Original Article

Effect of Craniosacral Therapy on students' symptoms of attention deficit hyperactivity disorder[1]

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Objectives: Complementary and alternative medicine methods (CAM) are now used for a wide range of disorders. Craniosacral therapy (CST) is one of CAM methods in which manual maneuvers with light forces are used for different aspects of health. In the present research, the effects of CST were studied for reducing symptoms of attention deficit and hyperactivity disorder (ADHD).

Method: Twenty-four children with ADHD were recruited as an available sample from Roshd Occupational Therapy Center and divided randomly into control and experimental groups. Before and after intervention, the Conner's Parents Rating Scale as well as child's symptom inventory-4th was filled out by parents. Both groups participated in occupational therapy programs as a routine intervention, while the experimental group received an additional CST for 15 sessions, twice a week. The collected data were analyzed as the covariance method by SPSS16.

Results: CST showed significant effects on increasing attention, reducing hyperactivity, oppositional defiant, conduct disorder, anxiety and embarrassment, social problems and psychosomatic problems of the participants.

Discussion: CST as a type of biomechanical correction can facilitate improvement in children with symptoms of ADHD.

Keywords: Complementary medicine, alternative medicine, craniosacral therapy, Attention deficit hyperactivity disorder, Cerebro spinal fluid (CSF).

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Introduction

Attention deficit hyperactivity disorder (ADHD) with a set of hyperactivity symptoms, impulsive behaviors and attention deficit leads to concentration problems (1). The disorder consists of three types including hyperactivity-impulsivity, attention and concentration deficit and mixed type (2). The prevalence rate of the disorder in students and is estimated to occur in 3-7% of school aged children (1) and in Tehran have been reported 3-6% (3). The disorder is always associated with a wide range of negative consequences for children (4, 5) and high costs to the family and communities (6), therefore this disorder is considered as one of collective health problems (7). Nowadays, medication is the most common treatment method in children with ADHD. But, due to the wide range of heterogeneity in children with ADHD, medication is not effective in all clients. Furthermore, even some drugs such as methylphenidate which has been approved by the U.S. Food and Drug Administration as a first-line treatment for people ADHD, has different adverse effects. These side effects strongly deteriorates patients' ability to manage their cognitive function such as attention and concentration (8). Therefore, the medication alone cannot meet the therapeutic requirements of children with ADHD and shall be combined with other intervention methods (9). Hitherto, twenty - four alternative treatments are identified in patients with ADHD. Among them are oligoantigenic diets, Enzyme-potentiated desensitization, Relaxation / EMG biofeedback, EEG biofeedback, massage, meditation, mirror feedback,channel-specific Perceptual training, and vestibular stimulation. A few have some supports for their effectiveness in some selected subgroup of patients while, many of them have no documented and or convincing evidences of efficacy.
National Centre for Complementary and Alternative Medicine (NCCAM) has introduced a group of

1- The article is derived from Master thesis.

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hitherto uncommon care and treatment systems in Westerners conventional medicine as complementary and alternative Medicine. Manipulative and body-based group is one of these classes which is carried by manual maneuvers on the body and includes chiropractic, massage therapy, craniosacral therapy, etc. The efficiency of some therapeutic groups including massage therapy for children with ADHD has been studied (10) and positive results thereof have been reported.

Craniosacral therapy is also milder and less risky than manipulative treatments of cranium bones and vertebrae. It is believed that Craniosacral therapy is one of the most useful complementary and alternative interventions to improve the symptoms of children with developmental disabilities (11). This method has deep effects on the brain and spine and can influence the endocrine and body immune system positively and eliminates pressure patterns and enhances fluid flow in body organs (12).

This treatment method leads to improve movement as well as balance in the central nervous system and enhances the level of performance via biomechanical improvement of the body. Therefore, CST not only improves body general state, but also removal of blockages and constraints can reduce disorders in children with ADHD and prevent breaking out of social and academic problems, and other mental disorders in their growth stages.

