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Cognitive and affective remediation training for mood disorders

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Mood disorders are associated with clinically significant impairments and abnormalities in executive functioning, working memory, processing speed and responses to emotionally evocative stimuli. Such features can persist between mood episodes, affect the return to full functional recovery and influence the likelihood of future relapse (Schmid and Hammar, 2013). Cognitive difficulties are often cited as impairing and persistent by patients with mood disorders. However, currently available pharmacological and psychotherapeutic treatments have limited effects on these cognitive impairments and abnormalities, with several studies suggesting that for many patients there are ongoing and significant impairments and abnormalities after recovery of mood symptoms.

Considerable research has been conducted into cognitive training programs, using intensive rehabilitative practice of specific cognitive and emotional functions, e.g. in schizophrenia, and to address cognitive decline with aging. This research has received increasing attention in the media and by the lay public, with patients now sometimes using commercial 'cognitive exercise' programs before seeking more formal care. The focus of this paper is on

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therapies targeting cognitive dysfunction in mood disorders; many of these have been adaptations of strategies used in schizophrenia, and others were developed to target specific mechanisms of depression. As a group of therapies, we have here called them cognitive and affective remediation training (CART). Here, we address several issues in the development and application of these therapies.

What are potential targets for CART?

Specific networks

In an acute episode of depression, strengthening or weakening specific brain networks by repetitive exercises may target cognitive and affective information processing mechanisms, ideally specific neural substrates that underlie mood symptoms. For example, neuroimaging studies suggest there is decreased recruitment of executive control networks, including regions such as the dorsolateral pre-frontal cortex (DLPFC), in depression. Preliminary studies suggest that practicing particular tasks designed to increase recruitment of this area normalizes reactivity to cognitive tasks and has positive effects on depressive symptoms and rumination (Siegle et al., 2014). However, there is little further evidence at this stage regarding specific effects of practicing other tasks on brain circuitry, and this is an area in which further research would be useful in order to generate further hypotheses.

Generalized functioning

Despite persistent cognitive and affective abnormalities, individuals who have recovered from depression are expected to function at a premorbid level at work, in family and in social settings. Inability to meet with these expectations can promote negative experiences, relapse and recurrence. Targeting multiple cognitive and affective domains thought to underlie a wide range of symptoms may thus improve function, affecting qualities from self-representation to rumination, ideally reducing the risk of relapse. In this case, CART may involve practicing a wide range of tasks, potentially in the context of other ongoing forms of therapy. Theoretically, CART and therapy could interact to support generalization and increase opportunities to engage in cognitive and social activity, though the incremental utility of this approach has not yet been empirically demonstrated.

What exercises should be performed?

One approach is to measure the patient's cognitive and emotional functioning, yielding a 'profile' before treatment, and to develop a personalized exercise package focused on relative deficits and abnormalities. The goal would be to practice exercises designed to strengthen areas of relative weaknesses, or to capitalize on relative strengths for a given individual. While this approach may be ideal, it relies on population norms to give information about 'normal' performance. These norms exist for the majority of cognitive tests, but not yet for many assessments of emotional information processing. Where pre-morbid testing is available, it may also be possible to target areas in which there has been a demonstrable and significant decrease in performance.

Thus, an alternative approach is typically used which targets areas of the brain or cognitive/affective functions thought to be impaired in mood disorder. This has led to many

hypothesized targets for cognitive remediation in the mood disorders. For example, the DLPFC is a canonical region in which functional abnormalities are associated with mood disorders across multiple neuroimaging studies. Preliminary studies, as noted, have successfully increased DLPFC reactivity by practice of cognitive tasks, and these have shown promising results in reducing mood symptoms. Abnormalities in attention to emotional stimuli have also been shown in major depressive disorder and have strong conceptual links to the high rates of anxiety, as well as social dysfunction and withdrawal observed in depression. Although findings have been mixed, some research indicates that programs designed to help individuals disengage from excessive attendance to negative stimuli, increase attention to positive stimuli, or to reduce tendencies to interpret stimuli in an overly negative fashion, reduce symptoms, reduce overly negative thought styles and affect neural reactivity to negative stimuli (Beevers et al., 2015). Still other researchers have focused on cognitive deficits, such as verbal learning, that appear most robustly related to mood disorders (Demant et al., 2015).

How should CART be delivered?

