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Case Report

Initiation of Smoking After Electroconvulsive Therapy in a Non-Smoker Patient with Major Depression: A Case Report

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Abstract

Electroconvulsive therapy (ECT) is a well-established intervention for treatment-resistant major depressive disorder (MDD). Although the neurobiological ramifications of ECT, particularly in relation to the mesolimbic dopaminergic system, have been correlated with the modulation of reward and reinforcement pathways, the capacity of ECT to influence substance-related behaviors remains inadequately elucidated. We report the case of a 42-year-old Iranian woman with a 14-year history of treatment-resistant MDD and no prior history of tobacco or other substance use. Following a second session of inpatient ECT, the patient experienced a sudden and intense craving for cigarettes, leading to the immediate initiation of daily smoking. This pattern of tobacco use persisted for several years, despite multiple motivated attempts at cessation. The patient's psychiatric management included standard pharmacotherapy and supportive interventions, but ongoing nicotine dependence remained challenging. There was no personal or family history of substance use, and no exposure to smoking in the inpatient setting, aside from a shared room with a smoker in a different ward. To our knowledge, this is the first documented case of cigarette smoking initiation following ECT in a non-smoking patient with MDD. The case underscores the need for heightened clinical vigilance and further investigation into ECT's effects on addictive vulnerability and reward processing.

Keywords: Electroconvulsive therapy, Major depressive disorder, Smoking, Tobacco use disorder, Nicotine dependence, Craving

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Introduction

Electroconvulsive therapy (ECT) is a well-established and highly effective intervention for treatment-resistant major depressive disorder (MDD).[1] It is especially advantageous for patients manifesting severe symptomatology, encompassing psychotic characteristics or suicidal ideation.[2] Although ECT is predominantly regarded as safe and effective, its neurobiological ramifications on cerebral reward circuits remain intricate and are not yet comprehensively elucidated.[3] Emerging evidence suggests that ECT can modulate dopaminergic pathways, particularly within the mesolimbic system,[4] which plays a central role in reward processing, motivation, and reinforcement behaviors.[5]

Although a large amount of research has demonstrated that ECT is effective in reducing core depressive symptoms,[6] there are still few studies that explicitly examine how ECT affects addictive behaviors and addiction-related disorders, and those that exist have yielded conflicting findings.[7-10] While some studies have found no discernible benefit from ECT, others have suggested that it may help reduce addictive behaviors,[10] whereas others have found no significant benefit.[11] Notably, it is extremely uncommon for patients who have never had a substance use disorder to develop substance use or craving after receiving ECT, and to the best of our knowledge, this has never been reported in the literature. This emphasizes the necessity of taking into account the neurobiological underpinnings of substance use behaviors when assessing unexpected post-ECT outcomes.

Nicotine, the principal addictive substance in cigarettes, exerts its effects primarily by stimulating nicotinic acetylcholine receptors, which subsequently promote dopamine release in the nucleus accumbens, reinforcing its dependence-producing properties.[12] Although smoking is a common self-medication for people with depression, it is very uncommon for patients who have never smoked to start smoking or develop a craving for nicotine after receiving ECT.

Here, we report a unique case of an Iranian woman with no prior history of tobacco use who developed strong cigarette cravings and subsequently initiated regular smoking behavior following a course of ECT for major depression. This case raises important questions regarding the neurobiological effects of ECT on reward sensitivity and substance-related behaviors and highlights the need

for further investigation into ECT-induced modulation of addictive vulnerabilities.

Case Presentation

An MDD diagnosis was made for a 42-year-old married woman from northern Iran who had no history of chronic illnesses like diabetes mellitus, hypertension, cardiovascular disease, or endocrine disorders. She had been receiving pharmacological treatments, such as citalopram, sertraline, and nortriptyline, since 2010 and had a 14-year history of mental health issues. According to the statements of patient and her family, the patient had persistent depressive symptoms, including low mood, anhedonia, and functional impairment, even after following several medication regimens.

She experienced other physical complaints during her illness, most notably excruciating musculoskeletal pain that primarily affected her lower extremities, to the point where it became very difficult for her to walk. Additionally, she gained a significant amount of weight—from 60 to 92 kg—which was attributed to her medication by her and her family. She also reported experiencing hypersomnia and becoming increasingly dissatisfied with her continued psychiatric care.

