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Electroacupuncture Combined with Acupoint Catgut Embedding for Treating Paediatric Epilepsy: A Case Report

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Abstract: *Paediatric epilepsy is a common neurological disorder, and this case report describes the good efficacy of electroacupuncture combined with acupuncture burrowing in the treatment of paediatric epilepsy. In this case report, an adolescent patient was diagnosed with paediatric epilepsy and had had recurrent seizures for many years, seriously affecting his daily life, with poor results from oral medication and frequent seizures. However, after 2 months of electroacupuncture combined with acupoint catgut-embedding, the seizure frequency was significantly reduced or even eliminated. With this case report, electroacupuncture combined with acupoint catgut-embedding can be used as a novel alternative therapy for paediatric epilepsy.*

Keywords: *Electroacupuncture; acupoint catgut-embedding; paediatric epilepsy; case report*

1. Introduction

Epilepsy is a common neurological disorder in children and, according to the World Health Organization, there are approximately 50 million people with epilepsy worldwide, with approximately 2.4 million [1] new cases each year. Seizures typically commence in childhood for most patients [2], and around 50-60% of children diagnosed with epilepsy experience enduring brain damage and persistent psychiatric or neurological impairments due to ineffective treatment. Mental, behavioural and cognitive disorders are often closely linked to epilepsy in children, leading to an adverse impact on their quality of life [3]. In China, the prevalence of epilepsy patients is roughly 7 per 1, 000, and this figure appears to be increasing annually.

2. Western understanding of epilepsy

Epilepsy constitutes a collection of chronic syndromes that occur due to recurring and sudden dysfunction of the brain. This is deemed as at least two unprovoked seizures in a span of more than 24 hours or one unprovoked seizure with a high risk of recurrence (at least 60%), or a medical diagnosis of epilepsy syndrome [4,5]. In 2017, the International League Against Epilepsy (ILAE) revised the categorisation of epileptic seizures to improve their classification. Focal ictal seizures, generalised ictal seizures, and seizures of unknown origin are now identified as distinct types [6]. Clinical manifestations in patients may present with varying degrees of autonomic, motor, sensory, mental, and consciousness disorders. Patients are often stimulated due to prolonged exposure to watching TV or playing video games, constipation, accidental shock, as well as excessive fatigue and insufficient sleep, amongst other factors [7]. Thus far, Western medicine lacks a programme for achieving complete or satisfactory efficacy in treating this disease. Conventional treatment methods rely upon symptom management through drug administration, alongside rehabilitative measures to aid the child's self-recovery.

Among the various pathogenic factors in epileptogenesis, neurotransmitters play an important role. Neurotransmitters are endogenous chemicals that transmit signals across synapses and regulate excitatory/inhibitory neuronal function by binding to their respective receptors. In neurons, the balance between glutamate (GLU), the main excitatory neurotransmitter, and gamma-aminobutyric acid (GABA), the main inhibitory neurotransmitter, plays a key role in the balance of cellular excitability [8].

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GLU is one of the main neurotransmitters acting as a stimulant in the central nervous system (CNS) and is the most abundant amino acid in the brain [9]. GLU mainly covers cognitive functions, including learning and memory. During synaptic transmission, GLU and its receptors are involved in excitatory synaptic transmission of neurons, regulating many forms of neuronal and behavioural demeanour plasticity as well as many forms of learning and memory during brain development [10] and play a key role in neuronal excitability by enabling rapid signalling in astrocytes and glial cells. Current research suggests that GLUs both cause seizures and may play an important role in secondary brain damage in epilepsy. Four types of GLU receptors have been identified: mammalian alpha-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor (AMPAR), sodium alginate receptor (KAR), N-methyl-D-aspartate receptor (NMDAR) and metabotropic glutamate receptor (mGLUR).

