

Case Study

Electroacupuncture for Children with Autism Spectrum Disorder: Pilot Study of 2 Cases

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Abstract

Objective: The objective of this study was to observe for efficacy, safety, and compliance of electroacupuncture for autism spectrum disorder (ASD).

Methods: Two (2) children with ASD received electroacupuncture for 24 sessions over 8 weeks and were assessed pre- and postacupuncture. We defined a positive or negative change as an improvement or deterioration of 25%, respectively, in total score or any subscales of Aberrant Behavioral Checklist (ABC), Ritvo-Freeman Real Life Scale (RFRLS), WeeFIM,[®] and as a rating of much improved or much worse on the Clinical Global Impression–Improvement (CGI-I) scale.

Results: For ABC, positive changes in “Irritability” and “Stereotypy” was noted in case 1 but no changes occurred for case 2. For RFRLS, positive changes were found for both cases in “Sensory motor,” “Sensory response,” and “Total score,” although negative change was noted for case 2 in “Affectual response.” For WeeFIM[®], there were no positive or negative changes in both cases. For CGI-I, positive change in case 1 with much improved in “Social relatedness, Communication, and Stereotypy behavior” was reported.

Conclusions: A short intensive course of electroacupuncture might improve some core features of children with ASD.

Introduction

Autism spectrum disorder (ASD) is characterized by deficits in social relatedness, communication, and lack of flexibility of thought and behavior. ASD has an estimated prevalence ranging from 5 to 63 per 10,000, and there is an increasing trend of ASD worldwide.¹

Although no modern diagnosis like autism spectrum disorder was found in Traditional Chinese Medicine (TCM) history, the origin might date back to ancient China, and might be categorized as one type of diseases of “childhood derangement.”

In our experience, the TCM approach for ASD is more holistic. The pathogenesis of ASD is the derangement and insufficiency of the Brain and Mind. The pathologic involvement is in the Brain, relating to the Heart, Peri-

cardium, Liver, Spleen, and Kidney. The etiology resulted from lesion or insufficiency of the Brain mind innateness, and dysregulation of the Heart, Liver, Spleen, and Kidney after birth.

Although behavioral and educational interventions had been the management model for ASD,^{2–4} parents often seek complementary and alternative medicine such as acupuncture. However, it remains unclear whether the existing evidence is rigorous enough to support the use of acupuncture for ASD.

To date, there is no study regarding the effectiveness and safety of electroacupuncture for ASD in international journals. As a result, we performed a pilot study to observe the efficacy and safety of electroacupuncture for children with ASD, and this served as the basis for our randomized controlled trial.

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Methodology and Subjects

The present pilot study was conducted from February to May 2005 in Hong Kong with the senior author (VCNW) as principal investigator at the University of Hong Kong and Hong Kong West Cluster Hospitals under Hospital Authority (Queen Mary Hospital, Duchess of Kent Children's Hospital), in collaboration with Clinical Centre for Teaching and Research in Chinese Medicine of Tung Wah Group of Hospitals.

The research protocol was approved by the Institutional Review Board of the Faculty of Medicine of the University of Hong Kong and Hospital Authority (Hong Kong West Cluster). Written informed consents were obtained from the parents.

Our research team advertised in poster form for case recruitment for the Acupuncture Research trial in special schools under the Tung Wah Group of Hospitals, and from the University of Hong Kong-affiliated hospital, Duchess of Kent Children's Habilitation Institute. Respondents were asked to complete a screening questionnaire and attend an interview at the Children's Habilitation Institute of the Duchess of Kent Children's Hospital. Clinical history, comprehensive physical examination, and evaluation for ASD were performed. The parents were interviewed by the first author (WXC) using DSM-IV⁵ and Autism Diagnostic Interview-Revised (ADI-R),⁶ and children were assessed for ASD using Autism Diagnostic Observation Schedule (ADOS).⁷ The eligibility of included cases was finally justified by a research meeting held by the project principal investigator (VCNW).

Those who met the following inclusion and exclusion criteria were recruited into the study with a 2-week washout period to stop other possible confounding interventions such as drug use before being invited back for a comprehensive baseline clinical assessment.

