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Original Article

Effects of mindfulness decompression therapy combined with transcranial magnetic stimulation in generalized anxiety disorder

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Abstract: Objective: To explore the clinical effects of mindfulness decompression therapy combined with transcranial magnetic stimulation in generalized anxiety disorder. Methods: In the present prospective study, ninety-two patients with generalized anxiety disorder were randomly divided into two groups, with 46 cases in each group. On the basis of drug treatment, patients in the control group received transcranial magnetic stimulation, and patients in the research group were treated with mindfulness decompression therapy combined with transcranial magnetic stimulation. The total effective rate, anxiety degree (evaluated by the Hamilton Anxiety Scale (HAMA) score), severity of condition (evaluated by the clinical global impression (CGI) score), comfort degree score (Psychology, physiology, environment, social culture), neuroelectrophysiological parameters and sleep quality (Pittsburgh sleep quality index (PSQI) factors) before and after treatment were compared between the two groups. Results: After treatment, the research group had higher total effective rate than that of the control group ($P<0.05$); the HAMA score and CGI score of two groups were both decreased, and the research group decreased much more than the control group ($P<0.05$); mismatch negativity (MMN) latency, target N2 latency and target P3 latency of two groups were all decreased, MMN amplitude and none-target P2 amplitude were both increased, and the research group improved much more than the control group ($P<0.05$); the scores of social comfort, environmental comfort, physiological comfort and psychological comfort of two groups were all increased, and the corresponding scores of the research group were all higher than those of the control group ($P<0.05$); PSQI scores of two groups were all decreased, and the research group had lower PSQI scores than the control group ($P<0.05$). Conclusion: Mindfulness decompression therapy combined with transcranial magnetic stimulation effectively relieve anxiety symptoms and improve comfort degree and sleep quality in patients with generalized anxiety disorder.

Keywords: Generalized anxiety disorder, transcranial magnetic stimulation, mindfulness decompression therapy, hamilton anxiety scale score and parameters

Introduction

According to the International Classification of diseases-10 (ICD-10) Classification of Mental and Behavioral Disorders, anxiety disorders are divided into phobic anxiety disorder and other anxiety disorders [1]. Generalized anxiety disorder (GAD) is one of the most common types among the other anxiety disorders, with anxiety and panic of unknown causes as the main manifestations. GAD is commonly accompanied by autonomic nervous dysfunction or motor tension, such as hand shaking, restlessness, palpitation, sweating, etc. [2]. It has been reported that the annual prevalence rate of GAD is more than 2%, and 4.1% of these patients among which will never heal [3]. Due to the characteristics of easy recrudescence and long-standing malady, many patients already had decades of disease before diagnosis, and they still have anxiety symptoms after repeated treatment [4].

Since the diagnostic criteria were defined, the treatment of GAD has been dominated by drugs. Selective serotonin reuptake inhibitors (SSRI) for 5-hydroxytryptamine (5-HT) and other drugs are the first-line recommended drugs [5]. With further exploration about neurophysiological mechanism of anxiety disorder, the treatment of GAD is also emerging. As a new physi-

cal therapy technology, transcranial magnetic stimulation (TMS) affects the electrical activity of brain tissue by inducing current to depolarize neurons through the electromagnetic fields, so as to excite the cerebral cortex and alleviate anxiety [6]. At present, TMS has been gradually applied to the treatment of GAD, and has been effective [7].

Anxiety disorder is a kind of mental disease, so psychological treatment is also irreplaceable in addition to the drug and physical treatment [8]. Mindfulness decompression therapy is a new type of psychotherapy, which mainly relieves stress, disease and pain through mindfulness meditation. Mindfulness meditation encourages the patients to do something positive for themselves to release their own pressure using their inner strength that others can't replace [9]. At present, many studies have confirmed that mindfulness decompression therapy has a positive effect on anxiety [10]. At present, TMS or mindfulness decompression therapy alone is effective in the treatment of GAD, but the prognosis of some patients is still poor the combination of TMS and mindfulness decompression therapy in the treatment of GAD has not been explored. In view of this, the present study analyzed the effects of mindfulness decompression therapy combined with TMS on the condition remission and sleep quality of patients with GAD. The related report is as follows.

Materials and methods

General materials

Ninety-two patients with GAD admitted in our hospital during February 2020 to October 2020 were selected as the research objects. They were divided into the control group and the research group according to random number table method, with 46 cases in each group. This study was approved by the medical Ethics Committee of our hospital.

