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Review Article

Analysis of Evidence-Based Autism Symptoms Enhancement by Acupuncture

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Abstract
Autism is considered as a complex developmental disability that appears during the first two years of life. It is considered as a neurological disorder that affects brain function leading to impaired development in social interaction and communication skills. Some clinical trials demonstrated that certain acupuncture points play relatively significant role in improving both signs and symptoms of this disease. Owing to limited information available about acupuncture point's combination and protocols, the present study aimed to explore the most frequently used acupuncture points and their channels for children with autism. Thirteen articles about autism enhancement were selected from 2007 to 2015. Acupoints and their channels used in these articles were analyzed according to usage frequencies. The present study identified the following main channels that contribute to autism symptoms enhancement along with the corresponding points' frequencies: Governing Vessel channel (12), Gall bladder channel (9), Kidney channel (8), Pericardium channel (7), Extra points channel (7), Liver channel (7), Heart channel (6), Conception vessel channel (6), and Bladder channel (6). On the other hand, the frequency of each corresponding acupuncture points are EX-HN1 (5), GV-17 (4), PC-6 (4), LR-3 (3), KI-3 (3), HT-7 (3), Lu-9 (3), GV-20 (2), GV-24 (2), GV-24.5 (2), GB-13(2), GB-19 (2), KI-4 (2), LR-4 (2), ST-36 (2), SP-3 (2), SP-6 (2). In conclusion, the consensus is that both channels and points may have an important role in autism symptoms enhancement. Based on the present study, the specific channels and points selection and stimulation types need further investigation through clinical trials.

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1. Introduction

Autism spectrum disorder (ASD) is considered as a developmental disorder characterized by impairments of social interaction and social communication. Repetitive and stereotyped behaviors are often associated with this disease [1]. The term ASD includes several disorders such as autistic disorder, Asperger syndrome, and others [2]. The impairments of ASD can have a severe impact on learning and social interaction that may persist to adulthood. In addition, ASD has a significant growing prevalence worldwide [3,4].

It is considered that acupuncture is one of the important components of Traditional Chinese Medicine. It is also effective in the treatment of many medical problems by regulating the functions of the autonomic nervous system and neuroendocrine system [5].

It has been proved that manual acupuncture and 10—20 Hz electroacupuncture stimulation increased the levels of arginine—vasopressin and oxytocin in certain areas of the brain in rats. Therefore, it is rational to posit that acupuncture or electroacupuncture may improve the social behaviors of autistic children by enhancing the function of the arginine—vasopressin and/or oxytocin systems in the brain [6].

Certain acupuncture points corresponding to various organs and meridians were used for autism; some of them are used more frequently in present research studies. The organ and meridian concept in the Traditional Chinese Medicine model has been assumed as a fundamental basis to improve the behavior, cognition and communicative ability in children with autism [7].

Owing to limited information available concerning the acupuncture points of choice in particular regimens, the present study aimed to find such points frequently used effectively for symptomatic enhancement of children suffering from autism spectrum disease.

2. Methods

2.1. Data sources

A total of 13 articles on the treatment of autism spectrum disease symptoms with positive results available online were randomly collected [6,8—19]. Articles with negative results were excluded.

2.2. Data synthesis and analysis

From these 13 articles, both channels and their particular acupoints were identified. Then frequencies were calculated for both channels and acupoints. Additionally, data were arranged into tables and figures to summarize them. Correlations between number of needles with duration of treatment (weeks) and number of needles with sessions number used in each articles with positive enhancement of autism symptoms were also calculated, all statistical analyses were done using Microsoft Excel software 2010.

3. Results

Table 1 summarizes the stimulation method besides session's numbers and durations with symptomatic enhancement testing method. While Table 2 represent channels used successfully for enhancing autism symptoms with their particular acupuncture points. Finally, Fig. 1 summarizes data shown in Table 2.

4. Discussion

Several attempts have been made to participate in autism spectrum symptoms enhancing using behavior therapy, drugs, and others. Yet, alternative approaches are still needed as all previously mentioned strategies participate partially in the treatment of this spectrum [20]. In addition, the treatment goal to gain complete rectification has not been achieved in moderate and severe cases. From this point of view, the present study demonstrated the acupuncture strategy used to enhance the benefits of the other approaches to try to reach treatment goals [21].