Inclusion Criteria

Children with ASD satisfying the following criteria were included in the study:

1. *Diagnostic and Statistical Manual of Mental Disorders* (4th edition) (DSM-IV)
2. Autism Diagnostic Interview-Revised (ADI-R)
3. Autism Diagnostic Observation Schedule (ADOS)
4. Age between 3 and 18 years
5. Have not received any acupuncture treatment in the preceding 6 months
6. Compliance with complete 2-month course of acupuncture

Exclusion Criteria

Exclusion criteria were children with associated neurologic disorders and epilepsy.

Interventions

The acupuncture was performed by the acupuncturist (WLL) from Tung Wah Hospital-Clinical Centre for Teaching and Research in Chinese Medicine of The University of Hong Kong.

TABLE 1. DEMOGRAPHIC DATA

Recruited case	Case 1	Case 2
Gender/age	Female/11 years 8 months	Female/11 years 3 months
Severity of autism	Severe (CARS: 37)	Mild-moderate (CARS: 31.5)
Present illness of history	Social relatedness: Seldom actively approach parent, liked to stay in room alone; poor eye contact Communication: Could wave bye-bye without pointing; Single words only, mainly echolalia; Could not follow simple command Stereotypic behavior: Repeatedly tapped desk and looked at corners; Sensitive to sound with putting fingers into ears, liked to smell things	Social relatedness: Seldom play with others, poor eye contact Communication: Pointing sometimes; Could shake head for "no"; Severe echolalia, Could say short phrases and follow simple command Stereotypic behavior: Severe behavioral problems with temper tantrum and self-injurious behaviors (e.g., biting hands; very sensitive to sound)
Family history	Mother and elder brother had speech delay	Elder brother also had ASD.
Medication	No	Risperidone had been used for 13 months; stopped for 2 weeks before acupuncture as washout period
Acupuncture before	No	Tongue acupuncture 3 years ago for 10 sessions

CARS, Childhood Autism Rating Scale.¹²

The following two sets (A and B) of acupoints were selected based on the clinical experience of the acupuncturist. These set of acupoints were alternately used for electroacupuncture.

Acupoint A set (N = 6):

Sishencong (EX-HN1),
Yintang (EX-NH3),
Neiguan (PC6),
Ernaodian (AT3),
Zusanli (ST36),
TaiChong (LR3).

Acupoint B sets (N = 6)

Sishencong (EX-HN1),
Yintang (EX-NH3),
Shenmen (HT7),
Shounaodian
Taixi (KI3),
Sanyinjiao (SP6).

The rationale of selection of acupoints is as follows: The acupoints selected from Head (*Sishencong* [EX-HN1], *Yintang* [EX-NH3]), Ear (*Ernaodian* [AT3]), and Hand (*Shounaodian*) were to “awake,” to “assist,” and to “calm” the mind as well as enlighten the mentality, while acupoints selected from the Heart (*Shenmen* [HT7]), Pericardium (*Neiguan* [PC6]), Liver (*TaiChong* [LR3]), Spleen (*Sanyinjiao* [SP6]), Kidney (*Taixi* [KI13]), and Stomach (*Zusanli* [ST36]) meridians were to make the Heart “unobstructed,” regulate the Liver, correct any derangement, invigorate the Spleen and the Kidney, and to facilitate the source of vital function.