According to this approach, there are some theories about the etiology of ADHD. For example, some experts of this approach believe that some patterns of pressure on brain cause incidence of ADHD symptoms (13, 14). More than half of children with ADHD suffer from structural problem in atlas-occipital region (15). Upledger believes that such structural problem which has causal relationship with ADHD occurs during parturition; in a way that the head turns backward excessively and a hyperextension occurs. This is a very threatening situation for the central nervous system. Tissues' reaction leads to reduction in physiological fluid flow of intracellular fluid, interstitial fluid, lymph and blood, and reduces the efficiency and productivity of fluids, and finally leads to abnormal accumulation of these fluids which followed by brain irritability.

According to another related theory, there is no balance between sympathetic and parasympathetic systems in children with ADHD. It is believed that sympathetic system is more active and dominant in children with ADHD than parasympathetic system (16). Accordingly, the effects of CST children with ADHD can be discussed in several perspectives:

- Impact on the structural problem in the atlas occipital region
- Impact on Craniosacral rhythm
- Impact on autonomic nervous system

Upledger has used craniosacral therapy as a quite successful treatment in solving the above issues and in reducing symptoms in children with ADHD since 1975. His clinical experiences indicated that the special outcome is to remove pressure on the membrane and cranium which leads to the natural motion of each bone, and the suture junction between these bones which contribute to adaptive activity and natural pumps (12, 15). Craniosacral therapy can alter pressure patterns. That is, elimination of pressure pattern can regulate brain cycle (brain ventricular contraction and dilatation), Craniosacral rhythm and accelerate the cerebro-spinal fluid circulation. Reduction in pressures of cranium and cerebral meninges improves brain function and enhances data processing; therefore, after reducing abnormal pressure of the brain and cortex, the ability to attend and concentration will improve significantly (14). According to another theory based on the fact that there is no balance between sympathetic and parasympathetic systems in children with ADHD; Levine found that body interventions such as Craniosacral therapy play a key role in helping these children and believes that Craniosacral therapy strengthens the parasympathetic system and creates balance between these two systems (16).

Methods

Participants: Twenty-four children (6-11 year old) with ADHD who referred to Roshd Occupational Therapy is setting in Tehran, Iran and participated in a randomized experimental study (Table1). Participants' diagnosis as ADHD has been approved by psychiatrists. Subjects were recruited by available sampling. The sample was matched by age and sex, then, randomly divided into equal control and experimental groups. Statical results Table (1) show that there are no significant age differences between groups. Characteristics of participants are shown in the table(1).

Table 1. Statistics of participants in study

Group	Number	M/ age	$t_{(22)}$	P
Control	12 (F 2, M 10)	99.42	0.669	0.510
Experimental	12 (F 2, M 10)	95		

This study and research project was approved by "University of Social Welfare and Rehabilitation ethical committee". Parents of all participants were provided with the information sheet and ensured that their participation in the research is voluntary and they are able to withdraw from the study in every stage of the process. Following their consent data were collected in the participant's convenient time and day. All children with ADHD whose parents provided consent to the study were included in the study. Subjects were blinded to the purpose of the study and assessors were blinded to group assignment.

Implement Practice: by collecting the required sample, the, homologation and randomized classification of subjects into control and experimental groups were conducted, and the *Conners Parents Rating Scale (CPRS-R) and Child Symptoms Inventory-4th (CSI-4)* were filled out by all parents of the two groups and finally intervention was performed. Both groups received current occupational therapy treatment as a routine intervention, but experimental group received additional CST. The intervention was taken place as individual performance of CST techniques which lasted 30 minutes each session- 15 sessions, twice a week. The SCT method was implemented by the researcher on the subjects; of course, initial trainings for CST were presented by relevant specialists to the research in this field. Therapeutic protocols used in this study were derived from Pishyareh work (23) to adopt appropriate techniques for children with ADHD among CST techniques. The two mentioned tests were run as post-tests on the parents, upon completion of the intervention period.