As shown in Table 1, the present study data from the 13 articles published from 2007 to 2015 reflect how limited the resources are for such kinds of intervention. Duration of treatment and session frequency (with the sessions ranged from 12 to 96 overall) that are needed to reach a significant improvement in autism symptoms according to treatment protocols ranged from 4 to 40 weeks. On the other hand, each patient needs a particular duration and number of sessions with particular acupuncture points based on his/her clinical status. Wong et al [8] reported on improvement after 12 sessions (which included EX-HN3, GV-24.5, PC-6, EX-HN1, LR-3, shenmen (HT-7), SP-6, ear naodian (AT-3) and ear shenmen (TF-4) acupoints, with electroacupuncture stimulation method). In contrast, Yuan et al [18] reported on improvement after 96 sessions (with GV-17 and GB-19 stimulated by "Jin's Sanzhen" therapy).

Additionally, Figs. 1 and 2 summarize a part of Table 1 data representing the associations between number of needles, total number of sessions, and duration needed to achieve significant improvement of symptoms. Both of these two figures showed reverse association between the numbers of needles and sessions, as Li et al (2001) used of only four needles and required 60 sessions and 60 weeks, Allam et al [19] used only three needles and required 72 sessions and 36 weeks, and Yuan et al [18] used only three needles and required 96 sessions and 16 weeks. While, Wong et al [8] used 17 needles and required 12 sessions and 4 weeks and Pei-Chen et al [16] used 24 needles and required 36 sessions and 12 weeks. These data suggest that autism spectrum disease, as an illness resulting from multiple causes, needs a combination of more than four acupoints per session to gain the best outcome. While deciding sessions number depends strongly on the clinical status and severity. The details of ideal acupoint combinations still need further investigation and clinical trials.

In addition, the previous paragraph concept does not apply for Pledger (2014) [12] who utilized 46 needling points and required 40 sessions, excluding scalp GV points, EX-HN1, EX-HN3, and SP-6 which are known to be the more

Table 1 Stimulation method, duration, patients, and autism scale type of present study data source.

First author	Year	Acupoint areas	No of points	No of needles	Stimulation method	Duration weeks (sessions per week)	Total sessions	Patients (*n*)	Control intervention (*n*)	Autism scale
Zhang Jun	2010	Leg, knee, foot, and shoulder	5	10	M	n.a.	n.a.	n.a.	n.a.	n.a.
Wang CN	2007	Scalp	3	3	EA	n.a.	n.a.	30	Behavior therapy group (30)	Picture and vocabulary scale and behavior ability
Young K	2009	Scalp and hand	7	13	A	n.a.	n.a.	n.a.	n.a.	n.a.
Wong YM	2010	Scalp and neck	3	7	A	n.a.	n.a.	n.a.	n.a.	n.a.
Xi Y	2010	Upper back and Scalp	9	16	A	n.a.	n.a.	32	n.a.	Autism treatment evaluation checklist
Wong V	2010	Scalp, hand, foot, and ear	8	17	EA	4 (3)	12	30	Sham acupuncture (25)	ABC, RDLS, and Parents report
Pei-Chen Lo	2015	Foot, leg, hand, wrist, and palm	12	24	Chan Ding	12 (3)	36	734	445	ASD prevalence by HHIS Chan Ding, and Autism screening questionnaire
Pledger J	2014	Scalp, foot, hand, abdomen, and leg	25	46	A	40 (1)	40	7	commenced treatment (7)	Social skills profile questionnaire and Pragmatics profile questionnaire
Wong V	2014	Tongue	4	5	A	8 (7)	56	21	9	Autism treatment evaluation checklist, Reynell language developmental scale, Symbolic play test
Zhang	2012	Hand and leg	4	8	TEAS	12 (5)	60	37	39	CARS as well as ABC
Li	2011	Scalp	1	4	A	60 (1)	60	30	40	CARS, ABC and Gesell Developmental Scale
Allam	2008	Scalp	3	3	A	36 (2)	72	10	10	Arabic language test
Yuan	2009	Scalp	2	3	JST	16 (6)	96	118	84	CARS

ABC = autism behavior checklist; ASD = autism spectrum disorder; CARS = childhood autism scale; RDLS = Reynell Developmental Language Scale; HHIS = heart to-heart imprint sealing; TEAS = Transcutaneous electrical acupoint stimulation; n.a. = not applicable; A = acupuncture; EA = electroacupuncture; M = moxabustion; JST = "Jin's Sanzhen" therapy.

Table 2 Acupuncture channels with corresponding acupuncture points used for treatment of autism symptoms distribution according to present study data source.