Screening criteria

Inclusion Criteria: Patients met the diagnostic criteria of GAD in ICD-10 Classification of Mental and Behavioral Disorders. Patients with persistent primary anxiety symptoms, accompanied by autonomic nervous symptoms or motor restlessness and seriously affected social function; aged between 18 to 60; Hamilton Anxiety Scale (HAMA) score >13; patients without any transcranial magnetic stimulation before admission; without family history of mental illness; patients and their families have signed the informed consent for the study; the patient was diagnosed for the first time and did not receive medical or surgical treatment before.

Exclusion criteria: Patients with severe cognitive impairment, severe visual and auditory impairment and mental retardation; accompanied by serious organic diseases, including brain organic diseases, severe liver, kidney, cardiovascular diseases, metabolic diseases, endocrine diseases, etc; patients who committed suicide during the study; patients with drug or alcohol dependence or psychoactive substance abusers; patients who cannot accept psychological test or accompanied with other mental disorders, such as schizophrenia, bipolar disorder, etc.

Methods

All patients were treated with paroxetine (GJZ H10950043, Sino US Tianjin Shike Pharmaceutical Co., Ltd., specification: 20 mg), 20 mg/d. After 2-3 weeks of administration, the dosage was increased by 10 mg/week according to the patient's condition and drug resistance, with the maximum dose of 50 mg. The treatment lasted for 4 weeks. The dosage of the drug should not be modified within 4 weeks of medication, and then it should be reduced gradually.

The control group

At the beginning of drug treatment, patients were also treated with transcranial magnetic stimulation (TMS) at the anterolateral right frontal lobe of the patients [11]. Magnetic field therapeutic apparatus (model number: YRD-CCY-I; Wuhan Yiruide medical equipment New Technology Co., Ltd., China) was employed at the frequency of 1 Hz, stimulation of 100% MT, pulse 1200. Each stimulation lasts for 10 s with an interval of 5 s and the total treatment lasts for 20 minutes, once a day. Treat 5 times a week, for continuous 4 weeks.

The research group

On the basis of the control group, the research group was treated with mindfulness decompression therapy as following [12]. (A).

Mindfulness and Introspection: guide the patients to relax with eyes closed. Breathe slowly from the nose, and feel the fresh air with heart until the fresh air fills the lungs. Hold the breath for 4 s or more, and then exhale slowly from the mouth. Feel the release of anxiety, pressure and tension at the time of exhaling. Concentrate the mind in higher ideals to achieve the state of inner peace. Then you can feel that the depressed and uneasy feelings gradually disappear, and you could achieve the state of calm and undisturbed. The time is controlled within 5 minutes. (B). Mindfulness breathing: Take abdominal breathing method during this process. Keep the left hand on the chest and the right hand on the upper abdomen. Try to relax the abdominal muscles and slowly inhale through the nose. Make the abdomen protrude, and then exhale through the mouth. In the process of breathing, the mind moves along with the breath. (C). Body scanning: keep the eyes closed, and guide the patient to imagine each part of the body. Then, scan the body parts one by one according to the order from top to bottom. During the scanning process, the attention should be completely focused on the scanning part, and the attention should be withdrawn after the scanning. (D). Mindfulness Yoga: under the guidance of professionals, some stretching exercises would be carried out, and each movement lasts for 3-5 breath. In the process of training, meditation should also be carried out to calm the brain, soothe the nerves, and feel the pleasure of the mood rather than the body's acid and tired. (E). Walking Zen: keep the eyes on the front and bottom and put the hands in front of the chest naturally. Then, walk back and forth on a long straight road naturally and smoothly. In the process of walking, you should have a clear perception of your own movements. You can also slow down the speed at will, and feel the friction between the soles of your feet and the ground during walking, including lifting feet, landing feet, and moving. Once training lasts for 30 min and keeps 2-3 times a day, continuous treatment for 4 weeks. All selected patients completed the above treatment program.

Outcome measures

Main outcome measures

(1) Clinical efficacy: The clinical efficacy was evaluated according to the change of HAMA score before and after the treatment. Cure means that the HAMA score was decreased by more than 75% through the treatment and the score was less than 7 points; remarkable effect was that the HAMA score was decreased by 50%-75% through the treatment; effective was that the HAMA score was decreased by 25%-49% through the treatment; invalid was that the HAMA score was decreased by no more than 25% through the treatment or even increases. The total effective rate = cases of (cured + remarkable effect + effective)/n *100%.

