Neuropsychological Mechanisms and Evidence of Mindfulness-Based Interventions for Addiction

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Abstract. Mindfulness meditation is a contemplative practice that involves focused attention and open monitoring. Due to its effectiveness in emotion regulation and attention regulation, mindfulness-based interventions combine mindfulness and other cognitive and behavioral practices to treat substance abuse and behavioral disorders. This article focuses on the neuropsychological mechanisms and empirical research of mindfulness-oriented recovery enhancement (MORE) and mindfulness-based relapse prevention (MBRP). MORE is a cognitive-behavioral treatment that uses mindfulness to cultivate reappraisal and savoring skills. MBRP is another cognitive-behavioral treatment that incorporates mindfulness meditation and core components of relapse prevention. It analyzes the neural mechanism of addiction, mindfulness, and mindfulness-based interventions. Moreover, it provides empirical research evidence of MORE and MBRP, proving that these two are effective treatments for addiction-related problems, including substance abuse and behavioral disorders.

Keywords: Mindfulness-based interventions; MBRP; MORE.

1. Introduction

1.1 Mindfulness Meditation

Mindfulness meditation, rooted in Buddhism, is a contemplative method that emphasizes concentrating on the present moment non-judgmentally and purposely. Mindfulness meditation involves focused attention (FA) and open monitoring (OM; i.e., receptive practices). FA includes focused, sustained attention on an internal or external object of attention, and OM involves a comprehensive and open approach to noting experiences as they occur. Mindfulness meditation is a method that aims to alter people's relationship with their thoughts and emotion instead of changing them.

1.2 Mindfulness-based Interventions (MBI)

MBIs prevalently employ in treating depression, anxiety, chronic pain, and addictive disorders. Mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR) were largely studied and used to treat depression and anxiety, demonstrating that mindfulness helps build disconnected connections with thoughts and emotions. Also, researchers developed MBIs for addiction, including mindfulness-oriented recovery enhancement and mindfulness-based relapse prevention. They intend to treat addictive disorders, including substance use disorders and internet gaming disorders. Mindful breathing and body scan practices (concentrating awareness on feeling throughout the body) are two important techniques in MBIs for addiction.

1.3 Mindfulness-Oriented Recovery Enhancement (MORE)

MORE uses mindfulness meditation to cultivate reappraisal and savoring skills. It adopts the Mindfulness-to-Meaning theory, which suggests a causative relationship between positive emotions and mindfulness, and mindfulness reframes life experiences' meaning. More specifically, the mission of MORE is to shift sustained attention from drug-related cues to other natural rewards. For example, MORE leads patients to decrease their reactivity to the drug use tool to delicious food.

1.4 Mindfulness-Based Relapse Prevention (MBRP)

MBRP combines mindfulness meditation and core elements of relapse prevention (RP). Mindfulness practices in MBRP focus on embracing all cognitive, physical, and emotional conditions. Its core mechanism is non-judgmental thinking, that craving thoughts are "just thoughts" instead of stable facts. RP component in MBRP aims to prevent the first lapse, stay abstinent, and offer lapse managing that prevents future relapse if a lapse occurs. Also, RP is founded on the cognitive-behavioral theory of addiction, indicating that a successful coping strategy increases self-efficacy when one faces a high-risk circumstance and lowers the likelihood of relapsing.

In conclusion, mindfulness as a contemplative method focuses on attention regulation and acceptance practices. Integrating mindfulness and other elements, mindfulness-based interventions like MORE and MBRP can be used to treat addictive disorders. This review paper presents neuropsychological mechanisms and empirical evidence of MORE and MBRP.

2. MORE Intervention

MORE typically involves eight sessions of 2-hour-group intervention. Participants are also asked to commit to daily 15-minute mindfulness practice at home with recorded guidance. MORE combines techniques including recognizing and altering inappropriate thoughts, mindfulness training, and positive psychology. MORE aims to develop awareness and coping skills to help participants reduce cravings. Specifically, for the awareness part, participants are trained to be present, to strengthen attention, to increase awareness of feelings and thoughts of self and other people, and to increase awareness of the addiction-action schema. Coping skills include nonreactivity to negative thoughts and emotions, reappraising stressful events, acceptance of thoughts and feelings, coping with cravings, addiction triggers, anxiety and negative emotions, and interpersonal stress. MORE is also prevalent in treating patients with persistent pain who are prescribed long-term opioids. The intervention in treating chronic pain patients integrate more specific training, including pain discrimination and coping with pain experiences.

3. MBRP Intervention

MBRP practices, based on MBSR and MBCT framework, are implemented for eight sessions of 2-hour group meetings each week. These sessions typically include 20 to 30 minutes of guided meditation, exercises aimed at awareness of cravings and triggers, discussion about acceptance of thoughts and emotions, identification and coping skills in high-risk situations, and social support. The practices include body scan techniques, breathing space practices, mountain meditation, and training to expand awareness of hearing, seeing, and triggers.

