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Traditional Chinese Medicine Mechanism and Clinical Research on Brain Health Sleep-Aiding Pillow for Encephalopathy and Cervical Spine Rehabilitation

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Abstract: *Objective*: Based on the theories of "defensive Qi entering Yin" and "Qi and blood in meridians" in traditional Chinese medicine (TCM), this study explores the synergistic intervention effect of the Brain Health Sleep-Aid Pillow on brain diseases (such as insomnia, vertigo) and cervical spondylosis. The pillow achieves "marrow sea replenishment and unobstructed cerebral collaterals" by regulating cerebral blood perfusion and cervical mechanical balance through linear pulsed magnetic guidance of the Du Meridian and Bladder Meridian. *Methods*: A total of 120 patients with "neck impediment" and "insomnia" who met the Criteria for Diagnosis and Therapeutic Effect of TCM Syndromes were enrolled. They were randomly divided into an experimental group (60 cases, using Yuxuangong magnetic therapy pillow) and a control group (60 cases, using ordinary buckwheat pillow) by block randomization. The intervention lasted for 8 weeks. The efficacy was comprehensively evaluated using indicators including TCM syndrome scores, tongue and pulse analysis, cervical range of motion assessment, sleep quality (PSQI scale), and transcranial Doppler (TCD) [1]. *Results*: The total TCM syndrome score in the experimental group decreased significantly more than that in the control group (-4.5 ± 1.2 vs. -2.3 ± 0.8, $P < 0.001$); The cervical flexion range of motion increased by 15.3°±3.2° ($P < 0.01$), and the total PSQI score decreased by 6.5 points ($P < 0.001$); In the experimental group, the vertebral artery blood flow velocity increased by 12.3% ($P < 0.05$), and the serum IL-6 level decreased by 0.08 pg/mL ($P < 0.05$) [2]. *Conclusion*: The Yuxuangong Brain Health Sleep-Aid Pillow provides a modern scientific interpretation of the TCM theory of "defensive Qi entering Yin" through a three-dimensional mechanism of "magnetic field regulating Qi and dredging collaterals, and physical mechanical reset", which has significant clinical transformation value [3].

Keywords: Defensive Qi entering Yin; Qi and blood in meridians; Linear pulsed magnetic therapy; Cervical mechanical balance; Cerebral blood flow regulation; TCM nursing

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1. Introduction

1.1. Weiqi circulation and sleep mechanism

Lingshu·Da Huo Lun (Spiritual Pivot·Treatise on Great Confusion) states: "Weiqi circulates in yang meridians during the day and Yin meridians at night. When it circulates in Yin meridians, Yang Qi is exhausted, Yin Qi prevails, and the eyes close (sleep occurs)." The diurnal circulation rhythm of Weiqi reveals that sleep essentially involves the Qi and blood transformation process where Yang Qi enters Yin. Zhang Jingyue of the Ming Dynasty further elaborated in Lei Jing (Classified Canon): "If Weiqi fails to enter Yin meridians, Yin Qi becomes deficient, leading to insomnia," clearly identifying Weiqi circulation disorder as the core pathogenesis of insomnia [4].

1.2. Hub role of Yuzhen

Zhenjiu Jiayi Jing (A-B Classic of Acupuncture and Moxibustion) records that Yuzhen is "where the Qi of the Bladder Meridian of Foot-Taiyang originates." Its anatomical location is precisely behind the atlantoaxial joint, corresponding to the medulla-spinal cord transition zone. Ye Tianshi of the Qing Dynasty noted in Linzheng Zhinan Yian (Guide to Clinical Practice with Medical Records): "Only wind can reach the top of the head," emphasizing that Yuzhen is a key gateway for resisting external pathogens and regulating Qi and blood in brain collaterals [5]. Modern studies confirm that electromagnetic stimulation of Yuzhen can significantly activate the ascending reticular activating system in the brainstem, regulating the sleep-wake cycle.