GABA is an inhibitory neurotransmitter that is synthesised by glutamic acid decarboxylase (GAD) and is mostly encoded by the GAD1 gene. Dysfunction of the GAD1 gene results in an imbalance between inhibitory and excitatory neurotransmission [11]. GABA is mainly located in interneurons and acts through GABA-A and GABA-B receptors to function. GABA-A receptors are ligand-gated ion channels that exert a rapid inhibitory effect by increasing the influx of chloride ions into the cell. GABA-B receptors are G protein-linked ion channels that exert a slow inhibitory effect by decreasing the influx of calcium. GABA-A is degraded to succinate semialdehyde by the enzyme GABA transcarbamoylase after its release from the presynaptic axon terminals. Succinate semialdehyde is converted to succinate by succinate semialdehyde dehydrogenase and enters the tricarboxylic acid (Krebs) cycle. Impaired GABA propagation has been associated with several types of epilepsy. Research [11] has also shown that GAD1 is mainly involved in GABA production and it is thought that GAD1 mutations may lead to GABA dysregulation in the brain and brain dysfunction. This human genetic study is important to explain the function of GAD1 mutations in inhibiting GABA synthesis.

The central process of epileptogenesis is thought to be caused by an imbalance between GABA-mediated inhibition and GLU-mediated excitation. There is increasing evidence that other neurotransmitters may also play a key role, such as dopamine (DA), norepinephrine (NE) and 5-hydroxytryptamine (5-HT). DA is an endogenous neuromodulator in cortical circuits and the basal ganglia and belongs to the family of catecholamines and phenylephrine. DA is a precursor chemical amine formed from levodopa, which is synthesised in the brain and kidney. NE, a catecholamine produced by DA, is an adrenal hormone and a neurotransmitter released by noradrenergic neurons in the central and sympathetic nervous systems. NE is synthesised from the amino acid tyrosine through a series of enzymatic steps in the postganglionic neurons of the adrenal medulla and sympathetic nervous system. It has been found [12], that endogenous NE has an anticonvulsant effect in epilepsy. The fact that NE provides synaptically mediated excitability indirectly by modulating the conductivity of ion channels or through GABAergic and GLUergic transmission may help to explain its role in epilepsy. 5-HT, the main neurotransmitter of the 5-HTergic system, is confined to the nucleus of the middle suture of the brainstem and plays an important role in the regulation of brain functions role in the regulation of brain function [13]. 5-HT is a biogenic monoamine that acts in the central and peripheral nervous system through 5-HT receptors. Abnormalities in 5-HT neurotransmission may play an important role in the pathogenesis of respiratory dysfunction during epileptic seizures [14].

Acetylcholine (ACH) is one of the neurotransmitters involved in cognitive functions such as learning and memory. ACH consists of acetate and cholinester and its release is mediated by cholinergic neurons. Clinical trials have shown that dysfunction of the cholinergic system may lead to epilepsy [15].

3. Traditional Chinese medicine understanding of epilepsy

Epilepsy is categorised as a condition in traditional Chinese medicine and can be traced back to the Yellow Emperor's Classic of Internal Medicine (HUNDI NEIJING). The Treatise on the Origin and Symptoms of Various Diseases outlines eight etiological factors which classify epilepsy: wind-epilepsy, panic-epilepsy, phlegm-epilepsy, cold-epilepsy, and heat-epilepsy. The Tang Dynasty physician Sun Simiao classified epilepsy into six categories according to the classification of internal organs: heart epilepsy, lung epilepsy, liver epilepsy, intestinal epilepsy, etc. , and believed that epilepsy was closely related to the heart, liver, and kidneys; and the Yuan Dynasty physician Zeng Shirong believed that epilepsy was inextricably linked to convulsive winds. The root causes of epilepsy can be summarised as wind, phlegm, stasis, and deficiency. Throughout history, medical professionals have commonly attributed the onset of epilepsy to phlegm and blood stasis, and have suggested that the underlying

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cause may be a physical inadequacy in the patient.

Chinese medicine attaches great importance to the concept of wholeness, believing that the human being is an organic whole, and that the various components that make up the human body are structurally inseparable from each other, functionally coordinated and complementary to each other, and pathologically influenced by each other. Therefore, Chinese medicine has a very rich understanding of the etiology of epilepsy, mostly attributed to external six obscenities, internal injuries and forgetfulness, congenital insufficiency, dietary disorders, overwork or panic, phlegm and turbidity upward disturbance, clouding the clear orifices to disturb the mind and spirit, and blockage of the meridians and channels and epilepsy, which is often summed up in the phlegm, blood stasis, wind, deficiency and other etiological factors, and the specific identification of the following aspects to be elaborated.

