

Translating laboratory research into practice: foundations, functions and future of cognitive remediation therapy for anorexia nervosa

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Cognitive remediation therapy for anorexia nervosa is a model of the translation of neuroscientific research into clinical practice. It is designed to improve the symptoms and general functioning of patients by remediating their cognitive deficits. In this report, we review its empirical foundations (basic and clinical) and its functions (what it targets and how) and provide a speculative view of its future over the next decade. Neuropsychological research has established that anorexia nervosa is associated with the traits of cognitive inflexibility and an excessively detailed information processing style, with neglect of the gestalt. These deficits are manifest, not only in the core pathology of the disease, but also in other areas of patients' lives. There is evidence that these traits can be remediated, and further study will establish whether this remediation brings secondary benefits in symptomatology and general functioning. We predict that within the coming years, a better understanding of the relative roles of strategy learning and brain exercise in cognitive remediation therapy will improve the design of interventions; that CRT will be increasingly well tailored to meet the specific neuropsychological and clinical profile of patients; and that it will be effective in different forms for both severe and mild cases of anorexia nervosa, in both in- and out-patient settings. We also propose that it will be key to exploiting the benefits of standard psychological therapies.

Anorexia nervosa (AN) is a disabling disorder that typically arises in adolescence and has a mean duration of 6 years. The clinical severity of the illness frequently puts patients at high levels of risk with equal numbers of deaths arising through medical complications and suicide [1,2]. Outcomes have not improved in the 20th century [3]. Diagnosis requires deliberate weight-loss behaviors leading to a body mass index (BMI) of 17.5 or below, distortion in the perception and evaluation of weight and shape, and a widespread endocrine disorder involving the hypothalamic–pituitary–gonadal axis [4]. The physical consequences, which include irreversible osteoporosis and reproductive infertility, have a secondary impact on a person's social development, since patients are often too ill to attend school and university, or socialise with their peers. They may therefore miss out on important developmental milestones. Despite these devastating consequences of the disorder, the evidence base for existing treatments – particularly for adults – is poor [5], and improved treatments are therefore an urgent need. Cognitive remediation therapy (CRT) is a promising candidate. First, it is derived from systematic neuropsychological research [6,7] and preliminary findings from a pilot intervention support its clinical effectiveness. Second, there is robust evidence for its benefits in the treatment of schizophrenia,

and preliminary evidence for its benefits in the treatment of obsessive–compulsive disorder (OCD). Third, it fills a gap in the psychological treatment of those patients who are too severely ill to receive a meaning-based therapy like cognitive behavioral therapy CBT. Since existing pharmacological treatments for AN are as yet of unproven efficacy [8,9], this avenue for early psychological intervention is extremely valuable. Finally, CRT provides excellent preparation for, or an additional component of, the traditional meaning-based psychotherapies that are required for full recovery.

Foundations of CRT for AN *Neuropsychological research & its translation in the clinic*

Cognitive inflexibility

There is robust evidence from neuropsychological laboratory research to suggest that patients with AN exhibit a trait of cognitive inflexibility or poor 'set-shifting' [10–12]. Set-shifting entails changing one's responses according to environmental contingencies. The Wisconsin Card Sorting Task is a widely used laboratory task that targets this skill. Participants have to work out an implicit and changing rule by responding to the researcher's feedback in order to correctly match stimulus cards with

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category cards of four basic designs: a single red triangle; two green stars; three yellow crosses; and four blue circles. The matching, or sorting rules, are defined by the dimensions of shape, color and number. The number of perseverative errors (following the previous rather than the current sorting rule) is used as a measure of set-shifting ability. People with AN perform significantly less well on this and similar tasks than people in the normal population. Our research in this domain was inspired by our clinical observations of rigidity in patients, which was evident not only in their weight-controlling behaviors, but also in other aspects of their lives. One example of its application is the multi-tasking required for cooking a meal and attending to children. In this case, both 'sets' need to be maintained in parallel and responses must shift constantly between them. Clinical experience has taught us that this kind of task is challenging for this patient group, who prefer to have a single focus. To what extent cognitive flexibility that is measured by the laboratory tasks predicts flexibility in everyday life is an important question for future research.