First author & year	GV	GB	KI	PC	Extra	LR	HT	CV	BL	Tongue	Lu	ST	SP	LI	Tb	Ear	Sj	Si
Wong V, 2010	EX-HN3	—	—	PC-6	EX-HN1*	LR-3	Shenmen (HT-7)	—	—	—	—	—	SP-6	—	—	Ear naodian (AT-3) and ear shenmen (TF-4)	—	—
Xi Y, 2010	GV-12, GV-20. GV-17, and GV-l5	GB-8, GB-13, GB-20, and GB-12.	—	—	Ex-HN1*	—	—	—	—	—	—	—	—	—	—	—	—	—
Wong YM, 2010	—	—	—	—	Ex-HN1*	—	—	CV-23	—	Ex-HN12	—	—	—	—	—	—	—	—
Wong V, 2014	—	—	—	—	—	—	—	—	—	TAC1, Run Ze, TAC2, Guan Zhu, TAC3, Tian Men, TAC4, and Di You	—	—	—	—	—	—	—	—
Zhang, 2012	—	—	—	PC-6	—	—	—	—	—	—	—	ST-36	SP-6	LI-4	—	—	—	—
Pledger J, 2014	—	GB-34	KI-1 and KI-3	P-1, P-5, and P-6	—	LR-3	HT-5 and HT-7	Ren-14, Ren-15, Ren-3, and Ren-4	BL-17, BL-20, and BL-23	—	Lu-3 and Lu-9	ST-40 and ST-44	SP-9	LI-18	TB-5, TH-16, and TH-5	—	—	—
	—	Massage Gall bladder or gall bladder in leg	Massage kidney channel in lower leg or kidney in lower legs and feet	Massage Pc channel	—	—	Massage and brush heart channel	—	—	—	—	—	—	—	—	—	—	—
Wang CN, 2007	GV-20, GV-24, and GV-17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zhang Jun, 2010	—	—	Massage KI-3, KI-7, and KI-10	—	—	Massage LR-4, LR-7, and LR-10	Massage HT-8 and HT-9	Massage CV-12	Massage BL-13 BL-15	—	Massage LU-9 and LU-8	Massage ST-36	Massage SP-3	—	—	—	—	—
	—	—	KI-3 and KI-4	—	Xiyan (EX-LE5) and Tianliao (TE 15)	LR-4	—	—	—	—	—	—	—	—	—	—	—	—
Li, 2011	—	—	—	—	EX-HN 1	—	—	—	—	—	—	—	—	—	—	—	—	—
Pei-Chen, 2015	—	GB-40	KI-4	PC-7	—	LR-3	HT-7	—	BL-65	—	LU-9	ST-42	SP-3	LI-5	—	—	SJ-4	SI-4
Young, 2009	GV-24.5, GV-24, and GV-17	GB-13 and GB-19	—	P-6	EX-HN1	—	—	—	—	—	—	—	—	—	—	—	—	—
Yuan, 2009	GV-17	GB-19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Allam, 2008	GV-17, GV-20, and GV-26																	
Total	15	9	8	7	7	7	6	6	6	5	5	5	5	3	3	2	1	1

* A group of four points, each located 1 cun from ➡ **Du-20** (anterior, posterior and lateral). TAC1, TAC2, TAC3, and TAC4 located on the underside of the tongue, on the lingual vein to the left of the frenulum.