3.1. Identify the evidence with phlegm

From ancient times to the present, most medical practitioners believe that the occurrence of epilepsy is closely related to phlegm. For example, it is mentioned in the Three Causes of Epilepsy: Epilepsy and Epileptic Symposium that "epilepsy is caused by shock and agitation, which makes the viscera and qi unbalanced, resulting in phlegm arising from depression and blocking of the meridians". -Another example is the statement in Eclampsia (Introduction to Medicine) that "Eclampsia has yin and yang, but only phlegm", which explains that phlegm is the key cause of epileptic seizures, and that phlegm is obsessed with the heart and orifices, resulting in epileptic epilepsy. Professor Liu Zuyi, a master of Chinese medicine, believes that epilepsy is caused by dysfunction of the internal organs, poor qi, abnormal fluid transport, thus phlegm and dampness arise internally, obscuring the orifices of the heart and leading to epilepsy, and that phlegm formation is the main cause of epilepsy due to the deficiencies in the three organs of the spleen, liver, and kidneys. It can be seen that the accumulation of phlegm in the body leads to obstruction of the meridians and channels, thus causing epileptic seizures.

3.2. Identify the evidence by stasis

Influenced by the medical practitioners of the past generations, many of them did not pay attention to the fact that "blood stasis causes epilepsy". In the book "The Heart of Medicine - Epilepsy", it is pointed out that Qi stagnation and blood stasis is one of the main causes of epilepsy, and "The Hundred Questions for Infants and Children - Epilepsy" provides the theoretical basis for the treatment of epilepsy by activating blood circulation and removing blood stasis. According to modern medical research, the phenomenon of phlegm and stasis inter-conjugation is very common in clinical practice. When epileptic seizures occur, the patient's qi and blood flow is in disarray, resulting in qi stagnation and blood stasis, so the method of invigorating blood and removing blood stasis plays a crucial role in the treatment of epilepsy. Therefore, the production of "stasis" in the body can also lead to epileptic seizures.

3.3. Identify the evidence with the wind

Ancient medical practitioners believed that wind is one of the six external influences that can lead to epilepsy. Wind is a yang evil, and its nature is inflammatory, and epilepsy occurs in the head and brain, which is easily attacked by wind. In "Taiping Shenghui Fang - Stroke Theory", "wind into the yang meridian will be crazy, into the yin meridian will be epilepsy" and "Pu Ji Fang", "wind is a disease, all by the coupling of the weak, Ying and Wei are weak and timid, the meridian is not smooth and closed the hole is the wind and epilepsy of the to also" have emphasised that the organism Wei surface is not cared for, and is prone to be injured by the wind evil. This is the reason why epilepsy is caused by wind.

3.4. Identify the evidence with the deficiency

Many medical practitioners believe that the patient's physical and visceral weakness is the root cause of the disease. Weakness of the spleen and stomach is the root cause of epilepsy, which can lead to epileptic seizures in the following ways: first, insufficient qi and blood cannot moisten the brain marrow, resulting in the loss of nourishment for the House of Divinity; second, the weakness of the spleen and stomach makes qi and blood run poorly in the body, resulting in stagnation of blood and qi; third, the spleen and stomach is the biggest hub of qi, blood, and yin and Yang, and the failure of the

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spleen and stomach makes the qi, blood, and yin and Yang elevation and lowering disorder, and the turbidity and clearness inverted, so that the brain marrow cannot be moistened with the clear Yang, and the turbidity and cloudiness of the yin and closed. This leads to epilepsy; fourthly, the weakness of the spleen and stomach causes water and dampness not to be transformed, which breeds phlegm and dampness and disturbs the clear orifices, causing the spirit to go out of control and triggering epilepsy.

4. Chinese and Western medical treatment of epilepsy

Pharmacological intervention is the preferred treatment for antiepileptic therapy. In the late 1970s, Professor Reynolds, who was the President of the International League Against Epilepsy at the time, discovered that monotherapy with antiepileptic drugs was more effective than drug combinations. This finding established the priority of monotherapy, which remains one of the fundamental principles of epilepsy drug therapy [16]. Antiepileptic medications are typically classified as either traditional anticonvulsant drugs or newer antiepileptic drugs. Traditional antiepileptic drugs, such as Valproate (VPA), Carbamazepine (CBZ) and Phenobarbital (PB), are well-established treatment options for epilepsy. Meanwhile, recent antiepileptic drugs like Oxcarbazepine (OXC), Levetiracetam (LEV), and Lacosamide (LCM) have emerged as promising alternatives. However, the majority of pharmacological interventions only have the ability to manage the condition rather than eliminate it, and often come with numerous negative side effects. For instance, carbamazepine and oxcarbazepine [17] exhibit adverse effects such as nausea and vomiting, whilst sodium valproate [18] induces skin rash.