(2) HAMA score and CGI score before the treatment and 4 weeks after the treatment: 14 items in HAMA scale were divided into asymptomatic, mild, moderate, severe and extremely severe according to the 0-4 grade scoring method. Scores <7: asymptomatic; scores 7-13: possible anxiety; scores 14-20: certain anxiety; scores 21-29: obvious anxiety; scores >29: severe anxiety. Clinical global impression (CGI) was divided into severity of illness (SI), global improvement (GI) and efficacy index (EI). SI and GI were scored with 0-7 points and 8 grades. Higher score means that the disease was more serious and the curative effect was worse. EI was divided into 4 grades: complete or basic disappearance of clinical symptoms is considered as marked effect; partial disappearance of clinical symptoms is considered as effective; slight relief of clinical symptoms is considered as slightly effective; no improvement or even deterioration of clinical symptoms is considered as deterioration. No side effect is considering as none; mild side effects with no affect to life is considered as light; obvious side effects with affect to life is considered as medium; side effects endanger the life safety of patients is considered as severe. The curative effect was valued by the Grade 0-4 method. The higher the score was, the worse the curative effect was.

(3) Electrophysiological indexes before and 4 weeks after the treatment: The latency and amplitude of MMN, latency of target N2, amplitude of non-target P2 and latency of target P3 were detected by MB11 brain evoked potential monitor (MAICO, Germany).

Secondary outcome measures

(1) Comfort score before the treatment and 4 weeks after the treatment: the comfort score

Table 1. Comparison of general data between two groups ($\bar{x} \pm sd$, n)

	Group		t/χ^2	P
	Control group (n=46)	Research group (n=46)		
Age (years)	39.6±6.2	40.3±6.4	t=0.533	0.596
Course of disease (years)	6.01±2.46	6.21±2.52	t=0.385	0.701
Gender			χ^2=0.697	0.404
Male	24	20		
Female	22	26		
Degree of education			χ^2=0.192	0.662
College and Above	29	31		
Below junior college	17	15		
Marital Status			χ^2=0.418	0.812
Married	29	26		
Unmarried	13	15		
Divorced	4	5		
Annual household income			χ^2=0.179	0.672
<CNY100000	18	20		
≥CNY100000	28	26		
Comorbidities				
Hypertension	15	17	χ^2=0.192	0.662
Diabetes	8	9	χ^2=0.072	0.788
Others	7	8	χ^2=0.080	0.788

was valued using the simplified general comfort questionnaire (GCQ), including 4 dimensions and 28 items. The four dimensions include social comfort (6 items), environmental comfort (7 items), physiological comfort (5 items) and psychological comfort (10 items). Higher score means more comfortable.

(2) Sleep quality before the treatment and 4 weeks after the treatment: sleep quality was evaluated by Pittsburgh sleep quality index (PSQI), including sleep quality, sleep time, sleep efficiency, sleep latency, sleep disorder, hypnotic drugs and daytime dysfunction. Each item is set with 0-3 points, with the highest total score of 21. The higher the score is, the worse the sleep quality is.

Statistical analysis

SPSS 21.0 software was used for the statistical analysis. The measurement data were expressed as mean ± standard deviation ($\bar{x} \pm sd$). Independent sample t test and paired t test were used for comparison between groups and within groups. The enumeration data were expressed by percentage and were analyzed with chi square test. Rank sum test was used for ranked data. P<0.05 means that the difference was statistically significant.

Results

General data

There was no significant difference in general data between the two groups (P>0.05). It can be seen that the two groups are comparable. See **Table 1**.

Clinical efficacy

The research group had higher total effective rate than the control group (P<0.05). The mindfulness decompression therapy combined with transcranial magnetic stimulation can effectively improve the clinical efficacy of generalized anxiety disorder. See **Table 2**.

HAMA score and CGI score

After the treatment, HAMA score and CGI score of the two groups were both decreased, and the research group had a greater reduction than the control group (P<0.05). The mindfulness decompression therapy combined with transcranial magnetic stimulation can effec-

Table 2. Comparison of clinical efficacy between the two groups (n, %)

Groups	Cured	Remarkable effect	Effective	Invalid	Total effective rate
Control group (n=46)	18 (39.13)	11 (23.91)	7 (15.22)	10 (21.74)	36 (78.26)
Research group (n=46)	27 (58.70)	9 (19.57)	7 (15.22)	3 (6.52)	43 (93.48)
Z/χ^2		Z=2.123			χ^2=4.390
P		0.034			0.036

Table 3. Comparison of HAMA score and CGI score between the two groups ($\bar{x}$ ± sd, score)

