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Intelligent Lighting Control System based on Big Data and Seasonal Depression Control

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Abstract

Seasonal affective disorder, also known as "winter depression," is a mood disorder caused by climate change. It has a unique pathogenesis, and the key to diagnosis is obvious seasonal onset and spontaneous remission of symptoms. Seasonal affective disorder has a significant impact on people's life, medical workers should accurately identify, timely treatment and intervention. As a unique treatment method, light therapy plays an important role in the treatment of seasonal affective disorder. There are some problems in the operation of the traditional lighting control system, such as the regulation is difficult, unreasonable equipment selection, etc., this paper briefly introduces the characteristics of the intelligent lighting control system based on big data, such as control flexibility, to be able to access different sensors, automatically adjust the lighting brightness and so on, puts forward a intelligent lighting control system based on big data design points. Meanwhile, the intelligent lighting control system based on big data and the control of seasonal depression were studied, and the main symptoms of seasonal affective disorder, susceptible population, pathogenesis, treatment and prevention were further elaborated.

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I. Introduction

Depression is a mental disorder with a high prevalence rate and a heavy burden of disease. Currently, drug therapy for depression is not ideal in clinical practice, so it is very important to seek effective non-drug therapy [1]. Patients with depression often show abnormalities in biorhythms, such as morning weight and evening light, early awakening, etc. Therefore, improvement of biorhythms is considered as a possible treatment approach for depression [2]. Studies have shown that the biological rhythm of the human body is regulated by the suproptic nucleus of the hypothalamus and the pineal gland, and the secretion level of the latter is affected by the changes of day and night light intensity [3]. A large number of studies have been conducted to explore the efficacy of light therapy for depressive symptoms, and most of these findings support the efficacy of light therapy for seasonal depression [4].

Smart city is the innovation of urban management revolution and development mode, and its core lies in using modern information and

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July – August 2020
ISSN: 0193-4120 Page No. 362 - 367

communication technology to build an intelligent perceptive environment [5]. Such an environment can not only manage equipment and information efficiently, but also change people's living habits and lifestyles to a large extent [6]. Urban lighting is one of the ideas and concepts of smart cities. Intelligent lighting system consists of signal acquisition, data communication, network transmission, analysis and calculation, decision support and other systems [7]. It can efficiently, timely and reliably monitor the working conditions of lighting facilities in local areas, make correct analysis on the operation of lighting system, and achieve the purpose of safe and stable operation [8]. Intelligent lighting control system based on big data adopts centralized control monitoring mode, which improves the real-time performance of lighting control [9]. It can control the switch of any street lamp according to the needs of seasons, climate and special holidays, so as to achieve timely and appropriate lighting [10].

This paper explores the overall effect of light therapy on seasonal depression and the possible influencing factors, so as to provide a reliable evidence-based medical basis for the effect of light therapy on non-seasonal depression. At the same time, it focuses on the specific application of data technology in intelligent lighting control system design to design a reasonable intelligent lighting control system. The subtractive scores of the depression rating scale before and after treatment were selected as the main efficacy indexes, while the effective rate and clinical cure rate were selected as the secondary efficacy indexes. The results showed that the intelligent lighting control system based on big data was effective for seasonal depression in general.

2. Introduction of Intelligent Lighting Control System Theory

2.1. Feature Analysis

So-called intelligent lighting control system, mainly refers to the use of advanced electromagnetic pressure regulating and electronic sensor technology, in public lighting control system for intelligent control platform, for the power supply equipment to conduct a comprehensive monitoring and tracking, get reliable guarantee system circuit voltage, current amplitude adjustment, ensure the lighting circuit of unbalanced load of scientific improvement, improve the system of the operating power, make lighting lamps and lanterns and line operating temperature falling, really achieve the purpose of optimization of power supply. Intelligent lighting control system has some characteristics: first, the system has strong control flexibility, which can ensure the circuit dimmer and switch to be controlled efficiently. Secondly, it has strong scene control function. By setting different scenes in advance, it can fade out and fade in during the scene switching process. Moreover, the system can be connected to different sensors, which can automatically control the lighting. For example, through the intervention of mobile sensors, the infrared ray of the human body to carry out a comprehensive detection, to ensure that the lighting lighting is highly efficient control. And, in some special occasions, according to the flow of people, the system can automatically adjust the lighting brightness. At the same time, the system can be networked, using the above advanced control means, the overall lighting control system for efficient control, to ensure that the building intelligent control system more perfect.