Data collection tool: There were three tools for collecting data. A questionnaire was used within which data on age and gender was collected and the two groups were matched accordingly. Data collection tools included CPRS (a 48 questions Form) and CSI-4 (parent form) in this study. They were empirical and standardized questionnaires. Then, Conners Parents Rating Scale (CPRS) was used to assess *participants and evaluate their problem behavior*. And finally, Child Symptoms Inventory-4th (CSI-4) two screens for emotional and behavioral disorders in subjects. The CSI-4 questionnaire used in this study includes A, B, C groups of main questionnaire and 41 questions and measures three types of disorders other than ADHD, and also *oppositional defiant disorder (ODD)* and conduct disorder.

Methods of data analysis: Data were analyzed using SPSS-16 and comparison test between two groups means (covariance analysis) were used to adjust the pretest sub-scales. Using covariance analysis, groups' performance was compared with pre-test and post-test and then pretest was entered as a covariate in covariance analysis to control initial differences. In covariance analysis, one or more covariances are measured in addition to dependent and independent variables.

Results

In the present study, Craniosacral therapy was considered as independent variable, and performance of children with attention deficit hyperactivity with subsets of attention deficit, hyperactivity, oppositional defiant disorder, conduct disorder, anxiety and embarrassment, social problems and psychosomatic were studied as the dependent variable.

Table (2) shows in all sub-scales of the child symptom inventory-4th (CSI-4), the mean difference between experimental and control groups is significant. While no difference was observed in CSI-4 scores between the two groups in pretest, but in post test significant differences were observed in all five subscales of CSI-4 between the two groups.

Table 2. Descriptive statistics of the pretest-posttest scores of the control and experimental groups in CSI-4

		Pre test				Post test			
Sub-scales of CSI-4		mean	std. deviation	skewness	kurtosis	mean	std. deviation	skewness	kurtosis
Attention deficit	control	7.42	1.17	0.24	-1.35	7.58	1.17	0.17	-1.52
	experimental	7.68	0.99	0.13	-0.99	5.25	0.97	0.14	-0.77
Hyperactivity	control	6.58	1.98	-0.49	-0.90	6.83	1.80	-0.82	0.29
	experimental	6.80	1.99	-1.60	2.40	5.17	1.94	-1.25	0.80

Sub-scales of CSI-4		Pre test				Post test			
		mean	std. deviation	skewness	kurtosis	mean	std. deviation	skewness	kurtosis
ADHD	control	14	1.95	0.26	-0.86	14.42	1.88	0.55	-0.35
	experimental	14.5	1.70	-0.80	-0.20	10.50	1.80	-0.58	-0.50
Oppositional defiant disorder	control	4.50	1.08	-0.77	1.58	4.75	1.22	-0.89	-0.89
	experimental	4.33	1.68	0.80	-0.97	2.68	1.83	-0.58	-0.50
Conduct disorder	control	4.25	1.55	0.03	-0.60	4.50	0.91	0.44	-0.33
	experimental	4.17	2.29	0.25	-0.77	3	2	0.33	0.42

Statistic analyses of data concerning students' scores in the two questionnaires are presented in the table (3).

Table 3. Descriptive statistics of the pretest-posttest scores of the control and experimental groups in CPRS-R

Sub-scales of CPRS-R		pre test				post test			
		mean	std. deviation	skewness	kurtosis	mean	std. deviation	skewness	kurtosis
Conduct disorder	control	65.42	6.14	-0.45	-1.04	65.92	5.16	-0.21	-0.82
	experimental	64.08	7.13	-0.23	-0.23	57.75	5.51	-0.97	0.57
Social problems	control	75.58	6.65	0.20	-0.38	76	7.03	-0.12	-0.40
	experimental	78.25	9.08	1.37	2.80	65.33	6.75	-1.72	3.85
Anxiety	control	63.17	5.17	1.07	0.38	65.25	5.88	0.96	-0.06
	experimental	61.92	6.32	0.53	0.49	52.42	6.13	-0.19	-0.97
Psychosomatic	control	68.58	6.91	-0.65	-0.41	71.08	6.51	-0.60	-0.33
	experimental	72.33	7.82	-0.60	1.08	59.67	7.05	0.41	-0.76
Total CPRS	control	72.17	4.55	0.46	-0.22	72.75	3.33	-0.37	0.34
	experimental	72.67	5.02	-0.91	-090	60.17	4.82	-0.95	1.43

