Review

Autism Treatment from Acupuncture Perspective

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ABSTRACT

Although acupuncture has been used in the treatment of autism for many years, almost no formal clinical trials have been devoted to confirm the effectiveness of the acupuncture for the disease in the western countries, where a big population of children and family have been suffering from the shortage of effective therapy. This review is to summarize the reports from about 20 clinical trials of acupuncture for autism in the last decade in China. The results of these reports suggested that acupuncture may be a potentially valuable approach in treating autism. Around 80% symptom improvements were stated in most of the studies. The reports also demonstrated that acupuncture may enhance the efficacies of conventional therapies for autism, such as behavior rehabilitation therapy. It was suggested that the effects of acupuncture for autism may be partially related with its effects on anti-inflammation and on the modulation of the brain signal conductivity, supported by the research including fMRI. A concept of transcranial electrical acupuncture stimulation (TEAS) is proposed. Compared with the conventional acupuncture technique, TEAS is hypothesized to target directly on the brain lesions of autism through modulating hyperpolarized or depolarized neurons of the brain, in order to improve the pathological status of autism. Clinical trials are needed to approve the proposal in the future.

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KEY WORDS: *Autistic spectrum disorder, acupuncture*

The Centers for Disease Control and Prevention have called autism a national public health crisis. Due to shortage of effective therapeutic options in conventional medicine, many interests have shifted to the alternative remedies. Growing evidences support that acupuncture may be a potential effective approach in treating autism. This commentary will briefly review the update information of acupuncture on autism and open the discussions on the clinical study of acupuncture for the disease in the future.

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Although no clinical trials worldwide have presented conclusive results on the effectiveness of acupuncture in the treatment of autism, some clues can be obtained from the clinical studies in the past decade. Reviewing the reports from about 20 clinical trials published in the last 15 years, with at least 30 cases in each study, the effective rates of autism treatment with acupuncture were around 80%. However, only a few of them were randomized controlled studies. No obvious side effects or safety concerns have been stated in these studies.[1,2,3] Here are a few examples. A 202 case controlled study with autism showed that the effective rate of the symptom improvement by acupuncture was 92.3%. Of the 78 and 58 severe patients, there were 92.3% and 40.5% improvements in the acupuncture treatment and control group respectively.[4] Reported from a 50 case of randomized controlled clinical trials, significant improvements were observed in language comprehension, self-care caregiver assistance, social initiation, receptive language, motor skills, coordination, and attention span, evaluated by the tests of Functional Independence Measure for Children (WeeFIM), Pediatric Evaluation of Disability Inventory (PEDI, Clinical Global Impression-Improvement (CGI-I) scale, Aberrant Behavior Checklist (ABC), and Reynell Developmental Language Scale (RDLS). In this study, acupuncture induced significant improvements in the language comprehension domain of WeeFIM ($p=0.02$), self-care caregiver assistant domain of PEDI ($p=0.028$), and CGI-I ($p=0.003$) in the electrical acupuncture group compared to the sham control group.[5] In a case of controlled study, 30 sessions of treatments were applied on 32 autism children to test the effects of a acupuncture technique of Seven-star Needle Stimulation for over 6 weeks. The results showed that the acupuncture treatment induced significant improvement in language and social interaction, but not in stereotyped behavior or motor function, monitored by EEG (qEEG) with the quantitative behavior measurement.[6]

The effectiveness of acupuncture was also evaluated in comparison with other conventional medical approach. In a clinical study of 40 cases, including those with severe autism, acupuncture group using JIN's 3-needling technique presented significant better results than that of the behavior intervention.[7] A report from a four month clinical trial revealed that acupuncture, compared to piracetam treatment, showed a more significant improvement on the language comprehension.[8] Acupuncture may be also potentially a valuable adjuvant therapy to certain conventional treatments. It was documented that forty autistic children received rehabilitation training programs of ABA, Conductive Education Approach and the sensory integration. Twenty of those also received acupuncture treatment by end of the rehabilitation training. There was a 55.0% markedly effective

rate in the group using additional acupuncture, compared with a rate 15.0% in the group with rehabilitation alone.[9] The studies above all selected some of internationally recognized questionnaires to evaluate the changes of psycho-behavior-neural symptoms and the effectiveness rate of acupuncture treatment. Those questionnaires include Aberrant Behavior Checklist(ABC), Autism treatment evaluation checklist (ATEC), Functional Independence Measure for Children (WeeFIM), Pediatric Evaluation of Disability Inventory (PEDI, Clinical Global Impression-Improvement (CGI-I) scale, , and Reynell Developmental Language Scale (RDLS). Overall, there is shortage of well designed randomized controlled clinical trails to evaluate the true values of acupuncture treatment for the autism. However, the information obtained should be enough to encourage further investigations.

