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Seasonal Affective Disorder: Neurobiological Mechanisms, Clinical Features, and Therapeutic Approaches

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ABSTRACT

Seasonal Affective Disorder (SAD) is a form of recurrent depressive illness in which symptoms appear in a consistent seasonal pattern, most frequently during the autumn and winter months. Since its formal identification by Rosenthal in 1984, SAD has been recognized as a condition marked by excessive sleep, low energy, reduced social engagement, increased appetite, and cravings for carbohydrate-rich foods, which interfere with daily functioning, academic performance, occupational productivity, and overall quality of life. It affects an estimated 4–15% of the general population, with a higher prevalence among females. SAD is influenced by multiple interacting factors, including disruptions in circadian rhythm regulation, altered melatonin and serotonin activity, reduced exposure to daylight, and other neurobiological processes. Research indicates that individuals with SAD may experience cognitive difficulties, particularly in attention, working memory, and emotional processing, which are comparable to those observed in nonseasonal major depressive disorder. Treatment options, including light therapy, cognitive behavioral therapy, lifestyle interventions, and pharmacological approaches, have demonstrated variable effectiveness. Furthermore, the article emphasizes the role of screening instruments, particularly the Seasonal Pattern Assessment Questionnaire (SPAQ), while acknowledging its limitations. Enhanced assessment tools are needed to support accurate diagnosis and timely intervention.

Keywords: Depressive symptoms, antidepressants, light exposure, circadian rhythm

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Introduction

Seasonal Affective Disorder (SAD) is a mood disorder that follows a seasonal pattern, most commonly emerging in the fall and winter and resolving with the arrival of spring and summer. The terms and conditions were first introduced by Rosenthal in 1984. [1] The main symptoms are excessive sleep, social withdrawal, overeating, fatigue and tiredness, and strong cravings for carbohydrates. A diagnosis of SAD requires that these symptoms persist for at least two consecutive years. The prevalence of SAD in the general population ranges from approximately 4% to 15%, and it is more frequent in women [2]. It is not just a temporary change in mood. It is a serious mental health condition that can greatly affect a person's daily life and overall well-being. People with SAD often experience difficulty concentrating, withdraw from social interaction, and struggle to perform well at work or school. These difficulties can reduce productivity and increase the need for medical care [3]. The interventions for seasonal affective disorder are to focus on light exposure, using either natural sunlight or artificial light, cognitive behavioral therapy, community engagement, healthy diet, vitamin intake, proper exercise, antidepressant medications, or combinations of these treatment approaches [4]. In this context, there is a need to improve the screening of SAD patients. Different tools are available for this purpose, with the help of the Seasonal Pattern Assessment Questionnaire (SPAQ), which is the earliest and most widely used instrument since its introduction. There are three main purposes of this tool: first, to examine and compare the main tools used to screen and assess Seasonal Affective Disorder; second, to identify the psychometric weaknesses and clinical limitations of existing instruments; and third, to suggest future directions for the development of more comprehensive scales that better reflect the multidimensional nature of SAD. Overall, this review aims to help clinicians and researchers make more informed and appropriate choices when assessing seasonal mood patterns [5].

Symptoms

This suggests that SAD is a mood disorder influenced by multiple factors, including changes in circadian rhythms, melatonin and serotonin levels, other neurotransmitter systems, and patterns of light and darkness during the day, as well as biological clock processes related to the photoperiod. However, the exact mechanisms involved in SAD are still not fully understood [6]. The initial episode of seasonal affective disorder typically occurs around the age of 30, and its symptoms are often similar to those of non-seasonal depression, including insomnia, reduced appetite, weight loss, agitation, and anxiety. Both common depressive symptoms and atypical autonomic nervous system symptoms mark episodes of SAD. In contrast, other forms of recurrent depression occur year-round and are not associated with seasonal changes, and the severity of symptoms can vary [7].

The Interplay Between Emotion and Cognition in Seasonal Affective Disorder and Its Relation to Depressive Symptoms

Different studies demonstrated that both SAD and major depressive disorder (MDD) are linked to cognitive impairments. In particular, each disorder was associated with poorer cognitive performance and everyday challenges—such as forgetting names or misunderstanding directions—stemming from deficits in controlled processes, including attention and working memory. These findings indicate that cognitive impairments in SAD may closely resemble those seen in nonseasonal depression [8]. Two components of information processing are particularly affected in MDD: working memory and processing speed. Most studies report working memory deficits in individuals who are currently depressed, although this finding is not consistent across all research. It is still unclear whether these deficits improve, disappear, or persist after remission. Some studies have shown that clinically remitted individuals continue to experience residual working memory impairments; however, because these studies used cross-sectional designs, it is difficult to determine whether the deficits were present during the acute phase of depression or whether they represent lasting cognitive effects of the disorder.

Our previous research has shown that individuals with SAD experience a greater decline in the recall of positive words during the symptomatic winter phase compared with healthy controls, suggesting deficits in working memory related to emotional information. However, only a limited number of studies have examined working memory functioning in SAD [9]. Michalon et al assessed visual and verbal cognitive functions in 30 patients with seasonal affective disorder and 29 control participants matched for age and education, both before and after two weeks of light therapy. The results showed that individuals with SAD had consistent difficulties in visual memory and visual construction skills, which improved after light treatment [10].

Treatment

Light therapy is an effective treatment for SAD, and many people begin to feel relief from symptoms within the first week. The use of high-quality light boxes that mimic natural daylight is recommended, as their higher intensity allows shorter treatment sessions, usually lasting about 30 minutes [11].

Cognitive Behavioral therapy (CBT) is a well-established treatment for depression that is mainly based on cognitive therapy and incorporates elements of behavioral therapy. It aims to interrupt cycles of negative emotions, physical sensations, thoughts, and behaviors by addressing maladaptive beliefs and promoting more effective coping strategies [12].

Sleep deprivation therapy, music therapy, change in diet, and healthy exercises have proven effective in treating depression, and also appear to be beneficial for the seasonal form of the disorder [13].

Several small and open-label studies have indicated potential benefits of escitalopram, duloxetine, agomelatine, reboxetine, nefazodone, bupropion, tranylcypromine, and mirtazapine. By contrast, Moscovitch et al. evaluated sertraline in a robust double-blind randomized controlled trial and demonstrated its superiority over placebo. However, as this remains the only study examining sertraline, the findings require further replication and cannot yet be considered definitive [14].

Conclusion

Seasonal Affective Disorder is a clinically significant mood disorder that follows a seasonal pattern and affects emotional, cognitive, and daily functioning. It is influenced by biological factors such as circadian rhythm disruption and neurotransmitter changes. Although treatments like light therapy and cognitive behavioral therapy are effective, improved screening tools and further research are needed for better diagnosis and management.

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