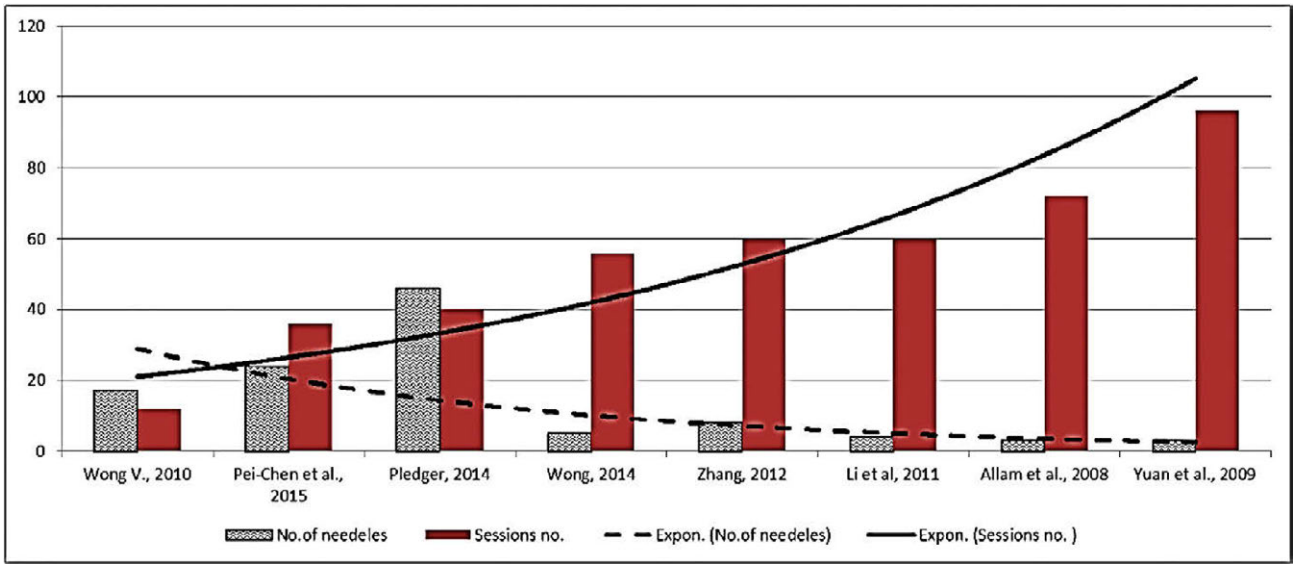

Figure 1 Number of needles and sessions used in articles with positive enhancement of autism symptoms, correlation coefficient $r = -0.60$.

frequently used acupuncture points in articles with a positive enhancement of autism symptoms. This exclusion could have been the reason for the need to increase the number of needles used as well as the number of sessions. This increases the probability that excluded points are the more effective acupoints to enhance ASD symptoms.

Additionally, as shown in Table 1, one of the obstacles in the present study is the wide range of enhancement rating scales, which made it impossible to identify quantitative differences in certain acupoints compared with the others. In addition, autism has a wide spectrum of symptoms, which, along with their severity, may differ significantly among autistic children. The most frequent rating scales were Childhood Autism Rating Scale (CARS) and Autism Behavior Check List (ABC) with three articles, then Autism Treatment Evaluation Checklist (ATEC) with two articles, as shown in Fig. 4.

Moreover, as indicated in Table 1 and Fig. 3, a 9 out of 13 articles involved in the present study utilized scalp area as part of their protocols. Three out of those nine articles used only scalp area as the sole acupuncture site which led to the need of more sessions to achieve symptomatic enhancement, including Li et al (2011) [15], Allam et al (2008) [19], Yuan et al (2009) [18] who utilized 60, 72, and 96 sessions, respectively. This supports the probability of the need of multiple acupuncture sites to achieve better enhancement in shorter duration for patients as ASD may be a multifactorial disease. Additionally, Wong et al [8] used

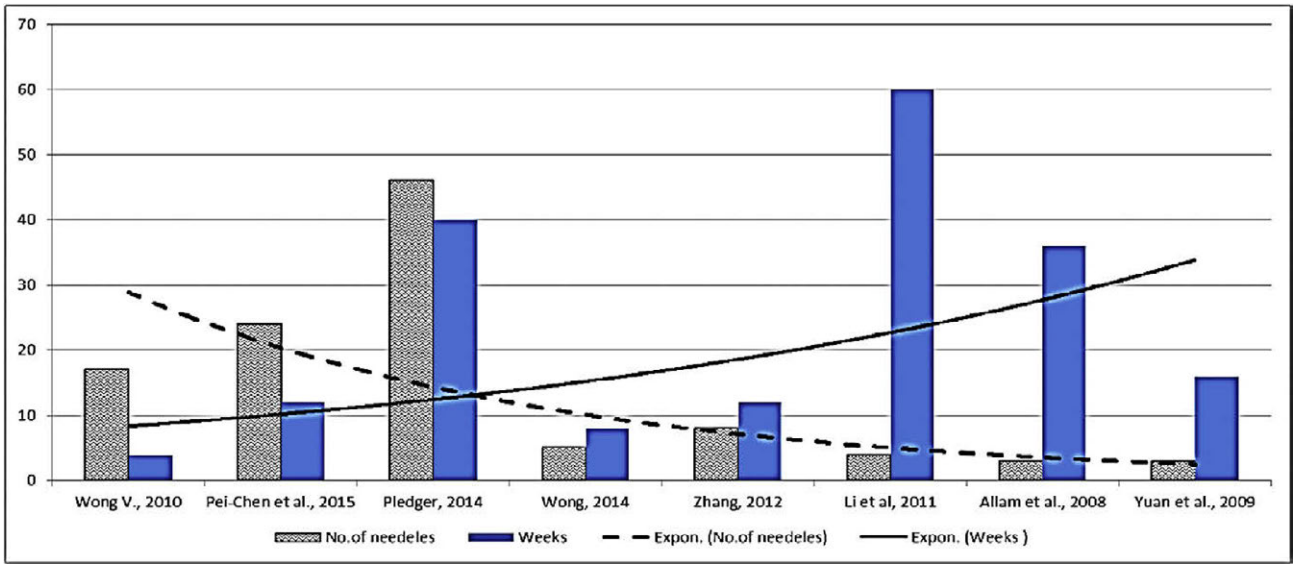

Figure 2 Number of needles and duration of treatment (weeks) used in articles with positive enhancement of autism symptoms, correlation coefficient $r = 0.07$.