The selections of acupuncture points have been various in the above clinical studies. In general, the acupuncture points were selected mostly based on the meridian theory in Chinese medicine. Some of those points are thought act by "waking up the brain and opening the orifice" in the theory. On the other hand, the relatively newly developed scalp acupuncture based on the brain anatomy has been commonly used in almost every group of clinical studies of autism. The most frequently used points of scalp acupuncture include: (1) Three Acupoints of the Temple: GB 8, l cun anterior and posterior to GB 8; (2) Three Wisdom Acupoints: GV l 2, bilateral GB 1 3，GV 20; (3) Three Acupoints of Brain: GV 17, 1．3 cun left and right to GV 1 7; (4) Four Acupoints of the Mind: Ex-HN 1(Si Shen Cong); (5) three points on the occipital area: GVl5，GB20，GBl2.[10] A few years ago, a randomized controlled 50 case clinical trial of tongue acupuncture was first reported being effective for autism. A significant improvement in the treatment as compared to the control group was seen in self-care and cognition domains of the Functional Independence Measure for children. The authors applied acupuncture on the tongue including points of Ex•HN 1 2，Ex-HN l , and CV23.[11]

Quite a few new technologies have been developed in evaluating the effectiveness of acupuncture in treating autism, in addition to the subjective psycho-behavior tests. One of the impressive works was from Dr. Jia Shaowei. His group reported at 2008 that electrical acupuncture significantly improved SPECT brain image of 78.95% in a 34 case clinical study, a result corresponding the clinical behavior improvement. They suspected that the increased blood flow and enhanced function in the prefrontal cortex, broca and wernicke region could partially contribute such changes.[12] fMRI has been one of the most promising tool in assessing the functional and structural changes of autism. For example, growing evidences support that autism is an inflammatory disorder of brain, evidenced by the fMRI finding that the total volume of brain, cerebella and caudate nucleus enlarged. The area of corpus callosum is reduced.[13] The inflammation may involve in the changes of the neurophysiology of autism, characterized by a disturbance of the signal conductivities, particularly, the exaggeration of the excitatory signals and deficit of the inhibitory signals during information processing. Such abnormal balance mostly exist in the prefrontal and temporal cortex as well as deep nucleis such corpus callosum.[14] In fact, the anti-inflammatory effects of acupuncture were explored in many studies.[15,16] Acupuncture may down-regulate exaggerated neural activity and generate a tranquilizing effect by enhancing GABAergic enhancing efficacy.[17] The results from Dr. Kathleen Hui's fMRI studies further suggested that acupuncture may modulate the conductivity of cortico – limbic-subcortical network.[18]

Another new technique used in the autism study was based on the discovery that the activity of the sympathetic autonomic nervous system is significantly altered in children with autism. The authors measured 48 acupuncture points on fingertips by using a biometric device capable of gas discharge visualization (GDV). They found that the psycho-emotional and physiological functional states of autism were correlated with the enhanced activities of the autonomic nervous system.[19]

So far, it seems that acupuncture is a potential approach to benefit the children with autism. However, it is clear that the ongoing knowledge and techniques of acupuncture need to be further studied and improved. For instance, no autism research of acupuncture has focused on the digestive system, although the inflammation in gut system may play an important role in the development of autism.[20,21,22] Furthermore, acupuncture alone is not a complete solution for autism, although many clinical studies suggested potent benefits. We hypothesize that acupuncture may mostly affect on the aspect of functional activities, probably including neural conductivity ignition and signal transduction, which may be similar to the concept of "Qi" effect of acupuncture in the view of traditional Chinese medicine. Considering that autism children have not only functional psycho-behavior symptoms but also significant abnormalities in nutritional abnormalities, such as essential fatty acid and phospholipids metabolism, which may accompany with the inflammation process and even the genetic disturbances.[23,24] So, it is reasonable to suggest that integration of acupuncture with proper nutritional therapy based on the individual needs is necessary.

The acupuncture technique itself needs to be upgraded based on scientific evidences. fMRI found that the superior temporal sulcus (STS) region is an important component of the network of brain regions that support various aspects of social cognition and social perception.[25] Excessive signaling may lead to hyperexcitable behavior as a result of shortage of GABAergic functions in the area. The superior temporal sulcus function may underlie many of the social and language abnormalities seen in autism.[26] Therefore, one of the major targets of autism treatment should be on the prefrontal and temporal-limbic region functions. From this point of view, conventional acupuncture may not provide enough impact in

these areas, because the acupuncture stimuli are usually distant from the pathological lesions of the brain. Here, transcranial electrical acupuncture stimulation (TEAS) is proposed by Dr. Jing Liu based on the information review and the preliminary clinical experiences.

The idea of TEAS is supported by the evidence of transcranial direct current stimulation (tDCS). tDCS involves placing metal electrodes on the scalp and applying a small and harmless electrical current across the cranium. The current can hyperpolarize or depolarize neurons in the path of the current.[27] It was shown that tDCS over frontal cortex enhanced retention of word learning.[28] Stimuli of 1 mA tDCS can induce a slight change in the resting potential of the brain cells, resulting improvement of the information process through modulating the depolarization thresholds of neurons.[29] Hence, we predict that TEAS may bring the electrical current across the targeted regions of brain as tDCS do, instead of the surface to surface stimulation of the scalp acupuncture. Both traditional acupoints and the neural anatomy should be considered when the acupoints of TEAS are selected. Another advantage of TEAS found from the previous clinical practice may be that the application is painless and easier accepted by children than that of traditional acupuncture. So far, we have little knowledge on how such electrical current can affect the brain function of those with autism. However, we predict that the targeted treatment of the TEAS can be well measured and evaluated by using modern techniques such as fMRI or EEG, considering that the prefrontal and temporal gyrus are located in the relative superior areas of the brain. Further investigations are needed to confirm the hypothesis.

Together, acupuncture seems a therapeutic approach which may be beneficial to children with autism. However, more qualified clinical trials are needed to approve the effectiveness of acupuncture on the disease. TEAS, a new technique of acupuncture is proposed to improve the efficacy of acupuncture on autism treatment.

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