The diversity and efficacy of TCM treatment for epilepsy is well-documented, with minimal adverse effects. Various documents indicate that [19,20] internal and external treatments can alleviate a range of seizure types and enhance patients' quality of life.

The pathological alterations in paediatric epilepsy affect various organs, such as the kidneys, liver, heart, spleen, brain, medulla, bones, and veins. Chinese medicine clinics typically employ basic treatment rules such as tonifying the liver and kidneys, benefiting the essence and marrow, awakening the brain and promoting mental clarity, nourishing the heart and enhancing intellect, clearing the meridians and collaterals, and strengthening the tendons and bones [21]. Commonly utilised medications comprise Acorus calamus, liquorice, tianmu, hemixia, poria and a variety of other drugs [22]. Yu Yunhong et al. [23] found through experimental studies that Chai Hu Shuo Liver Tang could significantly decrease the GLU content in the hippocampus of rats with epilepsy model, reduce the number of seizures, and exert antiepileptic effects. Chuanxiong is a commonly used antiepileptic drug in traditional Chinese medicine formulas, and its active ingredient, chuanxiongxizine, has been shown to have antiepileptic effects. Yang Baowang et al. [24] designed different dose combinations of Chuan Chenpiin and clonazepam and found that the high dose group of Chuan Chenpiin combined with the clonazepam pretreatment group could minimise the degree of myoclonus induced by subcutaneous injection of pentylenetetrazole (PTZ) in mice. Subsequently, after the mice were killed and the brain tissues were separated, the GABA and GLU contents in the tissues were determined by high-performance liquid chromatography, and it was found that the GLU content was reduced while the GABA content was increased in the high-dose chuanchuanpiisin pretreatment group, and the high-dose chuanchuanpiisin combined with clonazepam pretreatment group showed a more significant performance. It is suggested that chuanchuanpiisin can inhibit pentylenetetrazol-induced seizures by restoring the GlU/GABA balance and enhance the therapeutic effect of clonazepam. It has been found that the antiepileptic effect of gastrodin is mainly related to its enhancement of GABAergic neurons, anti-inflammatory, antioxidant, reduction of apoptosis and reduction of autophagy, and that gastrodin enhances the expression of GABA-A receptor, improves the function of GABAergic neurons and reduces the excitability of neurons, which in turn inhibits seizures.

The primary mechanisms of Traditional Chinese Medicine (TCM) and acupuncture comprise the modulation of neurotransmitters and receptors, regulation of voltage-gated ion channels, expression of apoptosis-related genes, antioxidant response and anti-inflammatory activities [25].

Acupuncture and acupoint catgut-embedding [26] are common external treatments for epilepsy in clinical practice. Developed on the basis of acupuncture treatment [27], according to the meridian theory of acupuncture, other absorbable threads or medical protein threads are buried in the corresponding acupoints through persistent and gentle stimulation of the acupoints to achieve the effect of "deeper and longer retention of the cure for persistent diseases" [28]. Protein thread is a kind of allogeneic protein for the human body [29-31], burying it in acupoints can produce stimulation to the human body, induce metamorphic reactions, increase the sensitivity of lymphocytes, and the combined effect of antibodies

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and macrophages in body fluids can improve the body's nutrient metabolism, enhance the body's ability to cope with stress, and promote the body's local blood flow, so as to effectively improve the body's blood circulation.

