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Scalp Acupuncture Treatment for Neurological Disorders

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ABSTRACT

Scalp acupuncture was used to treat many disorders in China since 5 BC and has been re-developed by incorporating traditional Chinese acupuncture with modern knowledge of anatomy and physiology during past a few decades. Scalp acupuncture is characterized by inserting needles, at a low angle of approximately 15-30 degrees, into the thin layer of loose tissue beneath the scalp surface of 14 therapeutic lines or zones. In 1991, scalp acupuncture points have been standardized following the announcement by World Health Organization the International Standard Nomenclature for Scalp Acupuncture Points. It is believed that scalp acupuncture is more effective in treating brain-related conditions because stimulating different parts of the scalp by scalp acupuncture closely corresponds to relevant function areas of brain. In this paper, recent development of scalp acupuncture application on some neurological disorders such as stroke, Parkinson's disease and multiple sclerosis are reviewed.

Keywords: Scalp acupuncture, neurological disorders

INTRODUCTION

Scalp acupuncture therapy has been used to treat many conditions in China since 5 BC (Liu et al., 2012). Scalp acupuncture needles are penetrated into the specific areas of the scalp or lines on the scalp, and it differs significantly from classic acupuncture in that it has its own theoretical basis and its acupoints are quite different from traditional acupoints (Hao et al., 2013). Modern scalp acupuncture was established on the base of traditional Chinese acupuncture, modern anatomy and physiology, by integrating traditional Chinese needling methods with western medical knowledge of representative areas of the cerebral cortex (Liu et al., 2012; Lu, 1991). This modern system of acupuncture was developed at a fast pace since 1970s, and scalp acupuncture acupoints were standardized in 1991 when the World Health Organization announced the International Standard Nomenclature for Scalp Acupuncture Points (WHO, 1991).

There are three basic features of scalp acupuncture that differentiate it from body acupuncture. Firstly, treatment zones (14 lines or zones) that have been mapped onto the scalp are associated with body functions and broad body regions, and are based on the ideas of different schools of scalp acupuncture (Liu et al., 2012; Lu, 1991). Secondly, scalp acupuncture is characterized by inserting needle into a thin layer of loose tissue beneath the scalp surface, at a low angle of about 15-30 degrees, with an insertion distance of about 1 cum (approximately one inch for adult) (Liu et al., 2012). Thirdly, the needles in scalp acupuncture are subjected to rapid stimulation, which may be performed a variety of ways including twirling, pulling/thrusting and electro-stimulation (Lu, 1991).

Despite its relatively short history, scalp acupuncture has been now used to treat a wide range of conditions in many countries (Liu et al., 2012; Lu, 1991). Scalp acupuncture has been proven effective for the treatment of brain-related conditions such as cerebrovascular diseases and neurodegenerative disorders (Wang et al., 2009a,b; Hao et al., 2013; Li et al., 2014; Chen et al., 2014); but also for other conditions e.g. tinnitus (Doi et al., 2016) and attention deficit hyperactive disorder (He et al., 2014). In this review article, recent development of scalp acupuncture application on some neurological disorders were summarized.

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Stroke

Stroke is the second most common cause of death preceded only by heart attacks, and is the major cause of disability in the western societies (Kong et al., 2010; Li et al., 2012). Stroke occurs when the blood supply to part of the brain is cut off and is mainly caused by ischemic or hemorrhagic. Ischemic stroke is the most common subtype of stroke, accounting for about 80% of all strokes (Kong et al., 2010; Li et al., 2012). Treatment of stroke depends on the type of stroke and which part of brain is affected. Conventional approaches include medication to prevent and dissolve the blood clots and reduce blood pressure, and surgery to remove blood clots, treat brain swelling and reduce the risk of further bleeding in case of hemorrhagic stroke (Prabhakaran et al., 2015). However, people who survived stroke are often left with long-term problems caused by injury to their brains.

