

The Effect of Sensory Integration Therapy on Social Interactions and Sensory and Motor Performance in Children with Autism

Mahdi Khodabakhshi*
Ph.D. student of Educational Psychology
Isfahan University

Ahmad Abedi, Ph.D.
Department of Educational Psychology
Isfahan University

Mokhtar Malekpour, Ph.D.
Department of Educational Psychology
Isfahan University

Objectives: The purpose of this study was to investigate of effects of sensory integration therapy (SIT) on social interaction and sensory and motor performance in children with autism spectrum disorders (ASD). **Methods:** twenty four children with ASD (22 boys, 2 girls), aged 6-12 years that matched on IQ and gender, were randomly assigned to an experimental or control group. We requested participants of the experimental group to attend in therapeutic program bases on sensory integration theory for 25 weeks (100 sessions), while participants of the control group only received daily common training programs. Pretest, posttest and follow up measured social interaction and sensory and motor performance. **Results:** Results revealed that SIT significantly improved social interaction and motor and tactile performance in the experimental group, and at 2 months post of intervention the improvement in the experimental group remained unchanged compared to post-intervention time. The social interaction and motor and tactile performance of participants of the control group was not changed across the experimental period. Results no showed a significant improvement for visual and auditory performance in experimental group. **Discussion:** We concluded that therapy based on sensory integration leads to significant reduction in some of symptoms to children with ASD.

Keywords: autism, social interaction; sensory and motor performance, sensory integration therapy

Partnership in daily life is often challenging for children with autism spectrum disorders (ASD). Participation and skill in everyday activities can be influenced by many factors, one of which is sensorimotor performance. Sensory and motor development plays an important role in learning young children typically use sensory and motor skills to explore the environment, engage in social interaction, engage in physical activities, and develop basic academic skills (Tomchek & Dunn, 2007).

Although the unusual sensory or motor responses are present in a number of clinical conditions, including William's syndrome (Gothelf, Farber, Raveh, Apter, & Attias, 2006), schizophrenia (Brown, Cromwell, Filion, Dunn, & Tollefson, 2002), fragile X syndrome (Rogers, Hepburn, & Wehner, 2003) and attention deficit and hyperactivity disorder (ADHD) (Dunn and

Bennett, 2002), but sensory and motor abnormalities commonly found in autism (Ben-Sasson, Hen, Fluss, Cermak, Engel-Yeger, & Gal., 2009). Sensory and motor impairments are extremely prevalent (80–90%) in individuals with ASD (Rogers and Ozonoff, 2005).

These abnormalities have been described in the perception of sound, vision, touch, taste, and smell, as well as kinesthetic and proprioceptive sensations. These include reports of both hypo and hyper responsiveness to sensory input, raising the possibility that two groups of sensory responders may exist within the autism spectrum (O'Neill and Jones, 1997; Gabriels, Cuccaro, Hill, Ivers, & Goldson, 2005).

Children with evidence of sensory processing dysfunction, such as those with ASD, often have difficulty regulating responses to sensations and specific stimuli and may use self-stimulation to compensate for limited sensory input or to avoid overstimulation (Roberts, King-Thomas, & Boccia, 2007; Schaaf & Nightlinger, 2007; Smith, Press,

*Corresponding author: Mahdi Khodabakhshi
College of Educational Psychology, University of
Isfahan, Isfahan, Iran.
Email: mkhodabakhshi54@yahoo.com

Koenig, & Kinnealey, 2005). Families report that sensory impairments significantly restrict full participation in daily activities and create social isolation for them and their child (Dickie, Baranek, Schultz, Watson, & McComish., 2009; Schaaf & Blanche, 2011). Moreover, behavioral and emotional problems have been associated with sensory and motor processing difficulties (Baker, Lane, Angley, & Young, 2008), and sensory symptoms have been significantly related to stereotyped interests and repetitive behaviors in ASD (Chen, Rodgers, & McConachie, 2009; Rogers, Hepburn, & Wehner, 2003; Wiggins, Robins, Bakeman, & Adamson, 2009).