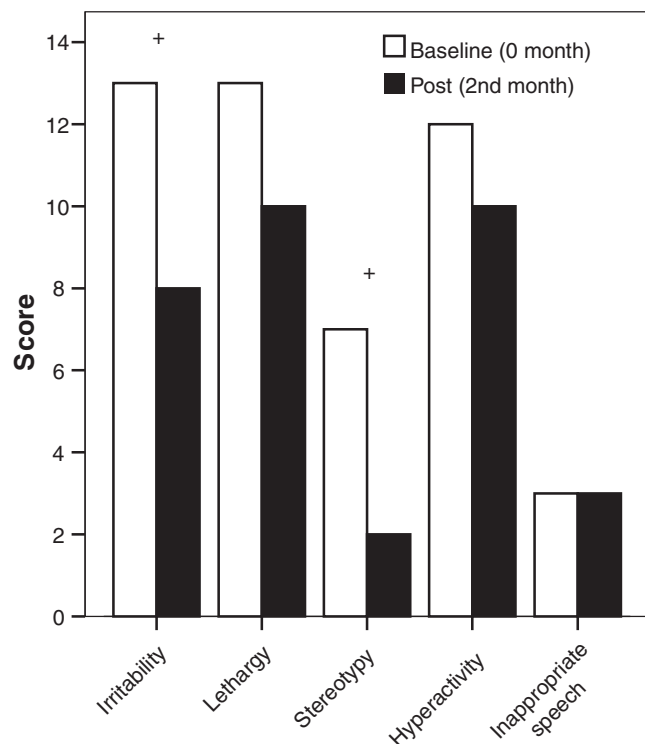


FIG. 1. Outcome of Aberrant Behavior Checklist of Case 1.

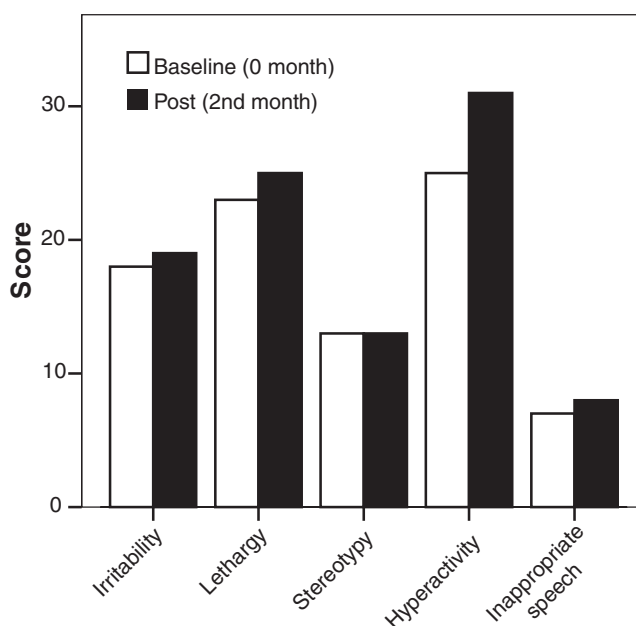


FIG. 2. Outcome of Aberrant Behavior Checklist of Case 2.

Electroacupuncture consisted of 24 sessions, with 3 sessions on alternate days per week, each lasting 30 minutes, spanned over 8 weeks. A sterile disposable 0.3 × 4-cm acupuncture needle (made in SuZhou, China, HWA-TO) was used.

During treatment, the patient was required to be in a supine or a sitting position. Needle sites were disinfected, and disposable needles were inserted into the acupoints selected.

A portable electroacupuncture machine was used for electroacupuncture in order to produce standardization of electric current [Model HWATO SDZ-II, Electronic Acupuncture Treatment Instrument, SuZhou Medical Appliance Factory, SuZhou, China] was connected to the handles of acupuncture needles to provide electrical stimulation for 30 minutes. Spacing-density wave stimulation was applied. Density wave frequency is adjustable from 5 to 100 Hz, while spacing wave frequency is one fifth of the density of frequency. Electrical stimulation was monitored by an indicator light throughout the acupuncture course.

These children continued their special education during the acupuncture period within the special school. They were advised not to accept other therapies such as alternative medicine during the acupuncture period.

Outcome Measures

*Aberrant Behavioral Checklist (ABC)*⁸

An improvement or deterioration of 25% in total score or in any five subscales (Irritability, Lethargy, Stereotypy, Hyperactive, Inappropriate Speech) will be defined as a positive or negative change. The ABC was filled in by the parent at baseline (0 month) and post-treatment (second month).

*Ritvo-Freeman Real Life Scale (RFRLS)*⁹

An improvement or deterioration of 25% in total score or in any of the five subscales (Sensory Motor, Social Relation-

ship to People, Affectual Response, Sensory Response, Language) will be defined as a positive or negative change. The RFRLS was filled in by the parent at baseline (0 month) and post-treatment (second month).

