

## Editorial: Brain Stimulation and Methamphetamine in Iran: A Debate in the Most Populous Persian Gulf Country



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**M**ethamphetamine dependence has been known as a serious health problem in a large proportion of illicit drug users in Iran [1]. Compared with the opium problem, methamphetamine dependence is a new epidemic concern in Iran [2].

The prevalence of methamphetamine dependence is associated with crucial health problems such as poor psychological well-being, social dysfunction, craving, and a higher rate of addiction severity [3, 4]. This issue necessitates professional attention to the rehabilitation of methamphetamine users and treatment of craving [5-8]. To date, few research studies have been conducted on this health concern.

Studies in Iran indicate that methamphetamine craving shows resistance to treatment [8]. While few pharmacological treatments have been found to be effective [9], motivational interviewing, matrix model and cognitive-behavioral therapy have been all evaluated in Iran to treat methamphetamine craving [7, 10, 11]. However, the treatment effects need to be more long-lasting [5, 12].

Previous studies show that methamphetamine users lapse and relapse for a variety of reasons include “pleasure-seeking”/“impulsivity”/“habits”/“pain avoidance”/“craving”/“bad feelings eliminating such as boredom & loneliness” which have a strong neurological

basis in the central nervous system and emotions and decisions that result from them. Thus we should use a range of different modalities to treat and prevent relapse [13].

Recently, a study has been published by Rohani Anaraki and colleagues in Iranian Rehabilitation Journal [14]. Repeated transcranial Direct Current Stimulation (tDCS) was implemented on the brain cells of 30 men with methamphetamine dependence. Five sessions of treatment vs. a sham condition were conducted. Methamphetamine craving was measured on a Visual Analog Scale (VAS). The study findings indicated that tDCS was effective in reducing self-reported craving in the treatment group while no significant changes were reported by the control group [14]. The study results are important; first because there are few similar research studies on tDCS in Iran [15-18]. Second, the results may be promising as a new treatment modality for Iran. It may address an important epidemic health problem in Iran.

As mentioned earlier, methamphetamine users relapse for various reasons, and tDCS can be efficient in many of them. For example, some relapses are caused by problems in emotion regulation and decision making. We know that emotion regulation training reduces drug use craving [19], on the other hand, tDCS can modulate behaviors that result from emotion regulation and decision making [20]. Isn't it better to use these two approaches

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together? Will not get better results? Another example is impulsivity, which is believed to be one of the main causes of relapse and many psychotherapy interventions have been designed to control impulsivity [13]. At the same time, a positive effect of tDCS on impulsivity was reported by 74 out of 92 articles in the systematic review of previous studies [21]. Drug-related attentional bias is also known as the cause of substance use, the development of addiction and relapse [22]. Interestingly, tDCS is also effective in this case and reduces attentional bias [23]. The results of such studies should be applied to methamphetamine-treated users.

And finally, craving which is one of the most common causes of relapse in methamphetamine users [24]. The tDCS has been identified as a new treatment modality for reducing methamphetamine craving in Iran [14-16] and it can be very effective and important, because it activates some brain cells and specific regions in the central nervous system [14]. The relapse of Methamphetamine abuse has important origins in the brain system [24]. Therefore, the direct activation of some regions in the brain may have direct and long-lasting treatment effects and tDCS may act as a direct therapeutic option for those patients who show resistance to methamphetamine treatment. If the direct activation of some brain cells and regions can reduce methamphetamine craving, it may be introduced as a treatment modality to the drug treatment system. This type of treatment is affordable, easily implemented and practical in drug treatment settings. However, there are two main problems. Rohani Anaraki and colleagues' study effects are related to post-treatment and positive follow-up results have not been reported [14]. The sample size is small and the study design is not a large-scale one. Therefore, the findings may not be generalizable to other patients with methamphetamine craving. The study findings are effective at a research level and it is not obvious if the findings can be effective at a population level. However, other studies have reported a positive effect of brain stimulation on craving [15, 16, 18, 25]. Six-month, 12-month and 24-month follow ups are not part of the study design. Therefore, the longevity of the treatment effects needs further investigation in future studies. Replication of the finding is essential to be assured that the true treatment effects can be obtained in a large number of patients. In their study, all patients are male and it is not documented if gender differences can have an effect on treatment outcomes.

It should be noted that other problems also exist beyond Rohani Anaraki and colleagues' study. First, there are not many well-designed and well-conducted randomized trials to show the long-term treatment effects of

the tDCS. Second, it is not obvious if it is the best treatment modality available or it can be used as an adjunct treatment only. It is possible that a combination of pharmacotherapy with tDCS or psychotherapy with tDCS or all three leads to the best treatment results. Furthermore, it is not obvious how long the treatment effects may last and to what extent the effects will continue following the end of the treatment.

Some methamphetamine-using groups such as elderly people and people who report co-morbid mental health problems may not benefit from tDCS. Progressive, and degenerative neurological conditions that affect people's control of their body are likely to be another concern. For example, the tDCS may not be effective for methamphetamine-dependent people who report progressive brain problems such as brain tumours, Parkinson's disease and Alzheimer's disease. Some neurological conditions such as epilepsy and stroke may have a negative impact on implementing tDCS.

To conclude, Rohani Anaraki and colleagues' study findings are important and the study subject is novel in Iran. This study and a few other limited studies may open a new era of serious research on treating methamphetamine craving in Persian context. While there is no approved pharmacological treatment [26], non-pharmacological treatments such as tDCS remain as only available options for further research. However, large-scale randomized trials with long-term follow-ups and representative samples are needed to investigate the effects of tDCS on treating methamphetamine craving and other relapse causes. Such studies need to consider representative samples of patients and specific groups should also be considered in the study. Gender and age differences should be investigated during treatment and at follow-up assessments.

## Ethical Considerations

### Compliance with ethical guidelines

All ethical principles were considered in this article

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### Conflict of interest

The author declared no conflict of interest.

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