Using scalp acupuncture to stimulate the scalp over the arm and leg motor control areas and other function area of the brain can be very effective to treat the paralysis and other sequelae of stroke. Scalp acupuncture was often in combination with medication or rehabilitation training to promote stroke functional recovery (Hao & Hao, 2008). Patients with ischemic stroke of subacute stage recovered better following combination of body acupuncture and scalp acupuncture treatment compared to conventional therapy. It is believed that subacute stage of stroke occurs between 1-6 months after onset of stroke, which is crucial for patient's long-term survival. Chen et al., (2014) conducted a randomized controlled clinical trial to assess the efficacy of combination of body acupuncture and scalp acupuncture in patients of subacute stroke. One hundred twenty-six patients were randomly divided into acupuncture treatment group (n=61) and conventional treatment group (n=65). Acupuncture was given 5 times a week for total 8 weeks. The Fugl-Meyer scale and NIHSS scale and Barthel index were used to evaluate the motor functioning, balance, sensation, joint functioning and activity of daily living before and during and after acupuncture treatment and follow-up. Assessment after 4-week acupuncture showed a very good improvement compared to baseline judged by all parameters but did not show significant difference from conventional treatment group. At the end of 8-week acupuncture patients demonstrated markedly improvement in all assessments compared to baseline. Further, acupuncture showed a significant functional improvement compared to conventional group at the end of 8-week treatment and 3 month follow-up assessment (Chen et al., 2014). Authors concluded that combination of body acupuncture and scalp acupuncture achieved better clinical efficacy in stroke recovery compared to conventional treatment.

Another randomized clinical study of evaluating combined therapeutic effect of scalp acupuncture and body acupuncture on limb function in subacute stroke patients was conducted (Tang et al., 2012). The Fugl-Meyer assessment (FMA), US National Institutes of Health Stroke Scale (NIHSS) were used to assess the patients' limb function and nerve functional lesion severity before and after the treatment. Acupuncture treatment (n=55) was given daily for 20 days. Control group (n=55) was given route neurological therapies. At the end of treatment, the FMA scores were increased significantly and NIHSS scores decreased considerably in both groups compared with baselines. However, patients in acupuncture group showed a markedly improvement judged by FMA and NIHSS scores compared with control group. There were no significant differences in recurrence rates between two groups at the end of 3 and 6 months' follow-up (Tang et al., 2012). This suggested that scalp acupuncture combined with body acupuncture could improve limb movement function and reduce the nerve function damage in stroke patients.

In a sham-controlled randomized clinical study (Hsing et al., 2012), 62 patients with 18-month post-diagnosis of ischemic stroke were randomly allocated to receive either 10-seesion of scalp electro-acupuncture treatment or placebo treatment. The outcome of the study was monitored by NIHSS scale. The data showed that scalp acupuncture produced a significant functional improvement judged by NIHSS scale compared with sham group. However, there was no significant difference in the Barthel, Rankin functional scales between two groups (Hsing et al., 2012).

He et al., (2012) assessed clinical efficacy of the staging treatment of combined scalp and body acupuncture on the function recovery of lower extremities for stroke patients. Ninety-six subjects were randomized into a treatment group (n=48) and a control group (n=48). In the treatment group, while scalp acupuncture was performed along anterior oblique line of vertex-temporal (motor area) on the affected side, the body acupuncture was performed by stages. At the flaccid stage, acupoints ST32, SP10, ST36 were selected. At the spasmodic stage, acupoints GB30, SP10 and GB34 were selected. Treatment lasted for 8 weeks. In control group, the acupoints were not selected according to the disease stages and no scalp acupuncture was applied. Motor function of the lower extremities and the activities of daily living before and after treatment were monitored using the modified Fugl-Meyer motor function assessment (FMA) and Barthel index (BI). At the end of treatment, patients from both groups showed markedly improvement judged by the FMA and BI scales compared with the respective baselines (He et al., 2012). Patients in combined scalp and body acupuncture group demonstrated significant improvement compared with control group. The patient's walking ability was much greater and walking speed was much faster in treatment group compared with control group. The data showed that combined scalp acupuncture and body acupuncture significantly improved the motor function of the lower

extremities and the activities of daily living for stroke patients.

Clinical efficacy of scalp electro-acupuncture on post stroke speech disorder was assessed (Jiang et al., 2015). Sixty patients with post-stroke apraxia were randomly divided into scalp electro-acupuncture plus rehabilitation group (n=30) and rehabilitation only control group (n=30). Scalp acupuncture was performed on the dominant hemisphere Broca area on the left cerebrum once daily for 4 weeks. The speech movement program module in the psychological language assessment including the scores of counting, singing scale, repeating phonetic alphabet, repeating monosyllable and repeating disyllable were monitored in patients of the two groups before and after treatment. At the end of the treatment, patients in both group showed obvious improvement in all parameters mentioned above compared with their respective baseline. Patients in scalp acupuncture group showed 100% (30/30) improvement compared with 53% (16/30) improvement in control group (Jiang et al., 2015).