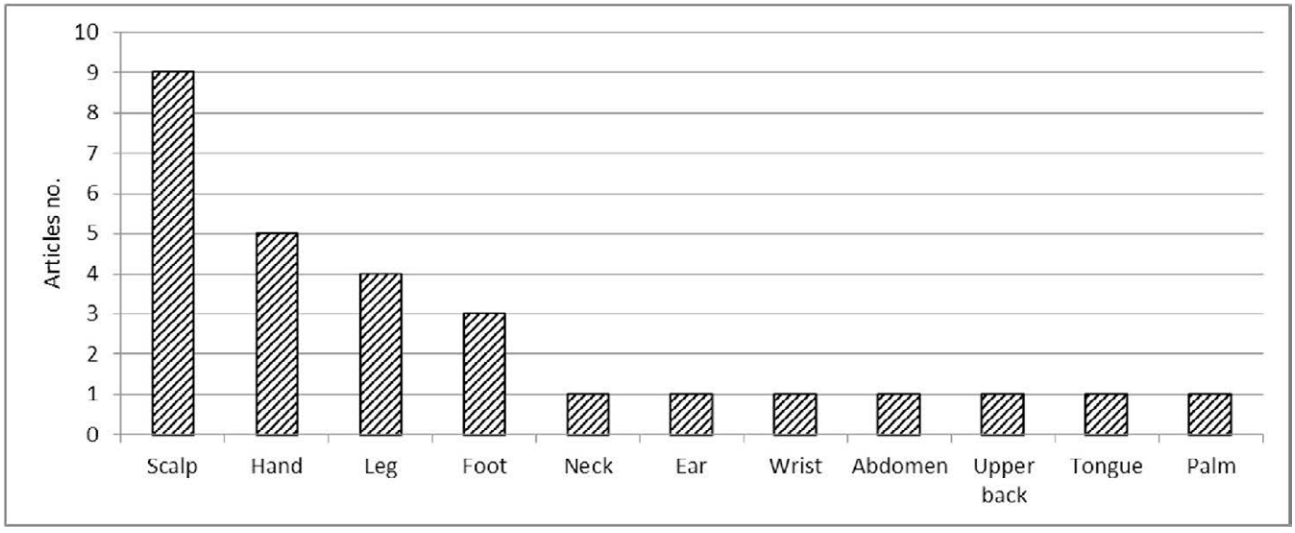

Figure 3 Frequency of body parts used in needling stimulation for symptomatic treatment of autism.

