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OPINION

Interventions for major depressive disorder: the role of automatic emotion regulation

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Insufficient inhibition of negative emotions is considered by researchers as the cause of the major depressive disorder (MDD) [1] and a main result of cognitive control deficits in the prefrontal cortex and dysfunctional reward processing in the striatum [2]. Compared with the healthy group, patients with MDD showed abnormal functional connectivity (FC) in emotion regulation, for example, the FC of the prefrontal-limbic system is decreased, and the FC of the prefrontal–striatum is increased. The former may be more related to the dysregulation of negative emotions, while the latter is thought to have a negative impact on the processing of positive emotions [2]. Currently, a decrease in positive affect and an increase in negative affect are seen as the main hallmarks of MDD. Researchers point out that this is due to the maladaptive beliefs of patients with MDD that emotions are uncontrollable, leading to less use of adaptive regulatory strategies [3]. Consistent with this view, the biased cognitive evaluation processes have been regarded as a central issue in depression and its related deficits in emotion regulation [4].

Studies have shown that patients with depression use more emotion regulation strategies such as inhibition and rumination rather than adaptive strategies such as reappraisal and acceptance [3, 5]. However, although patients with depression have deficits in actively regulating emotions, they can achieve the same effect as healthy individuals when they are instructed to perform emotion regulation strategies (such as reappraisal) [5], suggesting that people with depression are only less proficient in prompting the use of an adaptive strategy, not the ability to implement them [6]. Since reappraisal has always been regarded as a key strategy in emotion regulation, it can produce favorable outcomes in

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eliciting positive emotions and reframing the interpretation of negative events [3]. Therefore, changing the tendency of patients with depression to spontaneously use adaptive strategies (e.g., spontaneous use of reappraisal strategies) will become an effective depression intervention.

Based on the above problems, automatic emotion regulation (AER) provides a new idea for depression intervention. AER refers to goal-driven changes in any aspect of emotion that do not require conscious involvement, attention to the processes of emotion regulation, or deliberate control [7]. Therefore, AER should be used to realize emotion modulation without much cognitive depletion. Accordingly, it could be a promising method for mood rehabilitation in depressed individuals characterized by cognitive control deficits.

The training of AER may be carried out by instructing individuals to learn reappraisal by implementation intention (RII). RII needs individuals to form a goal intention (emotion downregulation) and a goal-directed if–then plan (reappraisal-based implementation intention) [8]. It was indicated that RII significantly decreased negative emotion after watching disgusting pictures, accompanied by smaller parietal late positive potential (parietal LPP, an index of emotion intensity) [9,10]. Compared with the control group, the group with RII was associated with decreased FC intensity in the putamen and fronto-parietal network, suggesting less involvement of cognitive control mechanisms [8]. Furthermore, there was no increased activity in brain regions associated with cognitive control (bilateral dorsolateral prefrontal cortex and dorsal anterior cingulate cortex) or negative emotion evaluation, expression, and regulation (medial prefrontal cortex and ventromedial prefrontal cortex) during RII compared to watching conditions [8]. This means RII can reduce experiential emotion and emotion-related brain activity without enhancing subjective effort or control difficulty.

In addition, implicit priming of regulatory strategy can bring new inspiration for AER. Emotion regulation based on implicit priming works through implicit establishment of regulatory strategies or goals, thus it is not as straightforward as implementation intention. However, it does not require the establishment of implementation intentions or consume cognitive resources, which may be more effective for patients with depression who have deficits in cognitive control. This regulatory strategy with calmness-related priming did not increase the cognitive cost, which was evident in similar or smaller fronto-parietal control network activations during implicit priming relative to watching conditions, but significantly decreased activity in the left amygdala and left insula [11]. Implicit reappraisal based on the word-matching task showed that implicit reappraisal was even better than explicit reappraisal in depression intervention, reflected in the smaller parietal LPP [12].

Taken together, future research needs to be focused on the intervention effect of reappraisal by implementation intention and implicit reappraisal. Also, there is evidence that brain stimulation methods, such as transcranial direct current stimulation, may be used to improve the effect of cognitive therapies on depression [13]. Thus, the use of brain stimulation protocol for the enhancement of cognitive regulation effects needs to be further addressed, including that of implicit regulatory strategy. Lastly, how to apply laboratory results to the intervention of patients with clinical depression, as well as the recovery effect of patients after such interventions, require further investigation.

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