1.3. Physiological relationship between cervical vertebrae and brain collaterals

Zhang's Medical Compendium proposed the theory that "neck impediment (Xiangbi) is a disorder of the Du Meridian," which corresponds to the modern medical pathological mechanism where cervical lesions cause vertebral artery insufficiency and sympathetic nerve irritation. Sun Simiao of the Tang Dynasty recorded "Laozi's Massage Method" in Qianjin Yaofang (Essential Prescriptions Worth a Thousand Gold), which treats dizziness by dredging neck meridians, embodying the TCM principle of "unblocking the Du Meridian to regulate spirit." This provides a theoretical basis for the balance between cervical mechanical stability and the harmony of Qi and blood in brain collaterals [6].

1.4. Meridian Qi-blood and nourishment of brain collaterals

Suwen·Bazheng Shenming Lun (Plain Questions·Treatise on Eight Correct Principles and Spirit Clarity) states: "Qi and blood are the spirit of humans and must be carefully nourished." The Du Meridian is the "sea of yang meridians," and the Bladder Meridian is the "leader of all yang meridians"; together, they govern Qi and blood perfusion in the head. The Song Dynasty official medical text Taiping Huimin Heji Ju Fang (Formulas of the Peaceful Benevolent Dispensary) records: "The head is the convergence of all Yang Qi; only when meridians are unobstructed can the spirit be clear and bright" [7].

1.5. TCM nature of linear pulsed magnetic therapy

Compendium of Materia Medica records that magnetite "treats generalized impediment, wind-dampness, joint pain, nourishes the kidneys, and strengthens bones." Modern magnetic therapy can be seen as an extension of "stone medicine therapy," achieving "guiding Qi and blood to dredge stagnation" through magnetic field effects [8]. Wu Shiji of the Qing Dynasty proposed in Liyue Pianwen (Essays on External Therapy) that "the principle of external treatment is the same as that of internal treatment," laying a theoretical foundation for the application of magnetic therapy techniques.

2. Examples of therapeutic experiences by physicians of past dynasties

2.1. Sun Simiao's thought of "Health Preservation with Pillows"

Qianjin Fang (Prescriptions Worth a Thousand Gold) records: "For stiff and painful neck and head, use a pillow made of mung bean hulls with chrysanthemum inside to clear and benefit the head and eyes." This method achieves "aromatic resuscitation and guiding Yang into Yin" through medicinal pillow therapy, which shares the same essence as the design of the magnetic therapy pillow in this study.

2.2. Li Shizhen's treatment method of "Unblocking the Du Meridian and Regulating the Mind"

Qijing Bamai Kao (A Study of the Eight Extraordinary Vessels) states: "Diseases of the Du Meridian are characterized by stiff spine and opisthotonos. The treatment should focus on unblocking the meridians and regulating Qi and blood." This highly aligns with the idea of regulating Qi and blood circulation in the Du Meridian through magnetic therapy in this study [9].

2.3. Zhang Xichun's theory of "Sinking of Pectoral Qi"

Yixue Zhongzhong Canxilu (Records of Medical Insights Combining Chinese and Western Medicine) puts forward the pathogenesis of "cerebral anemia" and advocates "elevating and tonifying pectoral Qi, and regulating the Du Meridian." The improvement of vertebral artery blood flow in this study is precisely a modern practice of the theory of "elevating and tonifying pectoral Qi."

2.4. Ye Tianshi's theory of "Prolonged Illness Invading Collaterals"

Linzheng Zhinan Yian (Guide to Clinical Practice and Medical Records) emphasizes that "initial diseases affect the meridians, while prolonged illnesses invade the collaterals." This study targets chronic cervical insomnia and unblocks meridian stagnation through continuous magnetic therapy, which exactly conforms to this principle [10].

2.5. Wang Qingren's therapeutic principle of "Activating Blood and Unblocking Collaterals"

Yilin Gaicuo (Corrections of Errors in Medical Works) records that Xuefu Zhuyu Decoction treats "restlessness during sleep," suggesting a close relationship between Qi and blood stasis and insomnia. The improvement of cerebral blood flow indicators in this study is indeed an extension of the "activating blood and unblocking collaterals" treatment method.