2.2. Intelligent Lighting Control System Framework

Smart lighting control system can make proper use of big data technology to further strengthen smart city lighting management. It is mainly composed of different sensors, central controller and communication module. On this basis, a more complete big data management platform for urban public lighting can be built. The system is mainly divided into intelligent perception layer, network transmission layer, big

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July – August 2020
ISSN: 0193-4120 Page No. 362 - 367

data processing application layer and so on. The application layer of big data processing is the core of intelligent lighting system, which can reflect the overall operation of the system. Scientific use of the data collected by the system, including the information of environmental parameters, and combined with the analysis of the results, accurate feedback to the control terminal of each branch of the system street lamps, to ensure that the lighting street lamps can achieve automatic regulation. In addition, through the implementation of monitoring street lamps, to ensure that the lighting faults of street lamps are handled in a timely manner.

3. Data Sources and Research Design

The case was a patient in a municipal psychiatric hospital from March to June 2020, who met the diagnostic criteria for CCMD-2-R depressive episode, excluding cardiac, liver, kidney and other physical diseases, alcoholism and taking antipsychotic drugs. In this study, depression cases with regular seasonal onset (group A) were determined by referring to the definition of Rosenhal seasonal affective disorder, that is, depression occurred in autumn and winter for at least 2 consecutive years, and alleviated or became manic in spring and summer. Cases of depression without regular seasonal onset (group B) were non-first-time authors. Among them, seasonal division: Spring March - May, summer June - August, autumn September - November, winter December - February. There were 33 patients in group A, including 15 males and 18 females, with an average age of (33.16±12.63) years. Group B: a total of 30 patients, including 11 males and 19 females, with an average age of (36.88 4±6.98) years. Hamilton Depression Scale (HAMD, 24 items) was used to evaluate the effect at the time of enrollment and at the end of the 8th week of light treatment with intelligent lighting control system. The effect was marked by a 50% decrease in the total score of HAMD. The scale evaluation was conducted jointly by two doctors, with good consistency among the evaluators.

4. Discussion and Analysis of Results

4.1. Symptom Characteristics

The symptom characteristics of the two groups are shown in Table 1, and the Chi-square test P value is less than 0.05.

Table 1. The symptom characteristics of the two groups were compared

Symptoms		Group A		Group B	
		n	%	n	%
Psychotic symptoms	Have	7	21.212%	10	33.333%
	No	26	78.788%	20	66.667%
Suicidal thoughts and behaviors	Have	8	24.242%	13	43.333%
	No	25	75.758%	17	56.667%
Social withdrawal	Have	13	39.394%	10	33.333%
	No	20	60.606%	20	66.667%
Sleep	Increase	17	51.515%	1	3.333%

July – August 2020
ISSN: 0193-4120 Page No. 362 - 367

	Reduce	16	48.485%	29	96.667%
Appetite	Increase	15	45.455%	3	10.000%
	Reduce	18	54.545%	27	90.000%
Day and night change	Early heavy	16	48.485%	20	66.667%
	On the evening of heavy	12	36.364%	6	20.000%
	No change	5	15.152%	4	13.333%
The weary	Have	26	78.788%	28	93.333%
	No	7	21.212%	2	6.667%
Decreased libido	Have	22	66.667%	24	80.000%
	No	11	33.333%	6	20.000%
Irritability	Have	24	72.727%	29	96.667%
	No	9	27.273%	1	3.333%
Anxiety	Have	25	75.758%	28	93.333%
	No	8	24.242%	2	6.667%

4.2. Comparison of Severity of Depression

The comparison data of the severity of depression was shown in Table 2 and Figure 1, and the T-test P value of the two groups was less than 0.01.

Table 2. Comparison of hamd total score and factor score

Hamd	A Group	B Group
Total Score	23.6±5.7	33.2±9.87
Somatization of Anxiety	7.72±2.17	7.84±3.2
Weight	0.36±0.53	1.34±0.7
Problems	2.07±1.85	4.97±1.97
Day And Night Change	1.15±0.37	1.15±0.25
Slow Motion	6.62±1.56	9.59±1.66
Sleep Disorders	1.92±0.76	4.66±1.85