	Groups		t	P
	Control group (n=46)	Research group (n=46)		
HAMA				
Before treatment	26.52±4.33	25.74±4.15	0.882	0.380
After treatment	11.69±2.41***	8.76±1.75***	6.672	<0.001
CGI-SI				
Before treatment	5.28±1.64	5.34±1.69	0.173	0.863
After treatment	1.63±0.38***	0.75±0.17***	14.337	<0.001
CGI-GI				
Before treatment	5.64±1.70	5.84±1.77	0.553	0.582
After treatment	1.77±0.40***	0.80±0.18***	14.999	<0.001
CGI-EI				
Before treatment	2.64±0.66	2.84±0.69	1.421	0.159
After treatment	0.63±0.21***	0.35±0.10***	8.165	<0.001

Note: Compared with the same group before the treatment, ***P<0.001. HAMA: Hamilton Anxiety Scale; CGI: Clinical global impression; SI: severity of illness; GI: global improvement; EI: efficacy index.

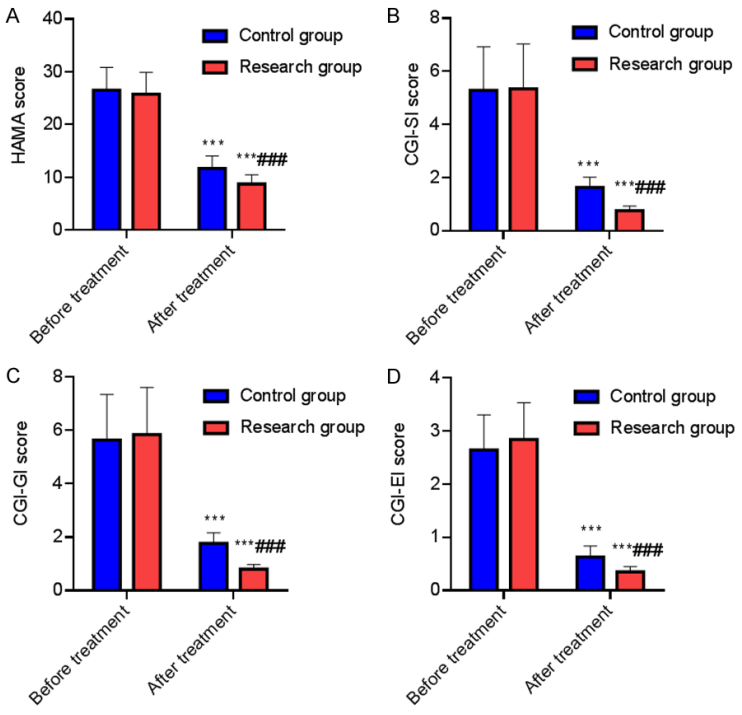

Figure 1. Comparison of HAMA score and CGI score between two groups. A: HAMA; B: CGI-SI; C: CGI-GI; D: CGI-EI. Compared with the same group before treatment, ***P<0.001; compared with the control group, ###P<0.001. HAMA: Hamilton Anxiety Scale; CGI: Clinical global impression; SI: severity of illness; GI: global improvement; EI: efficacy index.

tively alleviate the anxiety symptoms of patients and improve the overall clinical efficacy in the treatment of generalized anxiety disorder. See **Table 3** and **Figure 1**.

Neuroelectrophysiological indexes

There was no significant difference in the neuroelectrophysiological indexes between the two groups before the treatment (P>0.05). After the treatment, mismatch negativity (MMN) latency, target N2 latency and target P3 latency of the two groups were decreased, MMN amplitude and none-target P2 amplitude were both increased, and the improvement degree of the research group was better than that of the control group (P< 0.05). It can be seen that mindfulness decompression therapy combined with transcranial ma-

Table 4. Comparison of neuroelectrophysiological indexes between two groups ($\bar{x}$ ± sd)

	Groups		t	P
	Control group (n=46)	Research group (n=46)		
MMN latency (ms)				
Before treatment	203.59±26.81	201.71±25.78	0.343	0.732
After treatment	193.62±21.41***	181.04±19.76***	3.003	0.003
MMN amplitude (μV)				
Before treatment	3.27±0.51	3.36±0.56	0.806	0.422
After treatment	7.05±1.28***	8.62±1.57***	5.257	<0.001
Target N2 latency (ms)				
Before treatment	281.69±32.58	283.14±33.75	0.210	0.834
After treatment	263.52±30.59***	242.67±28.79***	3.366	0.001
None-target P2 amplitude (μV)				
Before treatment	1.48±0.38	1.50±0.40	0.246	0.806
After treatment	2.18±0.53***	3.17±0.84***	6.760	<0.001
Target P3 latency (ms)				
Before treatment	354.81±40.59	351.78±39.71	0.362	0.718
After treatment	338.57±42.05***	313.25±34.21***	3.169	0.002

Note: Compared with the same group before the treatment, ***P<0.001.