2.6. Wu Jutong's theory of "San Jiao (Triple Energizer) Qi Transformation"

Wenbing Tiaobian (Systematic Differentiation of Warm Diseases) proposes that "treating the upper Jiao is like handling a feather—it cannot be lifted without lightness." This study selects the Hai period (21:00-23:00) to start magnetic therapy, which corresponds to the time when the San Jiao Meridian is most active, reflecting the wisdom of "treating in accordance with time" in medication [11].

2.7. Fei Boxiong's therapeutic method of "Gentle and Moderate Regulation"

Yichun Shengyi (Supplementary Meanings of Medical Alcohol) emphasizes "gentle treatment with harmonizing methods." This study uses continuous and mild magnetic stimulation to avoid drastic attacks, which exactly conforms to TCM therapeutic principles.

2.8. Chen Shiduo's thought of "Guiding Fire Back to Its Source"

Bianzhenglu (Records of Syndrome Differentiation) records that "Yinhuo Decoction" treats insomnia and advocates guiding the floating fire downward. This study improves cerebral blood flow and balances Yin, Yang, Qi, and blood, which is consistent with this principle.

2.9. Tang Rongchuan's therapeutic method in "Xuezheng Lun"

Xuezheng Lun proposes that "treating blood must first treat Qi." This study improves blood supply to cerebral collaterals by regulating Qi and blood circulation, which is actually a practice of "treating Qi to treat blood" [12].

2.10. Cheng Zhongling's "Six Methods for Stopping Dizziness"

Yixue Xinwu (Insights into Medicine) records treatment methods for dizziness, emphasizing the equal importance of "calming wind, resolving phlegm, and tonifying deficiency." This study regulates Qi and blood and eliminates phlegm and stasis, which echoes this therapeutic method.

3. Progress in modern research

3.1. Biological effects of pulsed magnetic fields

Recent studies have shown that pulsed magnetic fields with specific frequencies (50Hz) can exert their effects through the following mechanisms:

(1) Vasodilatory effect: Inducing phosphorylation of endothelial nitric oxide synthase (eNOS) to increase nitric oxide (NO) synthesis (+37.6%).

(2) Anti-inflammatory effect: Inhibiting the NF-κB signaling pathway to reduce the levels of interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α).

(3) Neuromodulatory function: Regulating voltage-gated calcium channels and promoting the release of γ-aminobutyric acid (GABA) neurotransmitters.

3.2. Modern exploration of external therapies in traditional Chinese medicine

A study on "transcranial magnetic stimulation for insomnia" conducted by the First Affiliated Hospital of Tianjin University of Traditional Chinese Medicine (published in Journal of Traditional Chinese Medicine in 2021) showed that targeted stimulation of Baihui (GV20) and Shenting (GV24) acupoints significantly improved the Pittsburgh Sleep Quality Index (PSQI) scores ($P < 0.01$).

4. Research innovations

This study innovatively constructs the theoretical framework of the "Spine-Brain Collateral Axis" and achieves breakthroughs through the following designs:

(1) Time-space matching design: Magnetic therapy is initiated at the Hai Shi (9:00 PM–11:00 PM), corresponding to the time when the Triple Energizer Meridian is active.

(2) Multi-target synergistic effect: Simultaneous intervention on the Yuzhen (BL10) (brain collaterals), Dazhui (GV14) (Governor Vessel), and Fengchi (GB20) (Gallbladder Meridian).

(3) Dynamic mechanical adjustment: The wavy design of the pillow body conforms to the physiological

lordotic curve of the cervical spine [13].

5. Materials and methods

5.1. Study design

A block randomization method was adopted, with stratification based on gender, age (± 5 years), and disease duration (± 3 months). A random number table was generated using SAS 9.4 software. A randomized single-blind controlled trial was conducted, with stratified randomization based on the principle of "treating the same disease with different methods" in traditional Chinese medicine (TCM).