She sought a second psychiatric evaluation due to the chronic nature of her symptoms and the unsatisfactory response to medication, and she was later admitted for an inpatient psychiatric hospitalization. It was decided to start ECT as an adjuvant treatment during this two-week stay. Electroconvulsive therapy was administered using a Thymatron System IV device (Somatics LLC, Lake Bluff, Illinois, USA). A brief-pulse, bidirectional waveform was delivered with stimulus dosing adjusted according to the patient's age-based method. Bilateral frontotemporal electrode placement was used. Motor seizure duration was monitored via isolated limb movement and electroencephalographic (EEG) recording, lasting approximately 32 seconds in the first session and 38 seconds in the second session. The patient tolerated the procedures well, with no immediate complications.

There was a slight improvement in symptoms after the first ECT session, which was well tolerated. But after the second ECT session, the patient experienced a brand-new, unheard-of sudden onset of strong cigarette cravings. Immediately after this session, she started smoking for the first time, and she kept smoking after that.

The patient's social history showed that, despite being around her husband, who smoked frequently, she had abstained from tobacco for her entire life before this episode. There was no personal or family history of substance use disorders, and she categorically denied any prior urges, curiosity, or attempts to smoke tobacco. Because smoking was restricted to a specific room during her inpatient hospital stay, she did not directly witness smoking, even though she shared a room with another smoker.

After the second ECT session, the patient started smoking cigarettes, and this continued for about three years. She then made several determined attempts to stop, with intermittent periods of abstinence. She eventually relapsed and resumed her daily smoking habits, which have continued for the past year, as she still had intense cravings for nicotine. Four years before writing this report, she had her most recent ECT session.

She subsequently underwent two courses of ketamine-assisted therapy (the last in May 2025, and the first about 2.5 years ago), as well as continuous psychiatric follow-up. Duloxetine, pregabalin, bupropion, lisdexamfetamine (Vyvanse), propranolol, buspirone, and melatonin are the medications she is currently taking. Although she continues to smoke cigarettes, she currently expresses satisfaction with her treatment. A visual timeline summarizing the patient's major psychiatric treatments and behavioral changes is presented in Figure 1.

As shown in this figure, pharmacological treatments between 2010 and 2019 were followed by multiple courses of electroconvulsive therapy (ECT), after which the patient experienced the onset of cigarette smoking. Subsequent maintenance ECT and ketamine-assisted therapy sessions are shown, along with the eventual establishment of regular smoking behavior.

Discussion

We described a patient who experienced cravings for cigarettes after receiving ECT. This case is unique since there have not been any clear case reports of non-smokers starting to smoke after receiving ECT. However, ECT's modulation of the dopaminergic and cholinergic systems,

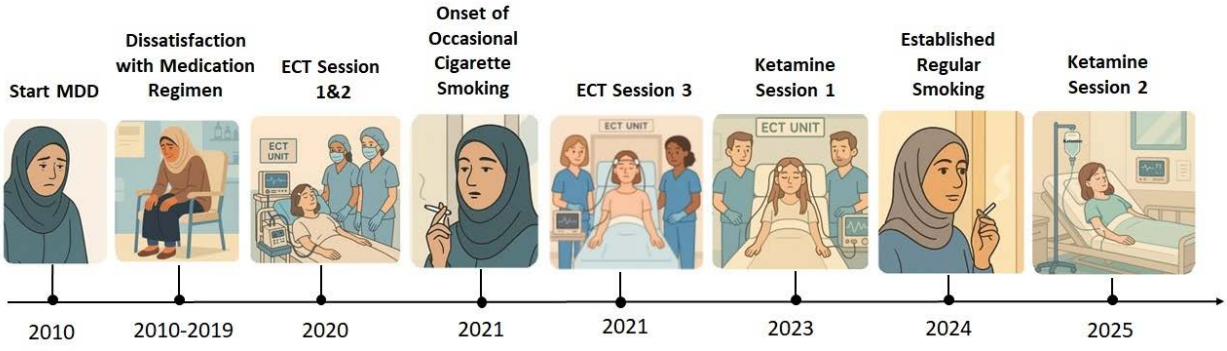

Figure 1. Chronological timeline summarizing the major clinical events and interventions in a 42-year-old woman with treatment-resistant major depressive disorder (MDD)

both essential to nicotine's addictive effects, is supported by indirect evidence. Teenagers who use e-cigarettes are typically the subjects of studies on smoking initiation; however, in this case, the novel trigger is therapeutic rather than behavioral. The fact that the patient started craving cigarettes right after the second ECT session raises the possibility that latent reward sensitivity may be revealed by acute neurophysiological changes that occur during ECT.

Although the patient was indirectly exposed to her husband's smoking habits, she had consistently abstained from tobacco use throughout adulthood, even in the presence of smokers. Hence, while environmental or psychosocial influences cannot be entirely excluded, the temporal association with ECT sessions and the absence of prior interest in smoking suggest a neurobiological rather than contextual trigger.