Table 5. Comparison of GCQ scores between two groups ($\bar{x}$ ± sd, score)

	Groups		t	P
	Control group (n=46)	Research group (n=46)		
Social comfort				
Before treatment	11.71±2.56	12.15±2.38	0.854	0.395
After treatment	17.63±3.28***	20.54±3.69***	3.998	<0.001
Environmental comfort				
Before treatment	13.53±2.89	13.72±2.92	0.314	0.754
After treatment	20.12±3.88***	23.83±4.32***	4.333	<0.001
Physiological comfort				
Before treatment	9.82±2.07	9.99±2.49	0.356	0.723
After treatment	14.37±2.45***	16.32±2.74***	3.598	<0.001
Psychological comfort				
Before treatment	17.65±3.29	18.06±3.32	0.595	0.553
After treatment	26.63±5.74***	31.24±6.43***	3.627	<0.001

Note: Compared with the same group before the treatment, ***P<0.001. GCQ: general comfort questionnaire.

gnetic stimulation can effectively improve the nervous system activity of patients with generalized anxiety disorder. See **Table 4**.

GCQ scores

After the treatment, the scores of social comfort, environmental comfort, physiological comfort and psychological comfort of the two groups were all increased, and the research group had higher scores than the control group (P<0.05). It can be seen that mindfulness decompression therapy combined with transcranial magnetic stimulation can effectively improve the comfort experience of patients with generalized anxiety disorder. See **Table 5** and **Figure 2**.

PSQI scores

After the treatment, PSQI scores of the two groups were decreased, and the research group had a greater reduction than the control group (P<0.05). Therefore, mindfulness decom-

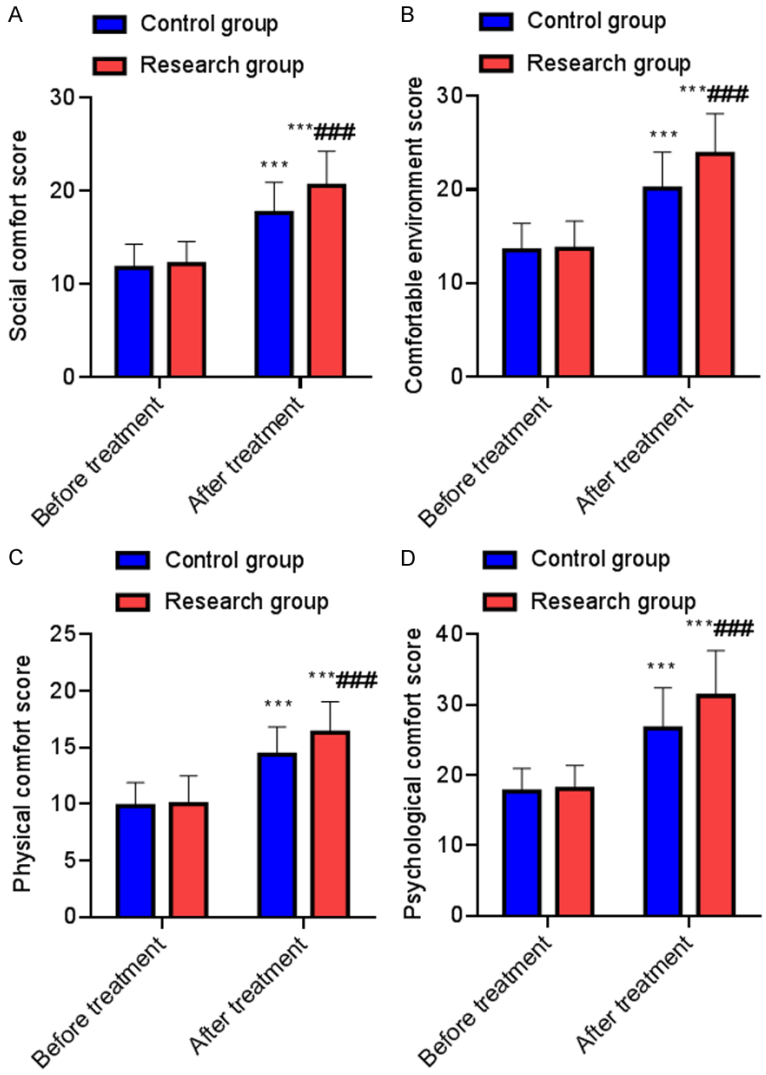

Figure 2. Comparison of GCQ scores between two groups. A: Social comfort score; B: Environmental comfort score; C: Physiological comfort score; D: Psychological comfort score. Compared with the same group before treatment, ***P<0.001; compared with the control group, ###P<0.001. GCQ: general comfort questionnaire.

pression therapy combined with transcranial magnetic stimulation effectively improved the sleep quality of patients with generalized anxiety disorder. See **Table 6**.