Format of delivery is potentially diverse, with varying degrees of therapist input. Some programs are offered online (some commercially, with no relationship to treatment services), some supplement online practice with online therapist input and others are offered within individual or group therapy formats. Formal comparisons showing superiority of one method of administration over others are largely lacking. Treatments involving mainly independent cognitive practice, with no clinician input are certainly appealing given the relatively low cost. In severe or complicated cases, however, skilled therapists may be able to help patients more fully realize the benefits of these types of treatments. For example, depression inherently involves reduced motivation, and achieving a necessary level of practice may be difficult. Titrating programs to avoid repeated failure and yet, promoting growth may also increase motivation. Skilled therapists may be able to help set expectations, reinforce incremental progress and help clients restructure extreme cognitive responses to failure in groups or individual therapy. However, we note that determining the optimal process of therapy will require considerable further research.

Should CART be paired with other forms of psychotherapy or rehabilitation programs?

Evidence in schizophrenia suggests that the benefits of cognitive remediation are greater when combined with therapies such as social skills training or occupational therapies. Conjoint therapies might help an individual apply new cognitive skills in other areas such as social and occupational functioning.

Cognitive deficits, such as problems in executive function, may predict poor response to other therapies. For individuals with demonstrated cognitive impairment, a subjective sense of cognitive impairment or poor clinical response and general functioning, CART techniques might improve rates of response, and should be considered in combination with traditional therapies. The authors of this paper have used CART as an adjunct to a variety of therapies in a variety of clinical situations. For example, CART has been used as an adjunct to

cognitive behavioral therapy for treatment resistant depression, with behavioral activation therapy for inpatient depression, with interpersonal social rhythms therapy for bipolar disorder and together with an occupational rehabilitative approach involving the translation of cognitive activities into strategies in particular occupations (Bowie et al., 2016).

Recommendations

Research on CART is growing, and there are many unanswered questions. The best validated approach to treatment of mood disorders remains a combination of pharmacotherapy with evidence-based psychotherapy, but, patients are increasingly aware of the possibility of 'brain training', and many are actively seeking these tools. Given this disjuncture between public need and perception and current research evidence, there is a need for guidance regarding recommendations for clients. We hope that the following preliminary recommendations will be helpful to clinicians and patients:

1. **Bringing mechanism into treatment:** It may be helpful to acknowledge cognitive concerns raised by patients and to explain neural and cognitive aspects of depression. It may also be helpful to note that, for some patients, cognitive problems recover as mood symptoms remit, but that CART approaches might help maximize recovery; CART approaches may be helpful even in remission for those who experience residual cognitive symptoms.

2. **Tailoring treatments:** If patients report cognitive problems, particularly if they persist into relative euthymia, a neuropsychological examination may be helpful. Tailored cognitive exercises may then be used to target identified cognitive dysfunction. Patients and caregivers may also benefit from suggestions regarding compensatory strategies to deal with cognitive dysfunction which is clearly impeding function at work, school or home.

3. **Disseminating CART:** Psychiatric services may benefit from training psychologists or other professionals in the availability and use of CART software and strategies, particularly for patients who are experiencing severe cognitive deficits, to improve patient access to these treatment modalities.

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References

Beevers CG, Clasen PC, Enock PM, et al. (2015) Attention bias modification for major depressive disorder: Effects on attention bias, resting state connectivity, and symptom change. Journal of Abnormal Psychology 124: 463–475. [PubMed: 25894440]

Bowie CR, Grossman M, Gupta M, et al. (2016) Action-based cognitive remediation for individuals with serious mental illnesses: Effects of real-world simulations and goal setting on functional and

vocational outcomes. Psychiatric Rehabilitation Journal. Epub ahead of print 21 April 2016. DOI: 10.1037/prj0000189.

Demant KM, Vinberg M, Kessing LV, et al. (2015) Effects of short-term cognitive remediation on cognitive dysfunction in partially or fully remitted individuals with bipolar disorder: Results of a randomised controlled trial. PLoS ONE 10: e0127955. [PubMed: 26070195]

Schmid M and Hammar A (2013) A follow-up study of first episode major depressive disorder. Impairment in inhibition and semantic fluency-potential predictors for relapse? Frontiers in Psychology 4: 633. [PubMed: 24062714]

Siegle GJ, Price RB, Jones NP, et al. (2014) You gotta work at it: Pupillary indices of task focus are prognostic for response to a neurocognitive intervention for rumination in depression. Clinical Psychological Science 2: 455–471.