Gilvano Amorim Oliveira [32] by performing acupuncture on 10 adult epileptic patients for 26 consecutive weeks and comparing them with the control group, it was found that the epilepsy scale scores and the average number of seizures per month of the epileptic patients improved significantly after treatment, proving that acupuncture has a good effect on improving epilepsy symptoms. Deng Bowen [33] by analysing 827 articles, a meta-analysis found that acupuncture therapy has a positive effect on the treatment of epilepsy. Xu Zhijie [34] by including 39 papers and analysing them using statistical software, it was found that the three most commonly used acupuncture points were: Baihui (GV 20), Fenglong (ST 40) and Neiguan (PC 6), the selected meridians were mainly the governor vessel, the hand and foot yangming meridians. Gao Dongsheng [35] found that electroacupuncture treats epilepsy by modulating the AKT/mTOR pathway through electroacupuncture intervention in epilepsy model rats using protein blotting and immunohistochemistry analysis, which promotes autophagy in hippocampal neurons during epileptic seizures to ameliorate epileptic symptoms in rats. Mao Zhongnan [36] comprehensive epilepsy was treated with acupoint catgut-embedding and western medicine alone, and the acupoint burrowing group was chosen to Dazhui (GV 14), Yaoshu (GV 2), Jiuwei (CV 15), Qihai (CV 6), the results of the trial showed that the total effective rate of the acupuncture point buried thread group was significantly better than that of the western medicine alone group. Electroacupuncture combined with acupoint catgut-embedding treatment for epilepsy not only reduces the frequency of seizures, but also causes changes in the patient's brain electricity, resulting in a significant improvement in the patient's overall outcome. Compared to traditional drug therapy, the side effects are less life-threatening to patients, and the effectiveness of the treatment is confirmed when compared to traditional Western drug therapy alone.

Therefore, we document a case where this epileptic patient was effectively treated with acupoint catgut-embedding to reduce the frequency of his seizures.

5. Case presentation

On 12 December 2022, a 15-year-old male patient presented to our clinic. The patient had a sudden onset of head and neck deviation to the left side, eyes staring to the left side, hands clenched into fists, confusion that resolved after a few seconds, and more than 10 seizures per day. The patient was diagnosed with epilepsy at a local hospital and was treated with oral sodium valproate solution. After that, there were no seizures for more than 9 years. In December 2018, seizures occurred again, manifested as flushing, screaming and hissing, involuntary movements of limbs, unconsciousness, relieved after more than 10 seconds, 6-7 seizures per day, and there were no seizures for 2 years after follow-up at the local hospital. From February 2022 to the time of consultation, similar symptoms reappeared, with frequent seizures of 8-10 seizures per day, each lasting tens of seconds. At the time of consultation, he was being treated with oxcarbazepine tablets, levetiracetam tablets and sodium valproate extended-release tablets.

6. Electroacupuncture and Acupuncture Point Embedding Therapy

Figure 1: Selection of acupuncture points for electroacupuncture and submerged wire therapy

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Selected points: Hall of Seal(EX-HN3), Spirit Court(DU24), bilateral Pool at the Bend(LI11), bilateral Neiguan (PC6), Zhenwei(RN15), bilateral Leg Three Li (ST36), bilateral Yanglingquan (GB34), bilateral San yin chiao (SP6), Dazhui(DU14), bilateral Lung Yu (BL13), bilateral Heart Yu (BL15), bilateral Liver Yu (BL18), bilateral Kidney Yu (BL23). The details are shown in Figure 1.

Electroacupuncture operation: After disinfecting the skin using 75% alcohol, stainless steel needles (size: 0.25 mm × 40 mm, Suzhou Medical Supplies Factory Co. , Ltd. , China) were inserted into the above acupoints to a depth of 10-15 mm. We used flat thrusts at the Yin Tang and Shen Ting, oblique thrusts at the hemlock, Lung Yu, Heart Yu, Liver Yu, and Kidney Yu, and straight thrusts at the other points. We used rotating and lifting and inserting needling operation methods to produce a sense of getting qi at the above points. The needle body was placed in situ for 30 minutes and treated every 15 minutes.

Acupoint catgut-embedding operation: The patient takes the lying position, the operator stands on his right side and presses the acupoints locally on the patient's body surface, and marks the above acupoints with a blue violet pen; after local disinfection of the acupoints and their surrounding skin with iodine swabs, disinfect both hands with seven-step cleansing method; wear sterile gloves, use sterile tweezers to take a section of 4-0# collagen thread of about 1-2cm (according to the patient's physique to choose the corresponding length), and then thread it 1/2 into the front end of the syringe of a sterile single-use injection needle, leaving part of it outside the needle. Then put 1/2 of it into the front end of the single-use sterile syringe needle, leaving part of it outside the needle. The operator uses the thumb and forefinger of the left hand to fix the acupuncture point, and the right hand holds the end of the syringe to stab into the acupuncture point up to 0. 8-1. 0 inches, and then pulls out the body of the needle after slightly rotating it, leaving the thread at the acupuncture point, and then stops the bleeding by vertically pressing the needle hole with medical gauze, and then finally applies the bottle mouth sticker at the needle hole.