Table (3) shows in all subscales of Conners Parents Rating Scale (CPRS), the mean difference between experimental and control groups is significant. While no difference was observed in CPRS-R scores between the two groups at pretest, but in post test significant differences were observed in all five subtests of CPRS-R between the two groups. Covariance analysis results in Table (4) shows that after controlling pretest the impacts of Craniosacral therapy for attention deficit, hyperactivity, attention deficit and hyperactivity disorder, oppositional defiant disorder and conduct disorder (sub-scales of the child symptom inventory-4th (CSI-4), were significant ($p \leq 0.001$).

Table 4. Results of covariance analysis of the impact of craniosacral therapy in CSI-4 scores in experimental group

Sub-scales of CSI-4	source	sum of squares	df	mean square	F	sig.
Attention deficit	pre test	19.062	1	19.062	65.575	0.001
	group	38.425	1	38.425	132.186	0.001
Hyperactivity	pre test	69.370	1	69.370	182.924	0.001
	group	21.350	1	21.350	56.653	0.001
ADHD	pre test	61.653	1	61.653	90.773	0.001
	group	112.335	1	112.335	165.391	0.001
Oppositional defiant disorder	pre test	32.779	1	32.779	67.903	0.001
	group	22.471	1	22.471	46.594	0.001
Conduct disorder	pre test	45.071	1	45.071	119.380	0.001
	group	12.417	1	12.417	32.888	0.001

Covariance analysis results in Table (5) shows that after controlling pretest the impacts of Craniosacral therapy on conduct disorder, social problem, anxiety, psychosomatic, and total (sub-scales of CPRS were being significant ($p \leq 0.001$).

Table 5. Results of covariance analysis of the impact of craniosacral therapy on CPRS-R scores in experimental group

Sub-scales of CPRS	source	sum of squares	df	mean square	F	sig.
Conduct disorder	pre test	554.238	1	554.238	159.593	0.001
	group	304.328	1	304.328	87.632	0.001
Social problems	pre test	369.816	1	369.816	22.121	0.001
	group	919.389	1	919.389	54.993	0.001
Anxiety	pre test	426.420	1	426.420	24.417	0.001
	group	836.059	1	836.059	47.873	0.001
Psychosomatic	pre test	664.780	1	664.780	40.024	0.001
	group	1131.408	1	1131.408	68.117	0.001
Total CPRS	pre test	116.282	1	116.282	9.333	0.001
	group	983.715	1	983.715	78.957	0.001

Conclusion

According to our data, the effectiveness of CST was significant in mentioned variables. The pretest effect was controlled as a covariance in this analysis. Results indicated the effectiveness of CST on increasing attention and hyperactivity in children participating in this study. These findings are aligned with the theory of Gillespie (14) and Upledger (12, 15).

Upledger theory can justify these effects. Based on his approach, special effects of CST are to remove pressure on the membrane and cranium in which this restoration causes natural motion of singly bones and the suture junction between these bones which are responsible for adapting activity and natural pumps. Increased movement in physiological fluids is necessary for all central nervous system and its related structures and systems for optimal performance and health and comforts the person(15). CST can alter pressure patterns and regulate the Craniosacral rhythm and accelerate cerebro-spinal fluid(14).

