

In summary, this pilot study showed that cognitive performance improved after 10 sessions of CRT in a group of severely ill AN patients. The study design does not allow us to address the question of whether cognitive performance improved as a *direct* consequence of CRT. However, it has been demonstrated that weight gain alone without addressing cognitive functioning does not improve task performance. A study conducted in the same in-patient unit and using the same set-shifting tests 4 years prior to the current study (Tchanturia *et al.* 2004), showed that patients' performance on set-shifting tasks did not significantly change as a result of treatment as usual, although BMI improved from 13.8 to 18.3. Retrospective comparison of data has limitations in terms of comparability of cohorts. However, the illness severity of AN (in terms of BMI) of patients in the 2004 cohort and those in the current study are comparable. The improved cognitive profile of AN patients in the current study suggests that a targeted intervention improves some aspects of cognitive performance.

Declaration of Interest

None.

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