7. Clinical effectiveness of treatment

Table 1: Results of EEG monitoring before and after treatment

	Video EEG	EEG Diagnostics
Pre-treatment 2022.03.02	During video monitoring, there were 9 clinical episodes at 12:32, 14:46, 17:13, 19:22, 04:57, etc. , awake or asleep, sitting or lying, and at 19:22, awake, sitting, manifested by screaming, involuntary movements of the fingers of the left hand, right hand raised to touch the head, body slumping, hands lifting and pulling the blanket, stirring of the lower extremities of both hands, turning around, shaking of the whole body, and lack of consciousness. It took about 18 seconds for relief to arrive.	Abnormal EEG. Episodic phase: spike wave onset in right frontal and anterior temporal leads, spike wave rhythm in all leads, spike wave rhythm irregular, slow waves continue for about 20 seconds before returning to background rhythm (interspersed with large number of movement artefacts during this period). Intermittent period: Slightly more low-high amplitude single and continuous spike, spike, spike-slow, spike-slow and spike-slow complex waves were seen in the awake and asleep bilateral prefrontal, temporal, anterior temporal, right middle temporal and midline frontal leads.
After treatment 2023.02.28	During video monitoring, the No clinical seizure events were seen in the patient.	Abnormal adolescent electroencephalogram. Background activity: slower occipital lead alpha rhythm than peers during wakefulness. Intermittent phase: slightly more moderate to very high amplitude spike waves, spike-shaped slow waves and spike-slow complex waves with single, continuous and paroxysmal discharges predominantly in right prefrontal, frontal and midline frontal leads.

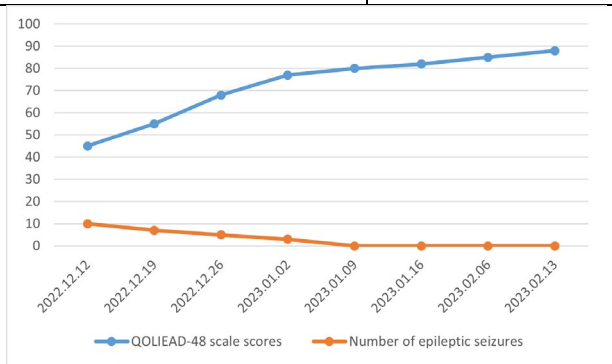

Figure 2: Changes in the number of seizures per week and quality of life questionnaire scores in adolescents with epilepsy

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The patient was treated once a week for 8 weeks. After the treatment, the patient's seizure frequency was significantly reduced, improving from 7-10 seizures per day to no seizures per day. At the same time, we recorded the changes in the results of pre- and post-treatment EEG monitoring (Table 1), as well as the number of seizures per week and the changes in the Quality of Life Questionnaire for Adolescents with Epilepsy (QOLIEAD-48) scores (e. g. , Figure 2).

8. Comment

In this case, we highlight that electroacupuncture combined with acupoint burrowing can effectively control the number of seizures and improve the patient's quality of life. The mechanism of epileptic seizures is extremely complex and has yet to be fully deciphered. It is currently recognised that the mechanism is an imbalance between excitation and inhibition within the central nervous system, which is closely related to ion channels, neurotransmitter imbalance, genetics and immune abnormalities. Many studies have found that electroacupuncture and acupoint acupuncture have significant efficacy in the treatment of epilepsy, which can improve the structure of the brain nervous system, effectively reduce the clinical symptoms of patients and reduce the frequency of seizures.

9. Summary

Our observations suggest that electroacupuncture combined with acupoint burrowing may have a therapeutic effect on epilepsy, controlling the recurrence of the condition, and may be used as an alternative therapy for the condition, however this is a single, uncontrolled case from which no firm conclusions can be drawn. A sufficiently large sample size is needed to validate the effectiveness of acupoint burrowing and to explore the potential mechanisms of action.

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