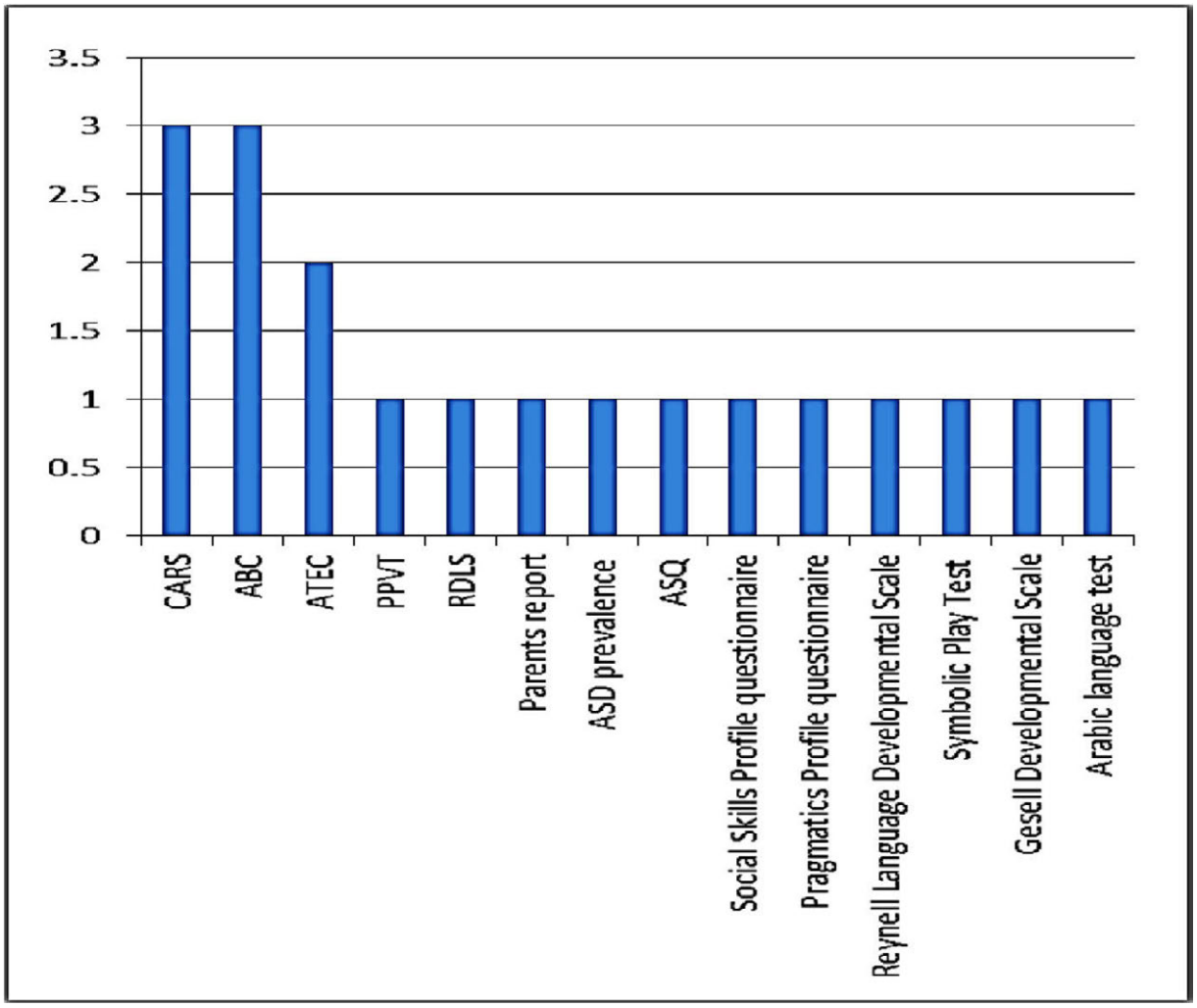

Figure 4 Frequency of autism severity diagnosis rating scales according to studied articles. ABC = autism behavior checklist; ASD = autism spectrum disorder; ASQ = Autism Screening Questionnaire; ATEC = Autism Treatment Evaluation Checklist; CARS = childhood autism scale; PPVT = picture and vocabulary scale.