Discussion

Drug therapy in the treatment of mental illness is known to have certain curative effect and some shortcomings in the meantime. For example, the drug may also affect other normal brain regions and interfere with the work of normal brain regions when it works on the brain; in addition, anxiety disorder belongs to chronic disease and most patients need long-term and large amounts of medication, which will lead to drug dependence. Moreover, patients may have a series of extrapyramidal adverse reactions due to the severe side effects of psychotropic drugs, such as eye roll up, facial deformity, mouth opening difficulty, etc. Therefore, non-drug therapy has become a new way for treatment of mental illness [13].

Transcranial magnetic stimulation (TMS) is a non-invasive and painless physical therapy that stimulates the evoked potentials in the motor areas of the cerebral cortex of patients through magnetic coils, and thus, induces brain tissue excitation. In the magnetic field, the coil discharge is stimulated to generate a pulse current to form a pulsed magnetic field. The magnetic field itself does not excite the brain tissue. However, the pulse magnetic field will generate an induced current by changing the membrane potential of nerve cells in the cerebral cortex once it acts on the central nervous system through the skull. Subsequently, the induced current stimulates the brain tissue to induce neural electrical activity and regulates brain tissue metabolism, and thus induces a series of physiological changes [14]. As the important areas related to emotion regulation and located in the prefrontal lobe and limbic system, the coil placement is preferred in the anterolateral right frontal lobe.

In addition to significant emotional symptoms, anxiety patients are often accompanied by severe sleep disorders, and they are more likely to be nervous and irritable than those without insomnia. Besides, sleep disorders often appear before anxiety symptoms as a pioneer symptom, and they interact with each other.

Table 6. Comparison of PSQI scores between two groups ($\bar{x}$ ± sd, score)

	Groups		t	P
	Control group(n=46)	Research group (n=46)		
Sleep quality				
Before treatment	2.01±0.56	1.95±0.51	0.537	0.593
After treatment	0.84±0.32***	0.58±0.25***	4.343	<0.001
Sleep time				
Before treatment	2.13±0.61	2.19±0.62	0.468	0.641
After treatment	0.82±0.31***	0.63±0.26***	3.185	0.002
Sleep efficiency				
Before treatment	2.12±0.61	2.14±0.62	0.156	0.876
After treatment	0.78±0.30***	0.60±0.26***	3.075	0.003
Sleep latency				
Before treatment	2.39±0.60	2.28±0.58	0.894	0.374
After treatment	1.09±0.66***	0.84±0.32***	2.312	0.023
Sleep Disorder				
Before treatment	2.21±0.59	2.25±0.62	0.317	0.752
After treatment	1.04±0.64***	0.81±0.30***	2.207	0.030
Hypnotic Drugs				
Before treatment	1.93±0.50	1.99±0.54	0.553	0.582
After treatment	0.72±0.38***	0.43±0.20***	4.580	<0.001
Daytime Dysfunction				
Before treatment	1.82±0.47	1.79±0.45	0.313	0.755
After treatment	0.61±0.33***	0.41±0.19***	3.562	0.001

Note: Compared with the same group before the treatment, ***P<0.001. PSQI: Pittsburgh sleep quality index.

Sleep disorders have a close correlation with the onset and progression of anxiety. Therefore, intervention on anxiety related insomnia has positive significance for the alleviation of anxiety [15, 16]. At present, TMS is still in the exploratory stage for the treatment of sleep disorders. To analyze the mechanism of TMS on insomnia, the induced current produced by pulsed magnetic field on cerebral cortex restores the disordered neuronal electrical activity, and thus induces slow wave sleep. The slow wave sleep helps the patients to get into deep sleep state and stabilize sleep rhythm; besides, the secondary current induced by external magnetic field releases neurotransmitters relating to sleep, such as 5-HT, acetylcholine and norepinephrine. In addition, c-fos gene expression was induced by stimulating current to enhance the activity of pyramidal neurons in prefrontal cortex, improve the cognitive function of patients and stabilize the emotion of patients, thus improving the sleep [17, 18].