Neglect of the gestalt

There is also good evidence that people with AN exhibit an excessively detailed information-processing style, with neglect of the gestalt [13–16]. The geometric figures task is one of the tasks used to identify this processing style in the laboratory. When asked to describe geometric figures for another to draw, people with AN will tend to identify details instead of beginning with global features of the figure. This is a poor organizational strategy that makes it difficult for the person drawing to produce an accurate representation of the figure and which also makes it difficult for the patient to recall the figure. Our research in this domain was inspired by our clinical observations of a detail focus in patients, which was evident not only in their eating behaviors, but also in other areas of their lives, such as their homework. The ability to process information as a function of context and so to respond appropriately to the task is, like cognitive flexibility, an important skill in everyday life. In the workplace, for example, one must continually be assessing the degree of detail that is required to make a particular assignment fit for purpose. A global overview is essential in this case. Again, to what extent performance on the geometric figures task and other similar laboratory tasks predicts processing style in everyday life is an important question for future research.

Bridging the gap from the lab to the clinic

We have integrated these neuropsychological findings into an etiological model of eating disorders that has facilitated their translation into clinical practice [17]. The CRT intervention itself consists of multiple versions of a variety of tasks that target the deficits in flexibility and gistful processing described above. Therapists meet patients for a total of ten sessions, twice a week, for 5 weeks, and for 30–40 min a session. The patient's progress is monitored through in-session observations of their performance on tasks, their meta-cognitive ability to reflect on their thinking style and their ability to implement related changes in their lives. Researchers assess direct changes in neuropsychological performance by assessing patients on similar tasks before and after the treatment. In this form, the manualized CRT intervention for AN is now being systematically tested, in case studies, an exploratory trial and, shortly, in a randomized, controlled trial. A series of case studies, two published [18,19] and the others available on request, has shown that CRT for people with AN can improve their performance on laboratory tests of the target deficits. In addition, the patient feedback in these studies suggested that patients find CRT helpful for teaching them generalizable skills that improve their everyday lives, and that they find it enjoyable and accessible. These qualitative findings are replicated in a qualitative analysis of letters written by patients at the end of CRT [20].

CRT for other disorders

CRT for schizophrenia

CRT has been used successively for several conditions. We restrict ourselves here to mentioning research findings in relation to schizophrenia and OCD. OCD is worth mentioning because of the close similarities, identified below, between AN and OCD. Schizophrenia is worth mentioning for two reasons. First, CRT for schizophrenia has been developed out of a substantial body of experimental and clinical evidence that has amassed over the past few decades. The depth of the research into CRT for schizophrenia makes it an excellent model and learning-point for the development of CRT in other disorders. A summary of the current state of this research is available in Wykes and Reeder [21]. Perhaps the most important finding is that cognitive deficits have a negative impact on the daily functioning of patients, which can be alleviated through CRT [22–24]. Recent studies have started to answer important specifics, such as

which deficit it is most beneficial to target (schema generation is the latest candidate [24]), whether improvements are durable (Wykes found sustained improvements at 6 months, with the exception of improvements in self-esteem [25]) and what level of improvement in social functioning (Wykes found improvement must rise above a threshold [23]).

The second reason for referring to CRT for schizophrenia is that cognitive flexibility is a shared deficit between those with schizophrenia and those with AN. Taking advantage of this shared ground, we have adapted our intervention of CRT for AN from the flexibility module in Delahunty and Morice's CRT intervention for schizophrenia [26].

CRT for OCD

CRT has also shown promising results in the treatment of OCD. AN shares several clinical features with OCD and, in particular, repetitive, stereotyped behaviors and a rigid, perfectionistic personality style [27]. The two populations also have a similar cognitive profile [28]; similar to people with AN, people with OCD have difficulties with set-shifting [29,30] and have a bias for detailed as opposed to gistful information processing [31]. Park and colleagues found that training patients with OCD in a gestalt-based information processing style improved their memory skills and alleviated their clinical symptoms [32]. The authors suggest that symptoms improved because patients learned to approach cognitive tasks with a good organizational method and to solve them strategically. That is, they began to consider the context rather than to direct their attention to trivia [32]. We hypothesize that similar benefits will be experienced by people with AN.

Functions of CRT for AN

CRT targets basic processes of thought

Psychological therapies can be categorized according to whether they target the processes, form or content of thought. By the processes of thought we mean the basic cognitive functions of memory, attention, planning and flexibility that underpin thinking. These can be summarized as the processing, retention and manipulation of information. By the form of thought, we mean the higher level interpretative functions of reasoning style, attributional style and the logical structure of thought. So, for example, a tendency to jump to conclusions (reasoning style), to blame oneself when things go wrong (attributional

style) and to see things in black and white (logical structure) can be summarized as the logical form of thinking. By the content of thought, we mean specific beliefs and assumptions, for example, the belief that one is stupid, or the assumption that showing emotions in public is a sign of weakness. According to this organizational scheme, psychoanalytical therapy targets the content of thought; cognitive remediation targets the processes that underpin thought; and cognitive therapy, or CBT, targets both the content of thought and its logical form.