Effect of scalp acupuncture on two different stroke models: spontaneously hypertensive stroke-prone (SHR-SP) rats and focal cerebral ischemia (by middle cerebral artery occlusion, MCAO) rats were assessed using MRI technique (Inoue et al., 2009). It was found that scalp acupuncture rapidly reduced the volume of the vasogenic oedema and promoted neurological function recovery in SHR-SP model. On the other hand, scalp acupuncture had no markedly effect on the cytotoxic odema, vasogenic oedema and neurological dysfunction in MCAO model (Inoue et al., 2009). This implied that scalp acupuncture may be more beneficial for stroke patients with hypertension-caused vasogenic origin than ischaemic origin.

Mechanisms underlying benefits of scalp acupuncture were investigated in both basic science and clinical setting. Very recently, effect and mechanisms of scalp acupuncture on neurological dysfunction of intracerebral hemorrhage stroke rat model was investigated (Liu et al., 2017). Rat model of intracerebral hemorrhage (ICH) received scalp acupuncture at acupoint DU20 through GB7 on the lesion side, for 30 mins, twice a day, from day one of surgery for consecutive 7 days. A group of intracerebral hemorrhage model not receiving scalp acupuncture and a group of sham surgery and a group of naïve were used as controls. Behavioral tests included a composite neurological scale, corner turn test, forelimb placing test, wire hang task and beam walking were conducted at days 3 and 7, followed by biochemical studies, such as western blot analysis and histopathologic examine. The data showed that at day 3 after intracerebral hemorrhage, there was no significant difference of behavioral tests between scalp acupuncture group and ICH. However, at day 7 after surgery, there was a significant improvement of neurological deficits in scalp acupuncture treated group compared with ICH. Biochemical studies showed that brain content of tumour necrosis factor alpha and nuclear factor KappaB protein expression, inflammatory markers, was markedly decreased in scalp acupuncture group compared with ICH and sham groups. The results demonstrated that improved behavioral effects by scalp acupuncture were associated with decreased inflammation in rat model of intracerebral hemorrhage.

The study of the influence of scalp acupuncture on levels of inflammation in patients with acute cerebral infarction (ACl) was conducted to investigate its mechanism underlying improvement of ACI (Wang et al., 2016). A total of 61 patients with ACI were randomly allocated to scalp acupuncture group (n = 31) and control (medication) group (n = 30). Scalp acupuncture stimulation of bilateral MS 6 and MS 7 was performed daily plus medication for 7 days, while patients in control group were given medication only. Clinical neurological dysfunction scales such as NDS, 0-45 points for consciousness, gazing, facial palsy, speech, myodynamia, walking-ability were monitored at the baseline and at the end of scalp acupuncture. Serum levels of inflammation markers, such as high-sensitivity C-reactive protein (hs-CRP), TNF-α, IL-6, and IL-1β, were assessed at the baseline and 3 and 7-day after scalp acupuncture. At the end of 7-day scalp acupuncture, patients showed a significant improvement of the neurological deficits compared with the baseline scores, and there was marked improvement in neurological dysfunction compared with control group. The levels of all inflammation markers were significantly decreased at both 3 and 7-day scalp acupuncture compared with baseline levels. The levels of inflammation makers were significantly lower in scalp acupuncture compared with control group. There was a correlation between the improved neurological deficit scores and decreased serum inflammation markers (Wang et al., 2016).

Together, the studies showed that scalp acupuncture improved neurological functions in both ischemic and hemorrhage models of stroke. Scalp acupuncture is effective in improving neurological deficits of patients with stroke, and it could be an important part of rehabilitation program for stroke recovery. Scalp acupuncture may 1) promote angiogenesis and improve regional energy metabolism (Xie et al., 2016); 2) up-regulate expression of glial cell-line derived neurotrophic factor, possibly promoting proliferation and differentiation of neural stem cells in the focal cerebral cortex and hippocampus (Lu et al., 2016); 3) ease cerebral vascular immune-inflammatory reactions (Zhang et al., 2007; 2009; Wang et al., 2016; Liu et al., 2017); 4) inhibit cerebral cortical apoptosis (Zhang et al., 2009).