WeeFIM^{®10}

This consisted of 18 structured questions concerning three domains [Mobility, Self Care, Cognition] as functional independence of children. The scores range from 1 to 7, with 7 meaning total independence. The calculated quotient as compared to Chinese norm for age will be assessed. An improvement or deterioration of 25% in any three domains is defined as a positive or negative change. The WeeFIM was assessed at baseline (0 month) and post-treatment (second month). [The use of the WeeFIM instrument to collect data for this clinical trial study was authorized and conducted in accordance with the terms of a special purpose license granted to Licensee by Uniform Data System for Medical Rehabilitation, Amherst, NY (a division of UB Foundation Activities, Inc., "UDSMR"). The licensee has not been trained or certified by UDSMR in the use of the WeeFIM instrument, and the patient data collected during the course of this clinical trial study have not been submitted to or processed by UDSMR. No implication is intended that such data have been or will be subjected to UDSMR's standard data processing procedures or that they are otherwise comparable to data processed by UDSMR.]

Clinical Global Impression-Improvement (CGI-I) Scale¹¹

This is a measure in a Likert scale of 1-7, with 4 = no change, 1 = very much improved, 2 = much improved, 3 = minimally improved, 5 = minimally worse, 6 = much worse, and 7 = very much worse. A positive change is defined as much improved or very much improved, whereas

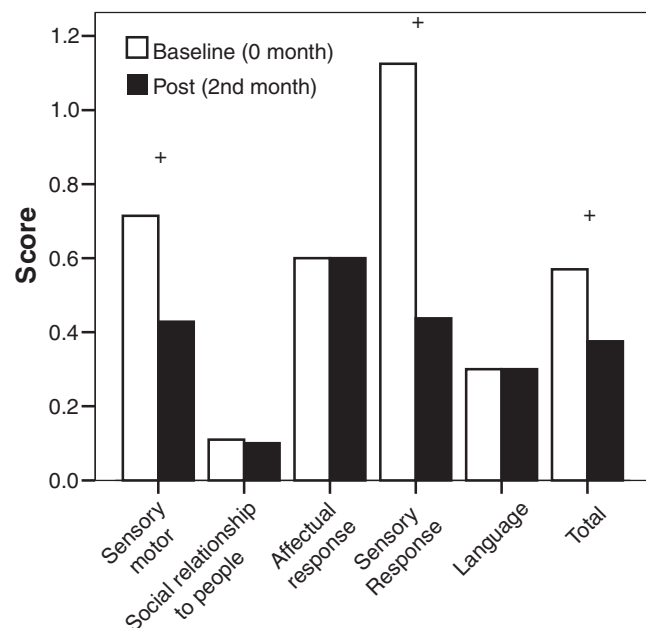


FIG. 3. Outcome of Ritvo-Freeman Real Life Scale of Case 1.

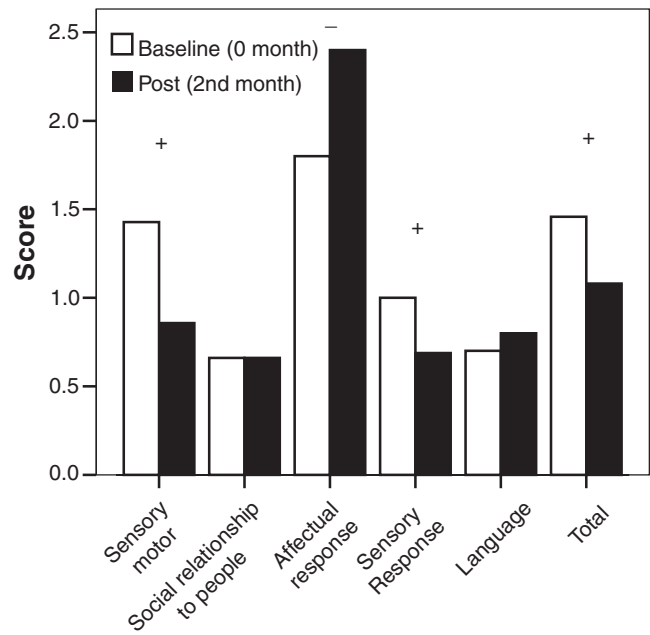


FIG. 4. Outcome of Ritvo-Freeman Real Life Scale of Case 2.

a negative change is defined as much worse or very much worse. The CGI-I was assessed by the parent and justified by the clinician (WXC) at post-treatment (second month).