The central function of CRT, then, is to improve the basic processes of thought and, in the case of AN, the processes of set-shifting and global, or gistful, information-processing.

How does CRT improve flexibility & gistful information processing in patients with AN?

Brain gym

It is a robust finding that exercising the brain can improve mental fitness, just as exercising the body can improve physical fitness [33]. Our brain is shaped by how we use it, and practising particular skills leads to increased activation and even increased size of the relevant brain areas. Musicians, for example, have an enlarged and more active Heschl's gyrus, an area involved in auditory processing [34] and taxi drivers have an enlarged and more active hippocampus [35]. Moreover, such benefits can be enjoyed by people who are challenged by age-related decline [36] and specific disease-related cognitive deficits [37]. By the same rationale, practising cognitive tasks that target flexibility and gistful processing can be expected to increase activation of the relevant cognitive circuits in people with AN.

Strategy teaching

Practice can increase a cognitive skill. However, the effects tend to be specific to a task [21]. If specific strategies are taught, the improved skill is more likely to be generalized to other domains. This aspect of cognitive remediation training involves meta-cognition, in which the patient reflects on his or her approach to a task. Once an appropriate strategy is learnt, practice can then facilitate the normalization of the strategy into a cognitive schema and thereby improve its accessibility to the patient in a range of everyday contexts. So, for example, if patients reflect on, and deliberately use, a gistful processing style in the geometric figures task, they are more likely to have access to this skill outside the sessions.

Transfer of skills to everyday life

In order to improve the transfer of skills even further, patients are encouraged to draw links between task performance and their lives outside the session, to reflect on those links and to carry out small behavioral tasks to implement what they have learnt. For example, reflecting on the geometric figures task, a patient might recall her detailed, perfectionistic approach to cleaning the house when she is expecting visitors. She might then reflect on whether this detailed approach is appropriate to the task at hand. Finally, she might implement the skills she has learnt in a small behavioral task. For example, she might practise not hoovering under the furniture and only hoovering visible parts of the floor. In this way, direct transfer is achieved.

Future perspective

Contributory roles of brain exercise & strategy learning in CRT

CRT for AN is a new and exciting development and there is much work to be done to harness its full potential. We imagine that within the decade we will have a better understanding of the basic mechanisms of CRT and, in particular, to what extent it works by enhancing basic brain processes in the development and refinement of neural connections, and to what extent it works by teaching patients strategies, thus laying the emphasis on learning. The answer to this question has implications for how training programs are designed. If repeated practice is necessary, multiple sessions of reasonable proximity are perhaps indicated. If strategy learning is sufficient then, given the above-average intelligence quotient (IQ) of this patient population, fewer sessions may be sufficient. We hypothesize that both brain exercise and strategy learning will be components of CRT in AN, but which applies will depend in part on the skill to be developed and in part on the patient group targeted.

Learning gistful processing versus practising flexibility?

Gistful processing, we suggest, is more amenable than flexibility to conscious learning because to process for gist is a clear strategy that can be consciously applied. Flexibility, on the other hand, is not so much a strategy as a measure of responsivity. It involves responding appropriately to shifting environmental contingencies, and it is not clear how this can be under a person's intentional control in the same way as gistful processing. The general principle of 'do it differently', which we teach our patients in sessions (encouraging them, for

example, to try a new route home), is an effort to turn flexibility into a strategy. Ultimately, however, the aim is to get patients to shift strategy in response to environmental shifts, and not simply to shift strategy for no specific and directed purpose. Encouraging them to break their routines is therefore only a step on the way to this ultimate aim. Whereas we suggest that gistful processing is more amenable to strategy teaching than flexibility, we also suggest, by the same logic, that repeated practice on flexibility tasks (but not on gistful processing tasks) may be crucial to the ultimate aim of increasing a patient's responsivity to shifting environmental contingencies.

Clinical severity & intensity of the intervention
Notwithstanding the comments of the previous paragraph, we suggest that, in the case of the most severely ill patients, repeated practice may be useful on the gistful processing tasks as well as the flexibility tasks, if only to increase the patients' chances of appreciating the significance of the ability. Severe weight loss leads to poor concentration [38], and these patients may therefore find it harder than out-patients to learn the strategy and appreciate its importance.