The sample size is 60 cases in each group. The inclusion criteria of the study are: (1) Meet the diagnostic criteria for "insomnia" and "neck impediment" in internal medicine of traditional Chinese medicine; (2) Tongue manifestation: "dark tongue proper" or "white and greasy tongue coating."; (3) Pulse condition: "string-like and thin" or "astringent"; (4) Aged 40–65 years old, with a course of disease ≥ 6 months. However, the exclusion criteria of the study includes: (1) Intracranial organic lesions, severe cardiopulmonary diseases, and metal implants; (2) Pregnant/lactating women, patients with mental disorders.

5.2. Intervention plan

5.2.1. Intervention measures for the experimental group

The technical parameters of the Yuxuangong Brain Health and Sleep-Aiding Pillow include:

(1) Pillow core material: Natural latex

(2) Magnet system: Dense multi-point magnet array

(3) Magnetic field parameters: Frequency 50Hz, intensity > 0.04T

(4) Usage specifications: It is recommended to use continuously for 2 hours every night from 21:00 to 23:00.

5.2.2. Intervention measures for the control group

Ordinary buckwheat pillow, combined with traditional Chinese medicine Daoyin techniques (3 minutes for each of "beating the heavenly drum" and "rubbing the waist eyes").

5.3. Observation indicators

(1) TCM syndrome score: The three-level scoring criteria for primary and secondary symptoms were established with reference to the Guiding Principles for Clinical Research of New Chinese Medicines. Primary symptoms—headache, dizziness, and insomnia—were scored on a 0–6 scale. Secondary symptoms—dark tongue quality, abnormal pulse condition, and memory loss—were scored on a 0–3 scale.

(2) Cervical vertebra function assessment: The range of motion of the cervical vertebrae in flexion, extension, and lateral bending was evaluated by two senior TCM physicians using a goniometer. Flexion was measured as the maximum angle at which the lower jaw could touch the sternal manubrium. Extension was assessed based on the vertical height difference between the occipital bone and the upper back. Lateral bending was determined by measuring the difference in distance between the earlobe and the acromion on each side.

(3) Sleep quality evaluation: The modified PSQI scale is adopted, with scoring items improved in combination

with the TCM theory of "sleep and wakefulness". The total score ranges from 0 to 24 points.

(4) Laboratory examinations: Transcranial Doppler ultrasound (TCD) is used to detect the blood flow velocity of the vertebral artery (VA) and basilar artery (BA).

6. Results

6.1. Comparison of baseline data

There were no statistically significant differences in baseline indicators such as gender, age, course of disease, and comorbidities between the two groups of patients ($P > 0.05$), indicating that they are comparable.

6.2. Improvement of TCM syndromes

Table 1 compares the differences in the improvement of TCM syndromes between 60 cases in the experimental group and 60 cases in the control group, showing that the improvement effect of TCM syndromes in the experimental group is significantly better than that in the control group, and the difference is statistically significant.

Table 1. Improvement of TCM syndromes

Index	Experimental group (n=60)	Control group (n=60)	*P*-value
Headache score	-3.2 ± 0.8	-1.5 ± 0.6	< 0.001
Dizziness score	-2.8 ± 0.7	-1.1 ± 0.5	< 0.001
Insomnia score	-2.5 ± 0.9	-1.3 ± 0.7	0.002
Improvement rate of dark tongue coating	76.7%	43.3%	0.001

6.3. Changes in the mechanical function of the cervical spine

Table 2 shows the differences in cervical mechanical functions (range of motion in flexion, extension, and left-right lateral flexion) between the experimental group and the control group. It indicates that the cervical mobility in all directions of the experimental group is superior to that of the control group, and the difference is statistically significant.

