

Transcranial Magnetic Stimulation Efficacy for Smoking Cessation

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Abstract

Ú { [\ä] *ä•ä& [] •äâ^!^äâc@^ä|äæäi } *äæ~•^ä [-ä] !^ç^ } cæà|äâ^æc@äæ } ää&@! [] ä&äâ•^ä•^ä , [!ä , äâ^ÉäÖ^•] äc^ä•i* } ä , &æ } cä funding towards understanding the neurobiology of addiction and options for smoking cessation treatment, tobacco kills more than 8 million people each year. Extensive research and neuroimaging studies have helped identify the pathway and mechanisms of dependency, craving, and withdrawal, which allows for targeted treatment options. Current guidelines recommend a combination of pharmacological treatment with behavioural counselling for optimal success. However, research continues for innovative interventions. One option being pioneered for addiction treatment is use of transcranial magnetic stimulation (TMS) therapy. When targeting appropriate brain structures, TMS has been shown to neuromodulate the brain pathway associated with addiction. This review of recent literature and studies assesses the ability of TMS to reduce cravings, cigarette consumption, and abstinence.

INTRODUCTION

Nicotine addiction is a major public health problem, with approximately 1 billion people worldwide using tobacco products. Nicotine addiction is a chronic relapsing disorder, and it is the leading preventable cause of death and disability in the United States. The World Health Organization (WHO) estimates that tobacco use causes 8 million deaths each year. The pathophysiology of nicotine addiction is complex, involving both genetic and environmental factors. The primary mechanism of addiction is the activation of the mesolimbic dopamine system, which leads to the release of dopamine in the nucleus accumbens (NAc), a brain region involved in reward and motivation. This dopamine release is associated with the development of a conditioned response, where the act of smoking becomes associated with the pleasurable effects of nicotine. Over time, this leads to the development of a habit, where the individual craves and uses tobacco to avoid withdrawal symptoms. The withdrawal symptoms are caused by the decrease in dopamine levels when the individual stops smoking, leading to irritability, anxiety, and depression. The severity of withdrawal symptoms varies among individuals, and it is a major barrier to successful smoking cessation. Current guidelines recommend a combination of pharmacological treatment with behavioural counselling for optimal success. However, research continues for innovative interventions. One option being pioneered for addiction treatment is use of transcranial magnetic stimulation (TMS) therapy. When targeting appropriate brain structures, TMS has been shown to neuromodulate the brain pathway associated with addiction. This review of recent literature and studies assesses the ability of TMS to reduce cravings, cigarette consumption, and abstinence.

Transcranial magnetic stimulation (TMS) is a non-invasive procedure that uses magnetic fields to stimulate nerve cells in the brain. It is used to treat a variety of conditions, including major depressive disorder, obsessive-compulsive disorder, and chronic pain. In the context of smoking cessation, TMS is used to target the brain regions involved in addiction, such as the prefrontal cortex (PFC) and the nucleus accumbens (NAc). The PFC is involved in executive functions, such as decision-making and impulse control, and it is thought to play a role in the development of addiction. The NAc is a part of the brain's reward system, and it is involved in the development of habits and the experience of pleasure. By stimulating these areas, TMS is thought to disrupt the neural pathways that underlie addiction, leading to a reduction in cravings and an increase in abstinence. Several studies have shown that TMS is effective in reducing cravings and increasing abstinence in smokers. For example, a study by Brown et al. (2018) found that TMS targeting the PFC significantly reduced cravings and increased abstinence in smokers. Another study by Brown et al. (2020) found that TMS targeting the NAc significantly reduced cravings and increased abstinence in smokers. These findings suggest that TMS may be a promising intervention for smoking cessation.

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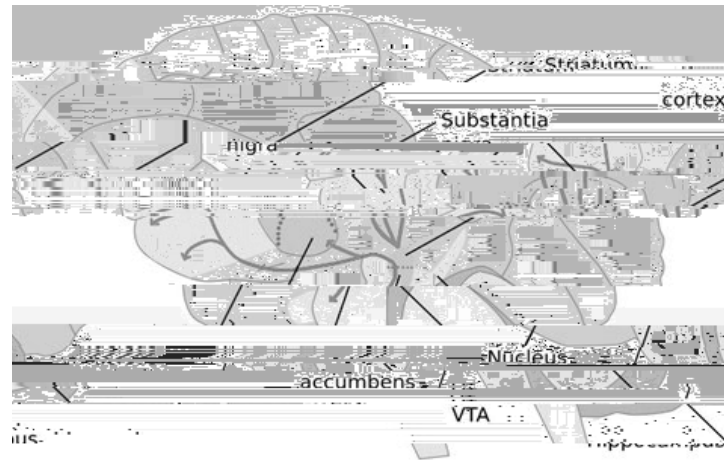


Figure 1: The brain reward center pathway.

Source: Brain rewards pathway. The Bryant Lab Addiction Genetics. Botson University



Interaction with the brain

Figure 2: TMS coil.

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