Muscular sclerosis

Muscular sclerosis (MS) is a chronic, disabling, incurable recurrent demyelination of the central nervous system by which about 2.5 million people in the world have been affected (Kostoff et al., 2008; Ganesh et al., 2013). The

cause of demyelination in MS is believed to be inflammation which causes myelin damage and forms plaques or lesions that are located primarily in the CNS white matter. Strong evidence suggested that demyelination-related inflammation is caused by abnormal function of immune system, which indicates that MS is an autoimmune disease (Reipert, 2004; Vidal-Jordana & Montalban, 2017).

At the site of the inflammatory lesions, the myelin sheath which insulates the nerve cells is destroyed in the process of demyelination. When myelin is lost, transmission of signals through nerves is slowed down or blocked, resulting in a range of symptoms, including physical, mental and even psychiatric problems (Compston & Coles, 2008). In some cases, the myelin sheaths around axons can be rebuilt on reducing inflammation. This process is called remyelination and is performed by oligodendrocytes. However, if there are not enough oligodendrocytes at the lesion site, remyelination will not occur or will be incomplete. Therefore, nerves will carry out their functions through electrical signals in an abnormal pathway, and the axons continue to remain for long periods without damage. The lost myelin sheath can be replaced by scar tissue where it is called MS, multiple means many and sclerosis means scar formation (Reipert, 2004; Vidal-Jordana & Montalban, 2017).

When the axons are damaged, they do not completely lose their function. As the disease progresses, oligodendrocytes and, ultimately, axons are destroyed, leading to a worsening of the symptoms. Common symptoms may include fatigue, vision problems, numbness and tingling, muscle spasms, stiffness and weakness, mobility problems, pain, problems with thinking, learning and planning, depression and anxiety, sexual problems, bladder problems, bowel problems, speech and swallowing difficulties. However, most people with MS only have a few of these symptoms (Reipert, 2004).

Scalp acupuncture has been shown to be a very effective technique for treating MS, because different parts of the brain, such as motor area, sensory area, foot motor and sensory area, balance area, hearing and dizziness area, and tremor area, are stimulated in MS patients, according to the presence of symptoms (Hao & Hao, 2008; Hao et al., 2013). Scalp acupuncture treatment for MS had much success in reducing numbness and pain, decreasing spasms, improving weakness and paralysis of limbs and improving balance (Hao et al., 2013). Many patients also reported that their bladder and bowel control, fatigue and overall sense of well-being significantly improved after treatment (Hao et al., 2013). This technique not only relives symptoms but also increases the quality of life and slows or reverses the progression of physical disability (Hao & Hao, 2008; Hao et al., 2013).

In one of case studies, a 65-year-old male patient who had had MS for 20 years was treated with scalp acupuncture. The motor area, sensory area, foot motor and sensory area, balance area, hearing and dizziness area, and tremor area were stimulated once a week for 10 weeks, then once a month for six sessions. After the 16 treatments, the patient showed markedly improvements. He was able to stand and walk. The numbness and tingling in his limbs gradually declined. His incontinence of urine or dizziness was significantly improved. He was able to return to work full time. This case demonstrates that scalp acupuncture can be a very effective treatment for patients with MS (Hao et al., 2013).

Parkinson's disease

Parkinson's disease (PD) is the second most common progressive neurodegenerative disease and is characterized by the loss of dopaminergic neurons in the substantia nigra of middle brain and subsequent depletion of dopamine in the striatum (Hornykiewicz, 2001; Obeso et al., 2008). The clinical manifestation of PD motor symptoms includes bradykinesia, resting tremor, rigidity of muscles and joints, gait and posture imbalance. Although the general intervention for PD involves pharmacological, physical, or deep brain stimulation therapies (Salat & Tolosa, 2013; Connolly & Lang, 2014), treatment is accompanied by a number of adverse effects such as dyskinesia and motor fluctuations in 50% of patients after 5 years' treatment and in nearly 100% of patients after 10 years' treatment (Olanow & Schapira, 2013).