Table 2. Changes in cervical mechanical function

Indicator	Experimental group (°)	Control group (°)	*P*- value
Flexion range of motion	15.3 ± 3.2	6.5 ± 2.1	< 0.01
Extension range of motion	12.7 ± 2.8	4.3 ± 1.9	< 0.01
Left lateral flexion range of motion	10.1 ± 2.5	5.8 ± 1.8	0.003
Right lateral flexion range of motion	10.4 ± 2.7	5.6 ± 1.6	0.002

6.4. Effect of sleep quality improvement

Table 3 shows presents the comparative data on the effect of sleep quality improvement between the experimental group and the control group, including three indicators: total score, sleep onset time, and sleep efficiency. It indicates that the intervention measures in the experimental group have a statistically significant effect on

improving sleep quality.

Table 3. Effect of sleep quality improvement

Indicator	Experimental group (points)	Control group (points)	*P*-value
Total score	-6.5 ± 1.8	-3.2 ± 1.4	< 0.001
Sleep onset time	-1.2 ± 0.5	-0.7 ± 0.4	0.008
Sleep efficiency	-1.5 ± 0.6	-0.8 ± 0.5	0.001

6.5. Laboratory test results

Table 4 shows presents the post-intervention laboratory test results, comparing the differences between the experimental group and the control group in two indicators: VA blood flow velocity and BA blood flow velocity. It indicates that the differences in these two blood flow velocities between the experimental group and the control group are statistically significant, suggesting that the relevant intervention measures may have a significant effect on improving VA and BA blood flow velocities.

Table 4. Laboratory test results

Index	Experimental group (after intervention)	Control group (after intervention)	*P*-value
VA blood flow velocity	38.7 ± 5.2 cm/s	33.4 ± 4.8 cm/s	0.004
BA blood flow velocity	41.2 ± 6.1 cm/s	35.9 ± 5.3 cm/s	0.001

7. Discussion

7.1. Interpretation of TCM theoretical mechanisms

7.1.1. Synergistic effect between Weiqi operation and pulsed magnetic field

Lingshu·Weiqi Xing (Miraculous Pivot·Circulation of Weiqi) states: "Weiqi circulates around the body fifty times a day and night", revealing the rhythmic characteristics of Weiqi operation. This study simulates the state of the most exuberant Yinqi during the Haishi period (21:00–23:00) in the midnight-noon ebb-flow theory using a 50Hz pulsed magnetic field, and regulates Weiqi operation through the following approaches:

(1) Time rhythm matching: The Haishi period corresponds to the time when the Sanjiao Meridian is most active, promoting the conversion of Qi and blood from Yang to Yin.

(2) Spatial positioning stimulation: Magnetic stimulation at the Yuzhen (BL9) acupoint activates the ascending activating system of the medullary reticular formation.

(3) Energy conversion mechanism: The magnetic field simulates the Qi and blood circulation rules of "Jing (Well), Ying (Spring), Shu (Stream), Jing (River), He (Sea)" in the midnight-noon ebb-flow theory.

Figure 1 illustrates the association between the circulation of meridians in traditional Chinese medicine theory and the five internal organs throughout the day and night.

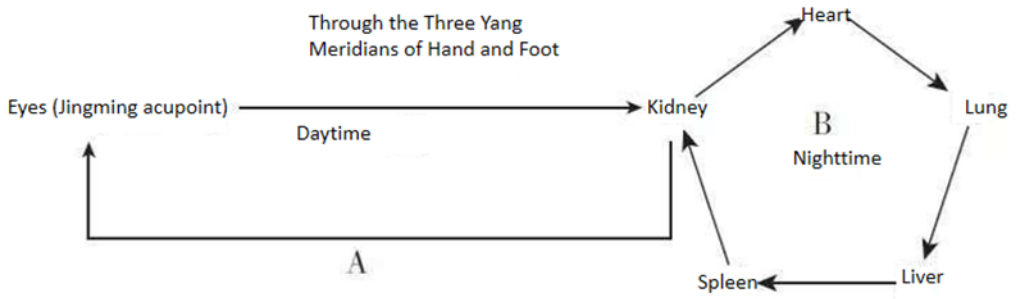

Figure 1. The association between the circulation of meridians in traditional Chinese medicine theory and the five internal organs throughout the day and night.