Role of neuropsychological & clinical assessment in CRT

In the near future, we envisage that CRT will be neatly tailored to an individual's cognitive and clinical profile. Our unpublished data has shown us that not all individuals have deficits on both flexibility and gistful processing, and that some do not have deficits on either. This information, in combination with clinical assessment indicating the severity of the illnesses, will make it possible to tailor the interventions to suit the needs of the individual patient.

For the less severe patients, we are in fact already piloting an out-patient intervention at the Maudsley that we call neuropsychological feedback rather than cognitive remediation. This therapy, which also targets cognitive flexibility and gistful processing, consists of three rather than ten sessions: an initial neuropsychological assessment, a feedback session and a follow-up session. In addition to being shorter, it does not involve the intensive use of exercises that characterize cognitive remediation therapy. It therefore lays the emphasis on learning as opposed to in-session practice. As we have discussed, this approach, which seems better suited to the less severe patients, may also be better suited to remediating gistful processing than cognitive flexibility.

In the next decade, we believe that hybrid interventions will emerge that combine elements of neuropsychological feedback (which is focused on straightforward learning) and cognitive remediation (which is focused on both learning and intensive practice).

CRT & CBT

We suggested at the start that CRT might improve the daily lives of patients. We also hypothesize that it will have an indirect impact on symptoms by facilitating the effectiveness of the standard psychological interventions and, in particular, CBT. There are various reasons why CRT is a promising pretreatment for, or an add-on to, CBT in patients with AN. Comparing CRT and CBT, and examining the relationship between them, should help to elucidate why this is so.

CRT as a pretreatment to CBT I

First, our clinical experience along with published and unpublished patient feedback has taught us that a key benefit of CRT is that it is more accessible and appealing to patients than other psychological interventions, and this includes the most severely ill patients who are the target of the CRT program [18–20]. This is largely because, unlike CBT, CRT does not address the core symptoms of the eating disorder and involves affectively neutral material. Patients with AN are characteristically avoidant of emotions [17] and CRT is therefore appealing because it provides a non-threatening environment for them. Even if a patient raises an emotional topic in the session, the tasks provide a focus that naturally curtails the possibilities of exploring such topics. Moreover, the tasks are fun and engaging, and provide a distraction for patients from their characteristic pre-occupation with food, weight and exercise.

CRT as a pretreatment for CBT II

Second, the tasks are relatively simple and the sessions relative short (usually 30 min long). This means that they are not an excessive strain on concentration, yet can improve concentration. It also means that patients experience a sense of achievement relative to the tasks, which improves their general self-esteem and self-efficacy. CBT, on the other hand, is not structured to provide the predictable and frequent sense of achievement that the CRT tasks provide. By contrast, it is also a comparatively complex therapy, and the most severely ill patients may suffer problems in concentration that limit the benefits they can gain from it.

CRT as a pretreatment for CBT III

Third, the gain from CBT should increase with improvements in concentration, and with improvements in cognitive flexibility and gistful processing. The ability to hold multiple perspectives, and to move between two or more – to shift set, that is – is important for cognitive therapy. A thought challenge, for example, involves evidence-gathering for two different perspectives. Equally important for cognitive therapy is the ability to achieve a global perspective on a problem or event. If someone believes themselves personally responsible for an event – and if this is a target of cognitive therapy – then a global view would be essential to generating a list of other contributing factors in order to challenge the belief. In other words, the logical processes, which are the target of CBT, are underpinned by the more basic processes that are the target of CRT.

CRT as a pretreatment for CBT IV

Fourth, CRT gives patients the opportunity to experience a positive therapeutic rapport at a time when they may not yet be well enough to manage the complexity and intensity of CBT and psychodynamic interventions. Like the Maudsley model of CBT for AN, CRT is delivered according to the principles of motivational interviewing as developed by Miller and Rollnick and applied to the treatment of substance addictions [39]. It is a key component of the motivational style that the therapist aims for equality between her/himself and the patient – something that is particularly easy in CRT since both therapist and patient can take it in turns to direct the tasks. The therapist also seeks as far as possible to allow the patient's own words to provide the starting point for therapeutic explorations. In the context of CRT, this means inviting the patient to reflect on their approach to the tasks, and on how the skills that they use in the tasks might be transferred to their daily lives. Finally, the therapist adopts a warm and positive stance, and offers the patient frequent encouragement. Our analyses of patient letters has demonstrated how these nonspecific aspects of the therapy are appreciated by patients [20].