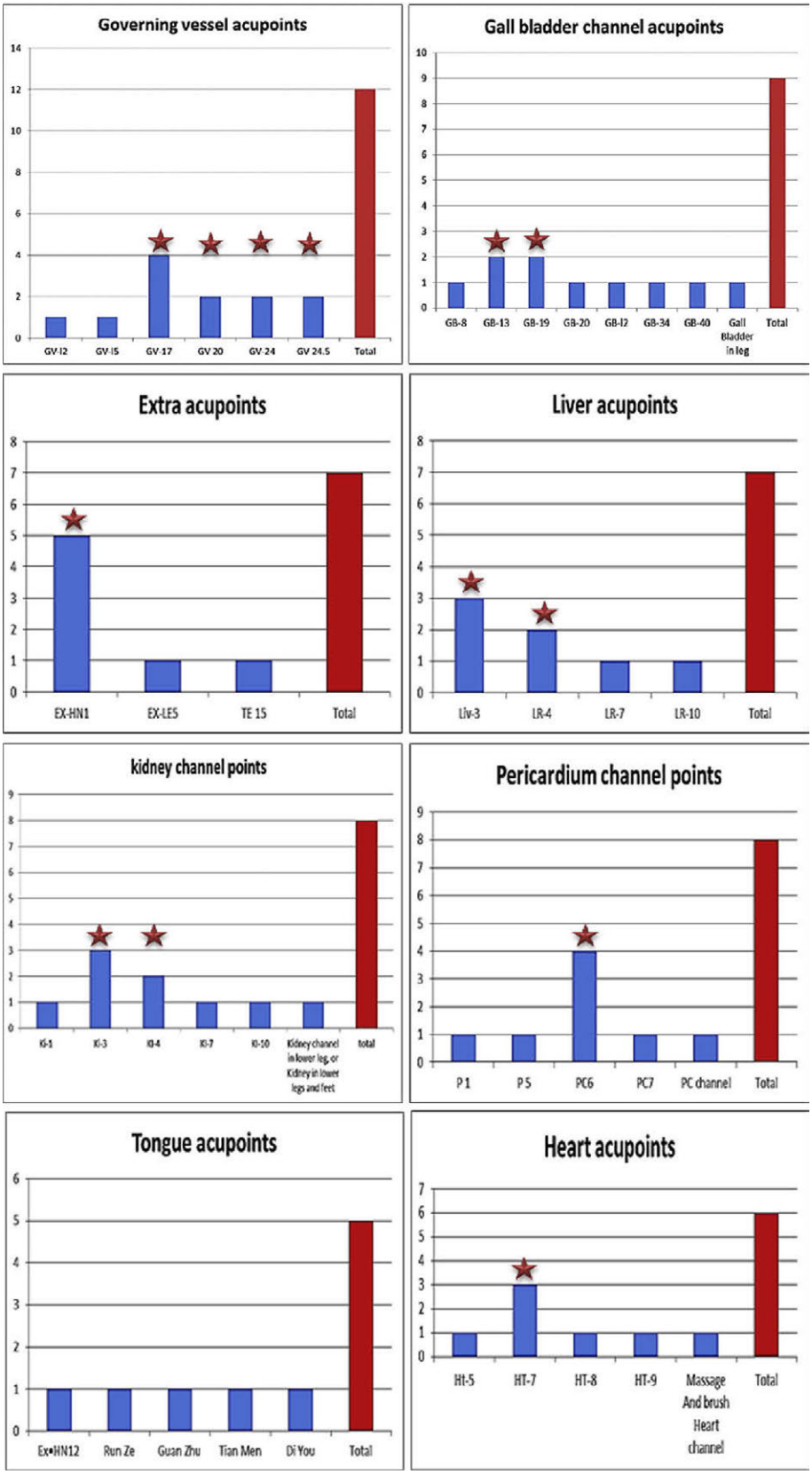

Figure 5 Summarizing information of Table 2. The X axis represents points according to corresponding channels used successfully for enhancing autism symptoms. The Y axis represents frequency of each acupuncture point in present study data source.

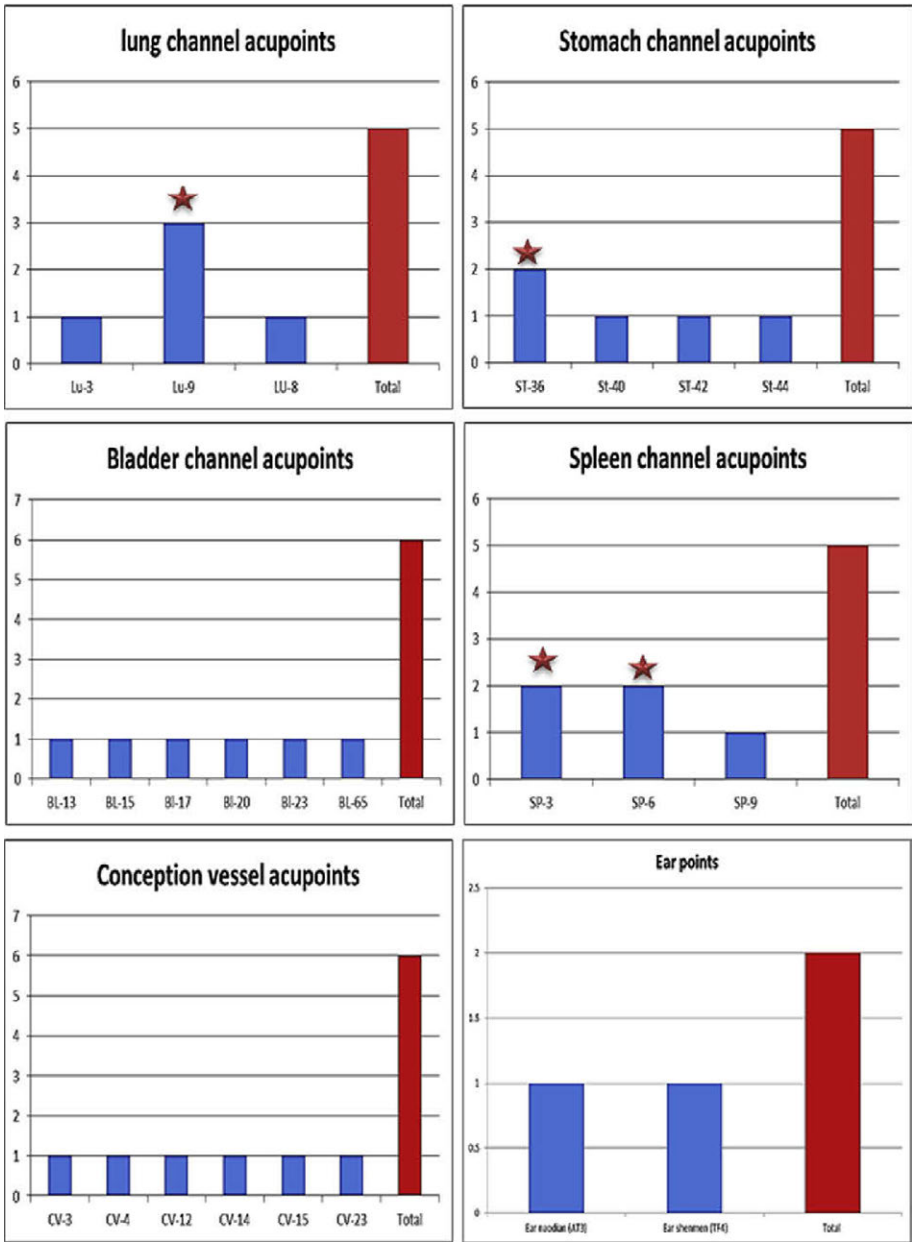

Figure 5 (*continued*).