The results in the present study showed that the research group had better clinical efficacy than the control group after the treatment; HAMA, CGI and PSQI scores of the research group were lower than those of the control group. Besides, MMN latency, target N2 latency and target P3 latency were all lower than those of the control group. At the same time, MMN amplitude, non-target P2 amplitude and GCQ score were higher than those of the control group, suggesting that mindfulness decompression therapy combined with TMS are more effective in the treatment of generalized anxiety disorder. Wu et al. reported that mindfulness decompression therapy combined with drug treatment was more effective than drug intervention alone to improve anxiety symptoms and the quality of life in patients with generalized anxiety disorder [19]. Yu et al. pointed out that mindfulness decompression therapy relieved the anxiety and improved the social support and comfort of patients with generalized anxiety disorder, which is also consistent with the results of this study [20].

Mindfulness therapy is not only a kind of practice through consciously paying attention to

both inside and outside of oneself, but also a kind of conscious process and mental state. Individual traits are closely related to the physical and mental health of human. Studies have shown the positive correlation between individual mindfulness and sleep quality [21]. The concept of mindfulness decompression believes that individuals with high mindfulness effectively mitigate the negative effects of stress on their physical and mental health by stimulating their self-regulation system. From the perspective of neurophysiology, Dentico et al. believe that mindfulness training strengthens the interaction between thalamus and cortex, promotes the changes of neural structure and nerve function, and thus increases the duration of rapid eye movement sleep and nocturnal wave sleep [22]. Silva et al. have also found that mindfulness meditators have higher subjective well-being and less difficulty in emotional and psychological symptoms regulation than non-meditators [23]. Besides, accumulating evidence shows that mindfulness decompression therapy effectively prevents and improves the depression and anxiety outcomes. From the physiological level, mindfulness exercise relieves stress-related diseases and promotes physical health by reducing the body's stress response and improving biological mechanism [24]. Based on mindfulness, through mindfulness introspection, mindfulness breathing, body scanning, mindfulness yoga, walking Zen and other ways, mindfulness decompression therapy focuses consciousness and attention on the current mind, so as to control and manage emotions, regulate body and mind, and reduce the pressure. The results of the study confirmed that mindfulness decompression therapy combined with TMS had a considerable effect on the treatment of anxiety symptoms. However, due to time constraints, we have not conducted long-term follow-up for patients with generalized anxiety disorder, so it is not sure whether the long-term prognosis is still good for patients with generalized anxiety disorder after the treatment. After leaving the hospital without guidance and supervision, we are not sure whether or not the patients could adhere to mindfulness decompression treatment. In addition, the sample size used in the study was small and the samples were taken from the same hospital, and thus it is necessary to expand the sample size for in-depth study in the future.

In conclusion, mindfulness decompression therapy combined with TMS has high application value in the treatment of generalized anxiety disorder, which effectively relieves anxiety symptoms, improves comfort and sleep quality. However, it is necessary to further expand the clinical sample size in the future research.

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Disclosure of conflict of interest

None.

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References

[1] Fan XD, Wang XD, Yu X and Liu P. ICD-10 Classification of mental and behavioral disorders. People's Medical Publishing House. In: Fan XD, Wang XD, Yu X and Liu P, editor. Beijing: 1993. pp. 72-81

[2] Yu JQ, Chi Q, Sun ZH, Jiang ZD, Shan MS, Fan CL and Xu N. Efficacy of combination of drug and mindfulness-based stress reduction against generalized anxiety d isorder and sleep quality. Med J Chin People's Armed Police Forces 2020; 31: 497-499.

[3] Hoge EA, Guidos BM, Mete M, Bui E, Pollack MH, Simon NM and Dutton MA. Effects of mindfulness meditation on occupational functioning and health care utilization in individuals with anxiety. J Psychosom Res 2017; 95: 7-11.

[4] Altunoz U, Kokurcan A, Kirici S, Bastug G and Ozel-Kizil ET. Clinical characteristics of generalized anxiety disorder: older vs. young adults. Nord J Psychiatry 2018; 72: 97-102.

[5] Kozel FA. Clinical repetitive transcranial magnetic stimulation for posttraumatic stress disorder, generalized anxiety disorder, and bipolar disorder. Psy Clin North Am 2018; 41: 433-446.

[6] Xu CX, Wang Q and Li HZ. Research progress of transcranial magnetic stimulation in the treatment of generalized anxiety disorders. Med Recapitulate 2018; 24: 4491-4496.