Another factor that can limit the participation and skill in everyday activities is social dysfunction. Social dysfunction is a main diagnostic feature of autism spectrum disorders (APA, 2000). Deficit in socialization has been found to be a major source of impairment in social interaction for individuals with ASD (Carter, Davis, Klin, & Volkmar, 2005; Frea, 1995). Sociologists have defined social skills as specific behaviors that lead to proper social interactions (Elliott & Gresham, 1987; Gresham, 1986). Social skills involve both verbal and non-verbal communicative behaviors. Signs of social deficits in children with autism spectrum disorders include lack of smiling and inadequate use of eye contact, impairment in asking and responding to questions, failure to give and acknowledge compliments during a social exchange (Beidel, Turner, & Morris, 2000), lack of orientation toward a social stimulus, problems in initiating and maintaining social interactions, difficulty in interpreting both verbal and nonverbal social cues, emotions, and facial expression (Celani, Battacchi, & Arcidiacona, 1999), failure to empathy (Dyck, Ferguson, & Shocher, 2001; Yirmiya, Sigman, Kasari, & Mundy, 1992), lack of imitation (Hobson & Lee, 1999), impairments in interpreting nonliteral language such as sarcasm and metaphor, difficulty in sharing affective experience or understanding the perspective of others (Gutstein & Whitney, 2002), failure to spontaneously seek to share enjoyment, interest, or achievements with other people, and a tendency to dwell on certain topics (Kerbel & Grunwell, 1998; Krasny, Williams, Provencal, & Ozonoff, 2003; Shaked & Yirmiya, 2003; Tager-Flusberg, 2003). There is empirical evidence that social skill deficits in children with autism contribute significantly to academic and occupational underachievement (Howlin & Goode, 1998), presage mood and anxiety problems later in development (Myles, Bock, & Simpson, 2001; Tantam, 2003), lack of learning opportunities and independence (Koegel, Koegel, & Parks, 1995), occurrence of stereotypy, property destruction, and aggression (Matson, Fodstad, & Rivet, 2009), poor peer acceptance and more social isolation (Bauminger & Kasari, 2000; Chamberlain, 2001),

increase in mental health problems (Hartup, 1989), and limitation of the ability to achieve normal developmental milestones and establish satisfying peer and familial relationships (Krasny et al., 2003).

It has been speculated that both sensorimotor and social deficits may originate from a common etiology (Baranek, Parham, & Bodfish, 2005), and these atypical sensory and motor reactions, can have considerable social implications and often limit the ability to participate in normal life routines (Smith et al., 2005). These problems make the life of the child and his/her family more difficult and they prevent the child from learning new skills and having interaction with the environment. So, choosing interventions that in terms of etiology be effective on both defects is essential and ethical requirement of implementation of treatment. To date for each of these problems, be used specific treatments, for instance, there are a large number of social skills treatment approaches proposed by investigators to improve social dysfunction in individuals with autism. These strategies include joint attention, imitation, peer training, social stories, teaching social skills and social cognition in groups (Ferraioli & Harris, 2011). Also there are a large number of treatment approaches that used to decrease of sensory and motor problems. These treatments include sensory learning, auditory integration training and biofeedback sensory integration therapy (Hess, Morrier, Heflin & Ivey, 2008). A treatment that appears to have multiple effects on decrease of symptoms of ASD in the children is sensory integration therapy (SIT).