Parental report

A systematic Parental Report was designed for parents to record any changes during acupuncture including the following domains: behavior, emotion, motor skill; cognition, language, eye contact, coordination, drooling; sleeping pattern and any other unexpected changes including possible side-effects from acupuncture. These are open questions for parents to answer accordingly, after which the researchers can follow up with personal interview.

Monitoring for safety

We had adopted two strategies to monitor the safety of electroacupuncture: (a) The parents were advised to directly report any possible adverse events they might have noticed or suspected to our research team or via Parental Report. (b) The researchers (including acupuncturist and clinicians) directly observe for any adverse events during the acupuncture session.

Results

Demographic data

Two (2) girls (Case 1; Case 2) self-approached our research team after poster advertisements were made in special schools and from the University of Hong Kong affiliated Hospital, Duchess of Kent Children's Habilitation Institute. The demographic data of both cases are shown in Table 1.¹² Both subjects were compliant with all acupuncture sessions.

Aberrant Behavioral Checklist (ABC)

The outcome of ABC of Case 1 showed positive changes in "Irritability" and "Stereotypy" domains. ("+" stands for positive change) (Fig. 1).

The outcome of ABC of Case 2 showed deterioration in the "Hyperactivity" domain although not reaching the level of negative change (Fig. 2).

Ritvo-Freeman Real Life Scale (RFRLS)

The outcome of RFRLS of Case 1 showed positive changes in "Sensory motor," "Sensory response," and "Total score" domains. ("+" stands for positive change) (Fig. 3).

The outcome of RFRLS of Case 2 showed positive changes in "Sensory motor," "Sensory response," and "Total score" domains, although also with negative change in "Affectual response" domain. ("+" stands for positive change and "-" for negative change) (Fig. 4).

WeeFIM

The outcome of WeeFIM of Case 1 showed improvement in "Self care" and "Total score" domains although not reaching the level of positive change (Fig. 5).

The outcome of WeeFIM of Case 2 did not show improvement (Fig. 6).

Clinical Global Impression-Improvement (CGI-I) Scale

The outcome of CGI-I of Case 1 assessed by parent at Post acupuncture (second month) was much improved in Social relatedness (Initiative and social response), Non-verbal (Pointing) and Verbal (Expressive and receptive language) Communication and Stereotypic Behavior & Restricted interests domains (being less compulsive behavior and adaptive to new environment).

Minimal improvement in Social relatedness (Social response) and Verbal communication domains (Expressive

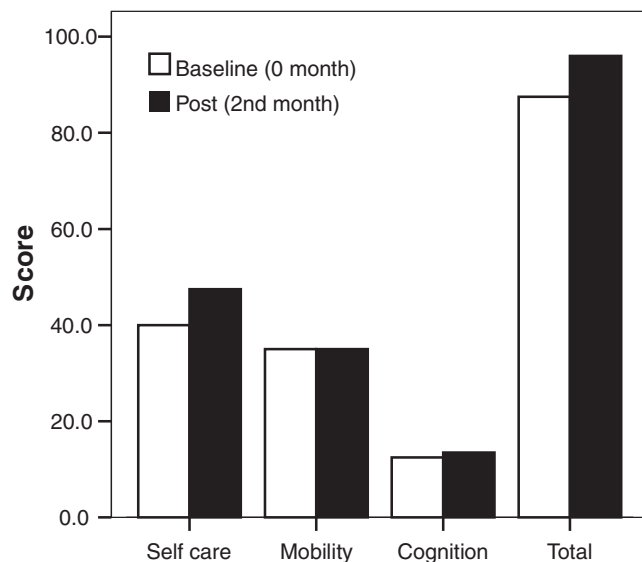


FIG. 5. Outcome of WeeFIM[®] of Case 1.