CRT as a pretreatment for, or add-on to, CBT

As well as teaching skills that are useful for CBT, and enabling patients to benefit from a positive rapport, CRT can be developed to overlap with CBT. In particular, the reflection on real-life scenarios, which is an aspect of

CRT, may generate a discussion of a patient's beliefs regarding a particular information processing style. A patient might, for example, endorse her detailed, perfectionistic approach and she might hold a negative belief about changing it. A discussion may then follow regarding everyday contexts when this perfectionistic approach makes life difficult for the patient. When CRT involves this form of reflection, it is targeting the content of thought, and not just the processes underpinning it. This, of course, is what is classically targeted in CBT. The following quote from unpublished work by Whitney and colleagues on patient feedback illustrates the point:

One of the patients who participated in the intervention (pseudonym Jennifer) commented, "I can see now that getting things right all the time, is not always fun, as I just end up having to work harder to get the task right." Here, Jennifer has modified her belief about the benefits of getting things right. In addition, Jennifer has developed a positive belief about perspective-taking: "I have come to understand that things are not always as they seem. There may be two sides to every story ... I have now learned to stop and listen and think about what the person is saying as I am not always going to be right all the time".

Behavioral tasks in CRT may also reflect the principles of CBT. They are in part a method for ensuring transfer, but they may also alleviate a patient's anxieties about the consequences of implementing their new skills, and arm them with positive experiences concerning the consequences of change.

These similarities between CRT and CBT bring to light the fact that the deficits patients exhibit in basic cognitive processes interact with their higher-level beliefs. Patients do not only exhibit inflexible cognitive processing, they are also afraid of change. Patients do not only exhibit a detailed processing style, they are also afraid of making mistakes. The implementation of flexibility and gistful processing in their lives therefore involves not only the training of the relevant cognitive circuits and teaching them strategies, it also involves addressing their beliefs about the threat of change and the importance of getting things right.

Incorporation of CRT within existing services

In the foregoing speculations, we have suggested that CRT has a place in both in- and out-patient services. In an in-patient setting, CRT may be a necessary first step before the patient can benefit from cognitive and psychodynamic therapies. One of the great advantages of CRT in this setting is that it does not require expert psychological involvement and nurses can therefore be trained to deliver it. The practical benefits of this are obvious. In an out-patient setting, on the other hand, patients may already be able to benefit from cognitive psychological therapies. In this context, CRT is better seen as an add-on rather than a prerequisite, and it is likely that a far less intensive form of it will be required. Finally, hybrid versions of intensive and brief forms may be appropriate according to the particular cognitive and neuropsychological profile of patients.

Executive summary

- Anorexia nervosa (AN) has high levels of morbidity and mortality, yet the evidence base for existing treatments is poor.
- Cognitive remediation therapy (CRT) is a promising new intervention based on neuroscientific research. It targets the cognitive deficits found in AN in order to alleviate symptoms and improve general functioning.
- The deficits are cognitive inflexibility and an excessively detailed information processing style, with neglect of the gestalt.
- There is evidence for the benefits of CRT in the treatment of obsessive-compulsive disorder and schizophrenia, and preliminary evidence for the benefits of CRT in the treatment of AN.
- CRT is hypothesized to work by:
 - The training of basic brain processes through the proliferation and refining of neural connections.
 - The teaching of more adaptive strategies.
- In the next decade, we predict that CRT will become established in both in- and out-patient settings. In in-patient settings, a more intensive version will be delivered by nurses as a pretreatment for cognitive and other psychological treatments; in out-patient settings, a brief version will be integrated into cognitive and other psychological treatments.

Conclusion

AN is a disabling and intractable disease for which few evidence-based treatments exist. Pharmacological approaches have not yet been proven to work, and psychological – including family-based – interventions are often too challenging for the most severely ill patients. CRT, of proven efficacy in schizophrenia, is a promising new treatment for the severe end of the spectrum of

AN but may also be of benefit to the mild end of the spectrum. It is a model of the translation of basic neuropsychological research into clinical practice. By improving concentration, boosting self-esteem and improving the flexibility and gistful processing of patients, it is hoped that it will not only bring direct benefits to patients, but that it will also facilitate the benefits of the more complex psychological interventions.

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