July – August 2020
ISSN: 0193-4120 Page No. 362 - 367

Desperation	3.24±1.97	4.15±2.13

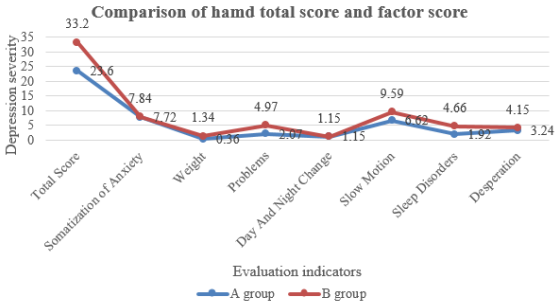

Figure 1. Comparison of hamd total score and factor score

4.3. Response to Light Treatment of Intelligent Lighting Control System

After 8 weeks of illumination treatment with intelligent lighting control system, the significant efficiency of the depression group with regular seasonal onset was 88.4%, and that of the depression group without regular seasonal onset was 63.6%, with significant differences between the two groups ($P < 0.05$). Previous studies have focused more on the biological symptoms of depression (diurnal mood changes) because it may be a marker for a putative disruption of 24-hour rhythms. Although 66.667% of the patients in the control group showed morning mood deterioration, 48.485% of the patients with regular seasonal depression showed morning mood deterioration, while 15.152% showed no change. Only a small number of patients showed late-severe mood change. There was no significant difference in energy between depression with seasonal patterns and depression without seasonal patterns, and fatigue was a common symptom. The seasonal patterns of depression suicidal thoughts and behaviors were significantly lower than those of the control group, and there were no significant differences in social withdrawal and job impairment.

4.4. Research and Discussion

There are still some problems with RCTS on the efficacy of light therapy for seasonal depression: for example, there is a lack of control Settings: no dark light control was set in the control group to reduce the placebo effect; The control group was only treated with drugs, and no dark light or negative ion generator control was set. Poor blind method setting: no blind method was set among the subjects, operators and evaluators, which increased the possibility of bias implementation. Lack of follow-up information: in particular, long-term follow-up results in the uncertainty of the duration of the efficacy of light treatment; Most studies have not systematically reported adverse reactions associated with light therapy, leaving us with little knowledge about the potential risks of light therapy and contributing to an overall understanding of its efficacy and safety. Future, therefore, to explore the study of light therapy efficacy in seasonal depression is still need to improve: first of all, research design and implementation aspects: future research into the standard should distinguish between depression and bipolar depression, and set up the weak light or anion device control to control the placebo effect, at the same time, the result of the patients and evaluator (in order to reduce the bias, also should be long time system of follow-up to determine the treatment response of light maintenance time. Secondly, the thesis report should systematically report the adverse reactions during treatment and follow-up, such as physical discomfort and the risk of mania. Furthermore, future research should also systematically explore the therapeutic mechanism of light therapy on depression, its possible predictive variables and mediating variables, in order to determine the optimal beneficiary population. In addition, the RCT for subjects with high selectivity, etiology and diagnosis of depression and heterogeneity is

July – August 2020
ISSN: 0193-4120 Page No. 362 - 367

bigger, RCT strict inclusion criteria often cannot represent the actual circumstances of the clinically depressed patients, make the results of the study the extrapolation of restrictive, future research such as could combine RCT and prospective cohort studies, case-control studies, study way the real world, will help to obtain objective and scientific research evidence relevant to clinical practice. This study analyzed and explored the efficacy of intelligent lighting control system in light treatment for seasonal depression, and the results showed that light treatment was effective for seasonal depression in general. At the same time, in the subgroup analysis of the clinical cure rate index, the light treatment did not gain an advantage over the control group, which may be mainly related to the insensitivity of the index and the reduction of the sample size of the subgroup analysis. Considering the low overall quality of the RCTS included in this study, more high-quality studies are needed in the future to provide high-level evidence-based medical evidence for the efficacy of light therapy for seasonal depression. Moreover, new technological innovations are needed to study the role of intelligent lighting control systems in the treatment of depression.

5. Summary

At present, China's intelligent lighting is still mainly at the level of meeting the basic visual function needs, lacking the research on the biological effects of light from the perspective of health lighting, especially the physiological and psychological needs of seasonal sunlight research. Practice has shown that has been clinically diagnosed depression, completely cure is very difficult. At present, light therapy for seasonal depression (SAD) has been proved to be effective. Due to the vast region and great difference in light climate in China, it is of great significance to consider the characteristics of light climate in different regions to determine the lighting design, which also needs further in-depth research.

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