[7] Antczak JM, Poleszczyk A, Wichniak A, Rakowicz M and Parnowski TJ. The influence of the repetitive transcranial magnetic stimulation on sleep quality in depression. Psychiatr Pol 2017; 51: 845-857.
[8] Wang YM, Li N, Yang LL, Song M, Shi L, Chen WH, Li SX, Wang XY and Lu L. Randomized controlled trial of repetitive transcranial magnetic stimulation combined with paroxetine for the treatment of patients with first-episode major depressive disorder. Psychiatry Res 2017; 254: 18-23.
[9] Hoge EA, Bui E, Palitz SA, Schwarz NR, Owens ME, Johnston JM, Pollack MH and Simon NM. The effect of mindfulness meditation training on biological acute stress responses in generalized anxiety disorder. Psychiatry Res 2018; 262: 328-332.
[10] Creswell JD, Taren AA, Lindsay EK, Greco CM, Gianaros PJ, Fairgrieve A, Marsland AL, Brown KW, Way BM, Rosen RK and Ferris JL. Alterations in resting-state functional connectivity link mindfulness meditation with reduced interleukin-6: a randomized controlled trial. Biol Psychiatry 2016; 80: 53-61.
[11] Huang Z, Li Y, Bianchi MT, Zhan S, Jiang F, Li N, Ding Y, Hou Y, Wang L, Ouyang Q and Wang Y. Repetitive transcranial magnetic stimulation of the right parietal cortex for comorbid generalized anxiety disorder and insomnia: a randomized, double-blind, sham-controlled pilot study. Brain Stimul 2018; 11: 1103-1109.
[12] Griffiths C, O'Neill-Kerr A, De Vai R and da Silva K. Impact of repetitive transcranial magnetic stimulation on generalized anxiety disorder in treatment-resistant depression. Ann Clin Psychiatry 2019; 31: 236-241.
[13] White D and Tavakoli S. Repetitive transcranial magnetic stimulation for treatment of major depressive disorder with comorbid generalized anxiety disorder. Ann Clin Psychiatry 2015; 27: 192-196.
[14] Sagliano L, Atripaldi D, De Vita D, D'Olimpio F and Trojano L. Non-invasive brain stimulation in generalized anxiety disorder: a systematic review. Prog Neuropsychopharmacol Biol Psychiatry 2019; 93: 31-38.
[15] Van Dalfsen JH and Markus CR. The influence of sleep on human hypothalamic-pituitary-adrenal (HPA) axis reactivity: a systematic review. Sleep Med Rev 2018; 39: 187-194.
[16] Klumpp H, Roberts J, Kapella MC, Kennedy AE, Kumar A and Phan KL. Subjective and objective sleep quality modulate emotion regulatory brain function in anxiety and depression. Depress Anxiety 2017; 34: 651-660.
[17] Chen PJ, Huang C LC, Weng SF, Wu MP, Ho CH, Wang JJ, Tsai WC and Hsu YW. Relapse insomnia increases greater risk of anxiety and depression: evidence from a population-based 4-year cohort study. Sleep Med 2017; 38: 122-129.
[18] Wang YY, Li XH, Zheng W, Xu ZY, Ng CH, Ungvari GS, Yuan Z and Xiang YT. Mindfulness-based interventions for major depressive disorder: a comprehensive meta-analysis of randomized controlled trials. J Affect Disord 2018; 229: 429-436.
[19] Wu L, Chen QQ, Li ZY and He RF. Efficacy of mindfulness therapy combined with paroxetine in the treatment of generalized anxiety disorder. Gansu Sci Technol 2020; 36: 146-148.
[20] Yu YL and Ma N. Effect analysis of mindfulness decompression therapy on emotion and social support of patients with generalized anxiety disorder. J Qiqihar Med College 2019; 40: 335-336.
[21] Lindsay EK and Creswell JD. Mechanisms of mindfulness training: monitor and acceptance theory (MAT). Clin Psychol Rev 2017; 51: 48-59.
[22] Dentico D, Ferrarelli F, Riedner BA, Smith R, Zennig C, Lutz A, Tononi G and Davidson RJ. Short meditation trainings enhance non-REM sleep low-frequency oscillations. PLoS One 2016; 11: e0148961.
[23] Da Silva JP and Pereira AM. Perceived spirituality, mindfulness and quality of life in psychiatric patients. J Relig Health 2017; 56: 130-140.
[24] Tomlinson ER, Yousaf O, Vittersø AD and Jones L. Dispositional mindfulness and psychological health: a systematic review. Mindfulness 2018; 9: 23-43.