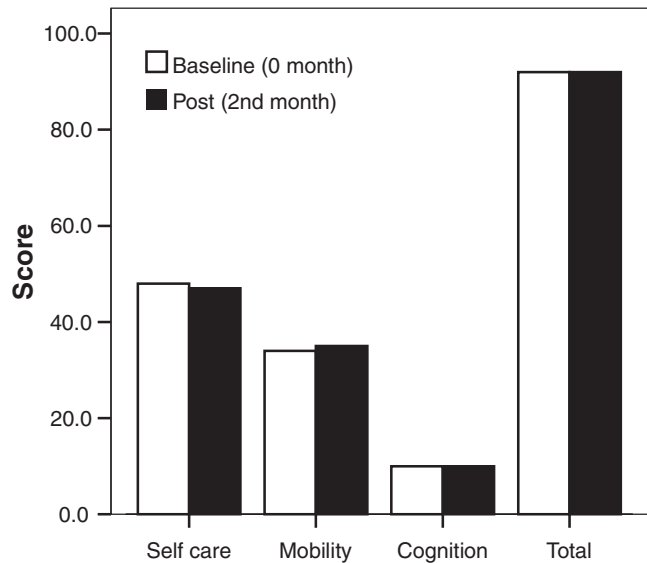


FIG. 6. Outcome of WeeFIM[®] of Case 2.

and receptive language) was reported in Case 2 at Post-acupuncture (second month) with parental assessment.

Parental report

The summaries of both cases are shown in Table 2 (Case 1) and Table 3 (Case 2).

Compliance and side-effects

The compliance for accepting acupuncture was good for both cases, although gentle holding for the child was needed for Case 1 in her first acupuncture session. Initial crying occurred in the first few sessions; however, the two cases adapted easily and tolerated the technique well. Mild side-effect with mild bleeding from the acupuncture site with spontaneous resolution occurred.

Discussion

Acupuncture had been practiced in China for over 2 millennia. In 1997, the U.S. Food and Drug Administration recognized the legal status of acupuncture as a treatment technique, and since that time so have several other countries such as Canada, the United Kingdom, and Europe.

In traditional Chinese acupuncture, nearly 400 acupoints on the body surface are interrelated to various functions. The surface acupoints were linked through 14 meridians to various organs or viscera of the human body.

ASD can have other comorbidities, making it difficult to be sure about the effectiveness of various modalities of therapy. Therefore, comprehensive conventional assessment tools such as ABC and RFRLS for symptomatology, WeeFIM for Function, and CGI-I for clinical global improvement were used in our study. In addition, the self-devised Parental Report, based on the third author's (VCNW) experiences of acupuncture studies in patients with various chronic neurologic disorders,¹³⁻¹⁷ was also used as a complementary tool for parents recording daily changes of children with ASD during acupuncture.

To date, no study regarding the effectiveness and safety of electro-acupuncture for ASD in international journals is retrieved. We reported the clinical outcome of two cases with ASD with electroacupuncture.

Social relatedness

After a short course of acupuncture, the marked improvement in social initiative and social response as well as eye contact in Case 1 according to Parental Report (Table 2), and the slight improvement in both social response and eye contact in Case 2 based on Parental Report (Table 3) were reported, although no change was found in both cases in "Social Relationship to People" of RFRLS (Figs. 3 and 4).

The course of social relatedness improvement of Case 1 is as follows: after three acupuncture sessions, the increased frequencies of response along with more confidence and shorter responsive time were found, following the marked improvement in social initiative throughout the later sessions (Table 2). In addition, more curiosity to environment was also stated in daily life during the acupuncture course.