Scalp acupuncture was used to PD for some time. Two clinical studies were conducted to assess effectiveness of manual scalp acupuncture on PD (Zhang et al., 2002; Yang et al., 2004). In the study by Zhang et al., (2002), 64 patients with PD were recruited and randomly divided into scalp acupuncture plus medication group (n=32) and medication only group (n=32), and scalp acupuncture treatment was applied daily for 30 days. While the study by Yang et al., (2004), 60 patients were allocated into scalp acupuncture plus medication group (n=30) and medication alone group (n=30), and scalp acupuncture treatment was given on one day interval for 90 days. The Webster scale was used in both studies to monitor the outcome. It was reported that scalp acupuncture for 30 days improved many aspects of the conditions but it was not statistically significant compared with medication control group (Zhang et al., 2002); However, 3-moth of scalp acupuncture treatment markedly improved many perimeters of measurements in patients with PD compared with medication only group (Yang et al., 2004).

When scalp acupuncture with electrical stimulation was applied to patients with PD for 30 days, it statistical significantly improved many aspects of the conditions judged by the unified Parkinson's disease rating scale compared with control groups (Huang et al., 2009). In another study (Jiang et al., 2006), patients with PD were given scalp electro-acupuncture for 6 weeks and single photon emission computer tomography (SPECT) measuring

99mTc-TRODAT-1 was used to examine the activities of dopamine transporter (DAT) before and after scalp acupuncture. Results showed that DAT activities were increased within the striatum on the affected side of brain compared with intact side (Jiang et al., 2006). A later study (Huang et al., 2010) showed that PD patients who received levodopa and scalp acupuncture, examined by SPECT measuring of 99mTc-ECD and99mTc-TRODAT-4, had increased regional cerebral blood flow (rCBF) in the frontal lobe, the occipital lobe, the basal ganglion, and the cerebellum in the most affected hemisphere as compared to baseline, but there were no change in basal ganglia DAT levels. On the other hand, treatment with levodopa alone did not change rCBF, whereas it increased basal ganglion DAT activity in the most affected hemisphere. This indicated that complementary acupuncture treatment in Parkinson's disease may affect rCBF but not basal ganglion DAT.

The protective mechanism of scalp acupuncture was studied with experimental model of PD (Wang et al., 2009a,b; Qi & Wang, 2011). Scalp electro-acupuncture was applied on acupoints GV 20 and EX-HN 5, once a day, 6 days a course, for total 2 courses on PD models. Immunohistochemistry of tyrosine hydroxylase (TH), the rate-limiting enzyme responsible for catalyzing the conversion of the amino acid L-tyrosine to L-3,4-dihydroxyphenylalanine, TUNEL method was used to observe the apoptotic amount, and in situ hybridization detecting the mRNA expression of brain-derived neurotrophic factor (BDNF) and DAT were used to assess the outcome of the scalp electro-acupuncture. It was found that scalp electro-acupuncture treatment significantly increased the area density (AD), numerical density (ND) and integrating optic density (IOD) of the positive neurons of TH in the substantia nigra of PD model, compared with control groups (Jiang et al., 2006; Qi & Wang, 2011). Further, scalp acupuncture markedly elevated the levels of the mRNA expression of BDNF and DAT in substantia nigra of PD model (Wang et al., 2009a), markedly decreased the amount of apoptosis (Wang et al., 2009b), and compared with control groups. This suggested that scalp acupuncture may increase TH+ cells by elevating the synthesis GDNF mRNA, decrease apoptosis and promote the reuptake of dopamine, leading to alleviate parkinsonian symptoms.

Altogether, scalp acupuncture provides an important complementary/alternative treatment approach for improving symptoms of many neurological disorders symptoms. By closely stimulating affected areas of the central nervous system, scalp acupuncture has showed more effective results compared to other acupuncture techniques. The studies mentioned above also demonstrated that scalp acupuncture treatment is safer, more effective, and caused fewer side effects compared with conventional treatment such as medications in the respective conditions.

Although the studied cited above showed a certain effect of scalp acupuncture on stroke, PD and MS, the quality of studies were variable. Because many of the studies did not follow the Consolidated Standards of Reporting Trials (CONSORT) 2010 checklist and the revised Standards for Reporting Interventions in Clinical Trials of Acupuncture (STRICTA) guidelines (MacPherson et al., 2010; Moher et al., 2010). For example, there were no sham acupuncture controls in majority studies. None of the included studies adopted assessor blinding. STRICTA checklist items i.e. "depth of insertion," "description of participating acupuncturists" and "the optimal dosage for the scalp acupuncture treatment" were not mentioned. So following CONSORT and STRICTA recommendation are strongly recommended, and well-designed studies with rigorous methodologies are required to confirm the effectiveness of scalp acupuncture for neurological disorders.

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