4. Neural Mechanisms

4.1 dopamine rewards

Addiction leads to neuroplastic alterations in executive function, stress, and reward systems. Substance usage causes the ventral striatum to emit opioid peptides and dopamine, mimicking the release of dopamine brought on by phasic dopamine firing. As a result of conditioned reinforcement, substance users may link environmental cues with the exhilaration caused by drugs when they use drugs (i.e., the specific settings or equipment when they use substances and the people they use with). As a result, incentive salience—defined as the desire for rewards resulting from one's physiological condition and previously learned associations concerning a reward cue (regulated by the mesocorticolimbic dopamine system)—is generated. Substance use behaviors may be compulsive, meaning people may make decisions based on their physiological need instead of their subjective wills. Eventually, chronic substance use results in dysregulation in reward systems, making natural

rewards less reinforcing, and substance users feel less joyful and motivated when pursuing natural rewards. The significant amounts of dopamine released due to environmental cues gradually exceed the amounts of regular release of dopamine and result in the craving for substances. Chronic drug abuse also dysregulates important nodes in brain circuits supporting executive function (i.e., the dorsolateral and ventrolateral prefrontal cortex and anterior cingulate cortex). Substance abuse disconnects executive function areas and reward systems, which conduces to craving and compulsive drug-seeking behaviors.

4.2 Meditation neural mechanism

From the cognitive perspective, mindfulness contributes to changes in motivation, attention, emotion, memory, sociality, and self-appraisal. Mindfulness enhances the ventral posterior medial cortex (vPMC), right temporoparietal junction (TPJ), and cortical midline structures (CMS), which are all considered attention-related neural circuits. Moreover, mindfulness impacts the default mode network (DMN), reducing inadequate self-thoughts.

4.3 MBI effects

The brain networks that support metacognitive attentional control (i.e., the parietal cortex, dorsal anterior cingulate cortex, and dorsolateral prefrontal cortex), in addition to the connections between these networks and the brain regions responsible for automaticity, memory consolidation, interoception, and hedonic regulation, are all improved by mindfulness-based interventions, according to the model developed by Garland et al. In order to boost goal-directed, healthy behaviors and decrease desire and negative thoughts, individuals may be able to self-regulate addictive impulses and change reward pathways with improved functional connectivity within and across various brain networks.

5. Research Evidence of MORE

A randomly controlled research with 135 participants shows that MORE causes lower responsiveness to drug cues and a greater ability to adapt to natural and drug reward cues. The amount of mindfulness practice time was negatively correlated with late positive potential (i.e., tested by EEG) opioid cue reactivity, savoring practice time was negatively correlated with desire during up-regulation of responding to reward cues, and mindful breathing practice time was positively correlated with the ability to moderate late positive potential responses to natural reward compared to drug reward. This is also consistent with the restructuring reward theory put out by Garland et al., which contends that using mindfulness techniques may change how intensely people value drug-related rewards in favor of natural pleasures.

Another randomly controlled research of MORE is targeted at internet gaming disorder treatment. After the 8-week MORE intervention, participants were found to have less craving for video games and decreased negative thoughts and emotions correlated with video game playing than the support group control condition. Decreased craving thoughts and behaviors resulted in the enhancement of participants' awareness of triggers and methods to cope with cravings through mindfulness and reappraisal practices.

Thus, MORE is effective in regulating responses to drug reward cues and decreasing drug-cue reactivity. Reappraisal and savoring skills enable the participants to disconnect drug-related cues with pleasure, which leads to the reduction of craving thoughts and behaviors.

6. Research Evidence for MBRP

Currently, there have been several studies about the effects of MBRP on other substance users, both short-term and long-term. According to Bowen et al., the MBRP group showed a 54% lower probability of relapsing into drug use than those who received therapy as normal. MBRP group had

31% fewer days of substance use than the Relapse Prevention group in the 12-month follow-up, demonstrating MBRP's efficacy over a reasonably extended time.

Abed and Shahidi's randomized-control study demonstrates that in the MBRP group, only 9% of participants still used heroin after a month, compared to 23% of participants in the treatment-as-usual (Methadone Maintenance Therapy) group used heroin. Additionally, the MBRP group scores much lower on the Heroin Craving Questionnaire's measures of desire and intention to use, indicating the short-term benefits of MBRP. However, since only adult males were included in this study, the results were not representative of other communities. In the future, researchers can try to use a larger and more diverse sample size to make the results more inclusive.

These pieces of evidence show that MBRP is a credible treatment for decreasing craving thoughts and relapse. As participants are trained to enhance the acceptance and awareness of their emotions and thoughts, they may thus develop skills to have more awareness of craving, treat craving as merely a physical state, and not feel guilty about craving thoughts or lapses.

7. Conclusion

Overall, mindfulness-based interventions like MORE and MBRP are both effective treatments for addictive-related disorders, including substance use disorders and internet gaming disorders. Since both MORE and MBRP adopt mindfulness meditation, the coping skills for craving in these two interventions are similar. The difference between these two treatments is that MORE focuses more on the cultivation of reappraisal skills, while MBRP focuses more on the prevention of relapse. MORE targets to help patients with addiction-related disorders refrain from addictive behaviors and cues. However, MBRP aims to prevent relapse among abstinent patients. Thus, MORE and MBRP are implemented in different clinical conditions. Future studies could conduct empirical research about the difference in the effectiveness of MBRP and MORE. Also, researchers could include a larger and more diverse (i.e., different genders, ages, races, etc.) sample and conduct longitudinal research about MBIs for addiction in the future.

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