Nonverbal and verbal communication

Much improvement in verbal (expressive and receptive language) or nonverbal communication in Case 1 according to Parental Report (Table 2) and slight improvement in verbal (expressive and receptive language) in Case 2 based on

TABLE 2. PROGRESS OF CASE 1 AS REPORTED BY PARENT DURING ACUPUNCTURE COURSE

<i>Session</i>	<i>Social relatedness</i>	<i>Nonverbal and verbal communication</i>	<i>Stereotypic behavior and restricted interests/others</i>
1st–6th	1, Social response: Increased frequency, shorter responsive time. 2, Increased willingness to imitate parent to speak		Attention span: Sat with mother listening to story for more than 30 minutes (< 5 minutes before) Coordination: Could write words within aligned lines and squares (outside lines before) Time concept: Prepared her schoolbag before leaving school and waited for parents to pick her up
7th–12th	Actively approached father and said: "have dinner" when mother asked her brother to have a dinner	Expressive: 1, Called "mother" appropriately ("father" instead before) 2, Said: "go to toilet" appropriately at school 3, Imitated 5–6 words (1–2 words before) Receptive: Followed father's order to press button accurately in lift (never done this before) Nonverbal: Identify brothers by finger pointing	Compulsive behavior decreased: Allowed parent turn the light off in her room and change the angle of bed lamp before asleep
13th–18th	1, Improved "eye-contact." 2, Held up a "strawberry" card or "tiger" toy, actively approached parent and brother, repeatedly saying card or toy's name until they had feedback	Expressive: 1, Increased in vocalizations with loud nonmeaningful words sometimes both at home and school 2, Called her "elder brother" appropriately Nonverbal: Pointing to "Strawberry" card by finger	Abnormal sensory behaviors lessened: No longer had temper tantrum to sudden loud sound (e.g., father scolded her brother loudly) Emotion: Excited at times at home and school. Eye–hand coordination: Could write "2" Adaptive to new environment: Adaptive to new bed in her room although had to explain in advance (strongly resisted even minimal changes before)
19th–24th	1, Frequently and actively approached parent to get their attention and feedback 2, Increased in curiosity to environment	Expressive: 1, Called "mother" incorrectly 2, Said "go to toilet" correctly 3, Responded and said "I knew" when father routinely told her "you should. . .," which is first time she actively said "I" instead of using "her name"	Temper control: No more temper tantrum even when she was not allowed chocolate although the reason needed to be explained to her Emotion: Excited at times

Parental Report (Table 3) were found, although no changes occurred in the domain of "language" of RFRLS for both cases (Figs. 3 and 4).

Some marked changes were found in Case 1 after six acupuncture sessions such as calling "mother" appropriately and saying "went to toilet" in the right way, while giving feedback and answering "I know" was reported in later sessions, which was the first time Case 1 actively said "I" instead of "name" (Table 2). In receptive language domain, Case 1 could understand some simple commands, which could not be done before acupuncture.

In the nonverbal communication domain, also, evident improvement was found in Case 1 with starting to point objects (cards, toys) by finger.

Stereotypic behavior and restricted interest

Stereotyped behaviors and restricted interests such as compulsive behaviors, abnormal sensory behaviors, adaptive to new environment and control temper were markedly improved in Case 1 according to the Parental Report (Table 2), which were compatible with the positive outcomes of ABC (Positive change in "Irritability" and "Stereotyped,"

and nonsignificant improvement in "Lethargy" and "Hyperactivity") (Fig. 1) and RFRLS (Positive change in "Sensory motor" and "Sensory response") (Fig. 3).

However, hand stereotypic movement as well as self-injurious behaviors were reported in Case 2 based on the Parental Report (Table 3) in the initial acupuncture sessions although decreased in later sessions, together with the fluctuant emotion, which was commensurate with the nonsignificant deterioration outcome ("Hyperactivity") of ABC (Fig. 2) and the negative change ("Affectual response") of RFRLS (Fig. 4) although positive change in "Sensory motor" and "Sensory response" of RFRLS (Fig. 4) was also reported.

Functional status

The outcome of CGI-I of Case 1 was much improved in "Social relatedness, Communication and Stereotypy behavior," while minimal improvement in "Social relatedness and Communication" was reported in Case 2. The outcomes of self-care and total score domains of WeeFIM of Case 1 (Fig. 5) had shown nonsignificant improvement although Case 2 did not show improvement in any domains of WeeFIM (Fig. 6).