ECT has significant effects on neurochemical systems, such as dopamine modulation within the mesolimbic pathway,[13] despite being a mainstay in treatment-resistant depression.[14] This pathway, which includes the nucleus accumbens and ventral tegmental area (VTA), is essential for motivation, reward processing, and reinforcement behavior.[15] ECT may temporarily change receptor sensitivity or dopaminergic tone, which could increase the brain's reactivity to rewarding stimuli.[16, 17] This could show up as more reinforcement from drugs like nicotine in people who are genetically or clinically predisposed.

Women exhibit distinct vulnerabilities concerning nicotine craving and dependence.[18, 19] Stronger craving responses in women are indicated by neuroimaging correlates, which are associated with regions such as the right anterior insula.[20] For instance, in women, craving is inversely correlated with cortical thickness in the right anterior insula.[20] Moreover, during abstinence-resumption cycles, women generally have stronger craving relief and more severe withdrawal symptoms.[21]

The intersection of these ECT-related neurochemical changes and female-specific sensitivity may create a brief "window of vulnerability" during which access to nicotine can lead to habituation and dependence. Importantly, the effectiveness of smoking cessation interventions varies by sex. Women usually only benefit from nicotine replacement therapy (NRT) at short-term follow-ups unless it is combined with high-intensity nonpharmacological (behavioral) support, whereas men benefit from NRT at both short- and long-term follow-ups, regardless of the level of behavioral support. In the absence of such assistance, women's NRT effectiveness typically decreases more quickly than men's.[22] In clinical practice, women may also prefer psychosocial or alternative interventions alongside pharmacotherapy.

This case presents a novel phenomenon: The potential induction of new reward-seeking behavior, in this case, the onset of smoking after ECT, even though studies such as the ECT-in-schizophrenia trial show that prior smoking can enhance positive therapeutic outcomes.[23] This finding adds to our knowledge of ECT may impact patients' reward processing.

Clinicians should remain vigilant for new-onset substance-seeking behaviors, particularly nicotine use, during and shortly after ECT. Early recognition is crucial because craving or experimentation at this stage may rapidly progress toward dependence. Preventive strategies could include patient education, counseling about smoking risks, and minimizing exposure to smoking environments during hospitalization. In addition, structured follow-up visits should aim to identify early cues of craving or reinforcement. From a research perspective, future studies are warranted to systematically assess craving intensity before and after ECT, investigate neurochemical biomarkers such as dopaminergic receptor imaging, and evaluate proactive cessation interventions during the early post-ECT period to reduce the likelihood of dependence.

Despite these implications, several methodological limitations should be acknowledged. Standardized instruments for assessing craving intensity (e.g., the *Questionnaire on Smoking Urges* or *Fagerström Test for Nicotine Dependence*) and neurocognitive status were not administered in this case, which limits the objectivity of craving assessment. Moreover, as this is a single-case observation, causality cannot be inferred, and the findings should be regarded as hypothesis-generating rather than conclusive. Subtle environmental or psychosocial factors—such as indirect exposure to smokers—also cannot be entirely excluded. Nevertheless, the temporal association with ECT sessions and the absence of any prior tobacco interest favor a neurophysiological explanation.

Conclusion

This case highlights a previously unreported relationship between ECT and the onset of cigarette smoking in a woman with MDD who does not smoke. This observation may reflect ECT-induced modulation of mesolimbic and cholinergic systems, which is further exacerbated by neurobiological sensitivity unique to women. Since there are no similar cases, this report might be a sentinel observation, calling for increased clinical awareness and more research on how ECT affects addictive behaviors.

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Authors' Contribution

Conceptualization: Seyed Hamzeh Hosseini
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Competing Interests

The authors declare that they have no conflict of interests.

Ethical Approval

This study was designed based on the ethical principles of the

Declaration of Helsinki (2008) for medical studies involving humans. The local Ethics Committee affiliated with the Mazandaran University of Medical Sciences has approved this study (Ethical Registration No.: IR.MAZUMS.REC.1404.241). Informed consent was obtained from the patient before publication.

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We confirm that the conception, design of the review framework, literature search, selection and interpretation of sources, and drafting of the manuscript were entirely performed by the authors. During the writing process, AI tools (ChatGPT and Grammarly) were used solely to enhance clarity, style, and grammar and punctuation. All cartoon-style illustrations in the figure were generated using OpenAI's ChatGPT (free version) image creation tools. Following this assistance, all authors critically reviewed and refined the text and take full responsibility for the accuracy, originality, and integrity of the scientific interpretations presented in this review.

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