CST as a kind of massage and physical therapies' method, it is believed that influences on the parasympathetic system of children with ADHD (16). Cognitive processes are controlled by the automated system, so there is a relationship between selective attention and levels of cortisol secretion (17). The biochemical relationship between cortisol and attention has also been approved (18). In other word, one of the massage therapy results and body-based therapy is to adjust cortisol level in people receiving the intervention (19). Logical inference from these findings is that these types of body-based therapies can influence on cognitive processes and among them attention and concentration processes.

The improved attention and hyperactivity symptoms can be also used to explain other hypotheses in addition to direct effects of CST. No research was found about the effectiveness of CST on reducing *oppositional defiant disorder* (*ODD*) and conduct disorder (CD) in children with ADHD. Massage therapy in children with AHDH improves the level of mood and increases of peace and happiness feeling, and may improve classroom behavior (10). The effect of massage therapy has been studied using EEG and the results have shown that it caused to create a special pattern of EEG, i.e. reducing alpha and beta in the intervention group. In fact, tactile stimulation leads to increase EEG pattern during mathematical computation and consciousness in people to be treated (20). This pattern, which reflects the balanced activity of the parasympathetic and increased level of comfort, accuracy and consciousness caused to improve the cognitive processes (20) and increase levels of cognition, adaptation and adaptive skills.

The research findings show that CST can have an impact on reducing social problems of students with ADHD. To explain the finding, the effect of CST on balance in sympathetic and parasympathetic system can be mentioned. This balance can increase comfort and facilitate cognitive processes and subsequent adaptation; it plays a crucial role in reducing social problems of these children. Gilmore proposed that CST enhance learning by facilitating the cerebro-spinal fluid flow such as blood in the brain(21); Thus, increased learning, in turn, can assist to learn behavioral patterns and better understand mutual relations and interactions. On the other hand, reduced primary symptoms of ADHD (attention

deficit and hyperactivity) can also decrease the social problems common in children.

Based on the analysis, CST influenced on and reduced anxiety and stress of participants in this study. Researchers have shown that serotonin secretion rate in children with ADHD is lower and this imbalance in the serotonin secretion is one of the most important factors in anxiety and embarrassment, moreover, increased serotonin levels can be considered as one of treatment goals in these children (22). One of the special effects of CST is to remove existed obstruction and restrictions; in fact, Serotonin secretion can be increased by releasing of visceral constraints through improvement in visceral fascial dysfunction in (22).

Our results showed that CST can contribute to reducing psychosomatic problems of students with ADHD. This variable is dependent on other components including anxiety; therefore, reducing anxiety is effective in decreasing in psychosomatic problems. In an interaction with biological and genetic potentials, anxiety and stress are considered to be fundamental elements in creating and exacerbating psychosomatic disorders.

According to previous data, CST has led to improve in living standards and sleep quality in the CST-treated subjects, therefore it is believed that the removal of obstructions and fascial constraints will improve the sleep level and reduce its related disorders (22). Reduction in the cortisol level and increasing serotonin after tactile stimulation can on decrease psychosomatic problems by reducing anxiety and stress (18). Moreover, one of the CST functions is to reduce muscle tone, leading to increase relaxation and safe mood in people. The effectiveness of CST has also been approved by reducing muscle spasticity in children with cerebral palsy(23). So it can be concluded that one of possible influencing factors of CST on psychosomatic problems in children with ADHD is the ability of this method in reducing muscle tone and increasing relaxation (23).

Thus, CST method should be considered as a useful treatment for children with this disorder. Although the effectiveness of this mechanism requires further study, tactile stimulation has been considered as an effective method. Tactile stimulation and massage therapy are effective in increasing consciousness and facilitating cognitive processes and play an important role in reducing stress and anxiety and mood by balancing of neurotransmitters (20). Upledger also finds this method useful in improving ADHD symptoms due to remove obstructions and congestion in atlas-occipital region because removal of pressure patterns and mentioned constraints facilitate and modify the cerebro-spinal fluid flow (15). Research on mechanism of effectiveness of CST on children with ADHD and removal of ambiguities in this regard is one of the most important requirements in the field study.

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