TABLE 3. PROGRESS OF CASE 2 AS REPORTED BY PARENT DURING ACUPUNCTURE COURSE

<i>Session</i>	<i>Social relatedness</i>	<i>Nonverbal and verbal communication</i>	<i>Stereotyped behaviors and restricted interests/others</i>
1st–6th	Eye contact: Slightly better	Expressive: Increased in vocalizations with nonmeaningful words	Memory: Slightly better Hand stereotyped movement: More than before at home and school Self-injurious behaviors: Some (e.g., biting hands and fingers) Reading ability: Improved fluency and liked to spend more time on reading Emotion: Easily lost temper at home and school Sleeping: Difficulty falling asleep
7th–12th	1, Responded and pointed to acupoints she had received when asked by teacher 2, Actively asked mother to give her money to buy flower	Expressive: Slightly better (5–6 words versus 2–3 words before)	Self-injurious behaviors: Shown at times, especially at temper tantrum Learning ability: Receptive ability was better than before Emotion: Fluctuated Drawing ability: Improvement
13th–18th			Self-injurious behavior Shown when temper tantrum Emotion: Slightly better than last 3 sessions Learning ability: Doing homework more quickly than before
19th–24th	Slightly better social response to others	Receptive: Accurately matched the classmates by names when asked by teacher (never done this before)	Emotion: Better than initial 12 sessions although still fluctuated

Other related domains

The other related domains (Table 2 and Table 3) such as attention span (Case 1), coordination [writing word ability (Case 1); drawing ability (Case 2)], Time concept (Case 1), Learning ability (reading and receptive ability) (Case 2)] were also reported to have an improvement during the acupuncture course.

Compliance and side-effects

Children with ASD may experience adverse effects of electroacupuncture but are unable to convey relevant information to their parents or the researchers due to the impairment of communication. Yet a better understanding of potential side-effects and compliance of electroacupuncture is one of this pilot study aims. We adopted two strategies via parents and researchers to try to monitor the safety of electroacupuncture.

A systematic review of prospective studies of safety of acupuncture¹⁸ found that the most common adverse events were needle pain, tiredness, and bleeding. Feeling of faintness and syncope were uncommon, and pneumothorax was rare.

The compliance for accepting electroacupuncture was good for both cases, although Case 1 accepted acupuncture the first time while Case 2 received tongue acupuncture before. Initial crying occurred in the first few sessions; however, both cases adapted easily and tolerated the technique well. Mild side-effect with minor superficial bleeding from acupuncture was found casually in both cases.

TCM and ASD

According to the concept of TCM, making the Heart (*Shenmen* [HT7]), Pericardium (*Neiguan* [PC6]) “unobstructed,” regulating the Liver (*TaiChong* [LR3]), and correcting any derangement might contribute the improvement of some core features (social relatedness, communication, and stereotype) of children with ASD.

In addition, the acupoints selected from the Head (*Sishencong* [EX-HN1]), (*Yintang* [EX-NH3]), Ear (*Ernaodian* [AT3]), and Hand (*Shounaodian*) to “awake,” to “calm” the mind and enlighten the mentality, as well as the acupoints selected from the Spleen (*Sanyinjiao* [SP6]), Kidney (*Taixi* [KI13]), and Stomach (*Zusanli* [ST36]) meridian to invigorate and to facilitate the source of vital function, might contribute to the positive changes in CGI-I and nonsignificant improvement of functional domains (Self-care and Total score) in WeeFIM of Case 1.

Although the improvement in some core features (Social relatedness, Communication and stereotype), and some associated features (sensory motor, sensory response) of children with ASD were found in our pilot study, there are some precautions in order to avoid misinterpreting the outcomes.

First, this study only includes 2 cases, with marked improvement in one case (Case 1), and minimal or narrow improvement in another (Case 2). Second, except for the stereotypic domain, the improvement of social relatedness and communication domains was mostly supported by Parental report and CGI-I rather than the scales such as ABC, RFRLS.

Conclusions

A short intensive course of electroacupuncture for selected acupoints might improve some core features of children with ASD.

Based on the outcomes of this pilot study, we had subsequently performed a randomized controlled trial to further study the efficacy and safety of acupuncture for children with ASD (Wong V, et al., unpublished observations, 2008).

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