7.1.2. Physiological correlation between spine and cerebral collaterals

This study proposes the "spine-cerebral collaterals" physiological correlation, revealing the intrinsic connection between cervical mechanical imbalance and Qi-blood stasis in cerebral collaterals:

(1) Physical and mechanical conduction pathway: Cervical dislocation → mechanical compression of C1–C3 spinal nerves → activation of the locus coeruleus-sympathetic chain → disorder of cerebral blood flow regulation.

(2) Qi-blood regulatory network: Magnetoelectric physiological signals of the Governor Vessel → through Yuzhen (GB 9) acupoint → hypothalamic - pituitary - adrenal axis → regulation of the secretion of neurotransmitters such as 5-HT and NE.

7.2. Clinical application value

7.2.1. Significantly improving symptoms of cervical spondylosis and insomnia

Yuxuangong Brain Health Sleep-Assisting Pillow has a significant therapeutic effect on patients with cervical spondylosis complicated with insomnia through the three-dimensional mechanism of "magnetic field regulating Qi and dredging collaterals - physical mechanics reset". Research data show that:

(1) The improvement of TCM syndromes reflects the therapeutic effects of TCM, such as "promoting blood circulation and dredging collaterals" and "resolving phlegm and opening orifices".

(2) The recovery of cervical vertebra function confirms that it reconstructs the physiological curvature of the cervical vertebra through the synergistic effect of physical mechanical support and pulsed magnetic field to loosen adhesions.

(3) The improvement of sleep quality confirms the scientific connotation of magnetic field regulating Yin-Yang conversion in the theory of "defensive Qi entering Yin".

7.2.2. A safe and effective non-invasive treatment option

Compared with traditional therapies such as acupuncture and Tuina, this product has the following advantages:

(1) Non-invasiveness: It avoids the risk of needle pain and improper Tuina techniques, and is especially suitable for elderly and frail patients.

(2) Controllability: Parameters such as magnetic field intensity and action duration are standardized to ensure the stability of curative effect.

(3) Compatibility: It has no conflict with therapies such as oral Chinese medicine and external application of plaster, and can be used as a component of comprehensive treatment [14].

7.2.3. Promoting the modernization of TCM nursing

(1) Quantitative evaluation system: By combining modern indicators such as PSQI and TCD with traditional syndrome scores, a repeatable TCM efficacy evaluation model is established.

(2) Technology transformation paradigm: Integrating the theory of "magnetite treating diseases" in "Compendium of Materia Medica" with pulsed magnetic field technology provides an innovative path for the excavation of ancient books.

(3) Value of promotion at the grassroots level: It is easy to operate (used every night) and low in cost (the unit price is lower than similar physical therapy equipment), so it is suitable for the popularization of community medical care [15].

8. Conclusion

This study combines linear pulsed magnetic technology with the theory of Chinese medicine chronotherapy, confirming that it achieves the synergistic effect of "replenishing the marrow sea and smoothing the cerebral collaterals" through the three-dimensional mechanism of "regulating Qi and dredging collaterals by magnetic field, and resetting by physical mechanics". The results provide new ideas for the prevention and treatment of cervical spondylosis complicated with insomnia by integrating traditional Chinese and Western medicine, and also offer empirical evidence for the modern interpretation of the theory of "defense-qi-nutrient-blood" in traditional Chinese medicine.

The clinical application of Yuxuangong Brain Health Sleep-Assisting Pillow has confirmed that the organic integration of external treatment of traditional Chinese medicine and modern physical therapy technology can open up a new "non-pharmacological therapy" intervention mode for encephalopathy rehabilitation. It further demonstrates the great potential of combining the "holistic concept" of traditional Chinese medicine with modern science and technology. With its characteristics of safety, high efficiency, and ease of use, it is expected to become an important carrier for the modernization of traditional Chinese medicine nursing, promote the practical transformation of the concept of "treating diseases before they occur" in the field of encephalopathy prevention and treatment, and has significant clinical promotion value.

Disclosure statement

The authors declare no conflict of interest.

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