scalp, hand, foot, and ear acupoints and needed 12 sessions; Pei-Chen et al [16] used foot, leg, hand, wrist, and palm acupoints and needed 12 and 36 sessions. These data suggest scalp area acupoints as one of the several parts of the body to have the ability to participate partially in autism treatment. Protocols involving scalp acupuncture combined with other areas may still be needed to reach optimum autism acupuncture treatment.

According to present study, from the results in both Table 2 and Fig. 5 that analyzed the usage distribution of certain acupuncture points used successfully in autism symptoms enhancement purposes, it is found that the frequency of each acupuncture points in studied data sources were EX-HN1 (5), GV-17 (4), PC-6 (4), LR-3 (3), KI-3 (3), HT-7 (3), Lu-9 (3), GV-20 (2), GV-24 (2), GV-24.5 (2), GB-13(2), GB-19 (2), KI-4 (2), LR-4 (2), ST-36 (2), SP-3 (2), SP-6 (2).

The extra points EX-HN1 (Sishenchong) is most frequently used for autism treatment, it is documented to be used successfully for the treatment of insomnia, autism, Alzheimer's disease and depression [22—26]. It is demonstrated that the electroacupuncture at Ex-HN1 can increase concentrations of monoamines in the body, so as to play the antidepressant role [27], in addition to its use in cognition treatment [28,29].

In another study, puncturing EX-HN1 (Sishenchong) can improve the sleep quality of insomnia patients, relieve depression and anxiety, and decrease relapse rate [30]. Additionally, it is used to treat senile dementia [31] and vascular dementia [32].

Governing Vessel channel (GV), on the other hand, is known to be used to treat brain disorders and psychological diseases. It is amazing how many points of the Governing

Vessel are indicated for the kind of disharmony usually associated with the heart and spirit, for example, manic depression, manic behavior, agitation, poor memory, disorientation, palpitations, insomnia, loss of consciousness, and epilepsy [33].

Clearing Governing Vessel and refreshing the mind needling could accelerate the recovery of injured brain nerve and the reconstruction of brain function. The acupuncture therapy could ameliorate both the motor development and cognitive development [34].

In addition, the acupuncture can obviously improve intelligence quotient (IQ) of children suffering from mental retardation using Sishenchong (EX-HN1), Baihui (GV-20), Naohu (GV-17), Benshen (GB-13), Fengchi (GB-20), Neiguan (PC-6), Hegu (LI-4), and Zusanli (ST-36) [35]. All of them are used positively in ASD treatment except GB-20. It is therefore recommended that further researches are carried out to clarify the effect of these particular points on ASD enhancement.

Additionally, Governing Vessel 20 (GV-20) is very important acupuncture point in neurocognition. This acupoint belongs to the Governing Vessel meridian which is located on the highest place on the head and is widely used in neurological and psychiatric diseases [36].

Furthermore, Wong et al [8] suggested that using certain acupuncture points (EX-HN1, EX-HN3, PC-6, HT-7, LR-3, AT-3, TF-4, and SP-6) with electrical stimulation enhances some autistic symptoms of children including comprehension of language with self-care abilities [8]. Except for ear points (AT3, TF4), all mentioned points are highly frequent in studies that reported positive enhancement of ASD symptoms. In addition, 12 sessions within 4 weeks appear to be the best combination used in the articles in the present study. Some frequent points and combinations reported in the present study, including GV-17, KI-3, Lu-9, GV-20, GV-24, GV-24.5, GB-13, GB-19, KI-4, LR-4, ST-36, and SP-3, have not been used by Wong et al [8]. Additional clinical trials using all frequent points demonstrated by present study are still needed to be carried out to prove its success.

In conclusion, the present analysis results suggest that acupuncture stimulation of more frequently documented acupoints may better enhance autism disorder symptoms. This hypothesis still needs several kinds of research to prove the best therapeutic protocols based on the current finding. Moreover, all the results obtained in the present study may represent a small part of a larger map that needs to be completely discovered.

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