Sensory integration therapy (SIT) is an extension of sensory integration (SI) theory that was originally developed by A. Jean Ayres to focus on the neurological processing of sensory information (Ayres, 1991; Baranek, 2002; Watling & Dietz, 2007). SI theory is based on the understanding that interferences in neurological processing and integration of sensory information disrupt the construction of purposeful behaviors (Schaaf & Miller, 2005; Watling & Dietz, 2007). Treatment is designed to provide controlled sensory experiences so that an adaptive motor response is elicited (Baranek, 2002). Treatment is carried out by a therapist trained in the approach and goals are often centered on improving sensory and motor abilities to: a) develop better sensory modulation for attention and behavioral control, and/or b) integrate sensory information as a basis for improved for motor planning (imitation, sequencing, learning novel tasks) as a precursor for greater participation in school, play, social, and daily living activities (Baranek, 2002). Briefly, the theory proposes that if a child is engaged in individually tailored sensory-motor activities, their nervous system is better able to modulate, organize, and integrate sensory information and more likely to use sensory information in adaptive ways (Ayres,

1972). Components of the intervention include a sensory-rich, playful, child-centered approach, providing a just-right challenge and facilitating progressively more sophisticated adaptive behaviors by engaging the child in individually tailored, developmentally appropriate play interactions (Schaaf et al., 2009).

Because SI is an extensively used treatment approach for children with ASDs (Watling et al., 1999), it is essential to establish the effectiveness of interventions to implement evidence-based practice. At present, the effectiveness of SIT on social dysfunction of individuals with autism has been rarely studied, and few research studies have examined effectiveness of SIT on sensory and motor dysfunction in individuals with autism. The research results regarding SIT's effectiveness are inconsistent. Some studies of children with ASD or pervasive developmental disorders (PDD) have provided support for the effects of SIT in areas such as reducing self-stimulating, repetitive and stereotyped behaviors and sensorimotor problems (Pfeiffer, Koenig, Kinnealey, Sheppard & Henderson, 2011; Fazlioglu&Baran, 2008; Smith et al., 2005; Case-Smith & Bryan,1999; Linderman& Stewart, 1999; Jang, 1996; McClure & Holtz-Yotz, 1990; Zisserman, 1991). But some of studies have not provided support for the effects of SIT (e.g., Carter, 2005; Davis, Durand & Chan, 2011; Watling & Dietz, 2007; Devlin, Leader & Healy, 2009).

In a study Fazlioglu and baran (2008) examined sensory integration therapy program on sensory problems for children with autism. They revealed that sensory integration therapy program positively affected treated children. Linderman and Stewart (1999) in a single-subject study examined the effects of sensory integrative-based occupational therapy provided in an outpatient clinic on the functional behaviors of two young children with pervasive developmental disorder at home. They stated that both participants displayed significant improvements in the areas of social interaction, approach to new activities, response to holding or hugging, and response to movement. Decreases were noted in the frequency and duration of disruptive behaviors (e.g., high activity levels,aggressive behaviors), with an increase in functional behaviors, such as spontaneous speech, purposeful play, and attention to activities and conversation. Case studies by McClure and Holtz-Yotz (1991) and Zisserman(1991) indicated that programs of controlled deep pressure and tactile input successfully reduced the disruptive behaviors displayed by two children with autism.

Since on average autism spectrum disorder diagnoses are identified at age 5.7, it highlights the need for effective treatments at later ages (Shattuch, Durkin, Maenner, Newschaffer, Mandell, Wiggins, et al., 2009). The use of more effective and evidence-based treatment when choosing intervention is essential and ethical requirement of implementation of treatment. Although some conclusion of effects SIT on symptoms of autism are promising (May-Benson &Koomar, 2010), there is a need for systematic, methodologically rigorous investigations for evaluate its effectiveness. However, the empirical evidence for the effectiveness of treatment SIT is limited and inconclusive, and on the other hand the results of these studies are inconsistent. Too, many studies were hampered by small samples, absence of randomized controlled trials and use of wide of single-subject and case study. To address these gaps in the area, in the present study our main goal was to examine the effects of SIT on social interactions and sensorimotor performance for Children with autism. Another purpose of this study was whether improvements in the symptoms in participants assigned to the intervention group would be maintained at 2-month follow-up.

Method

Participants

Participants were 24 children with ASD (22 boys and 2 girls) ranging in age from 6 to 12 years ($M= 8.95$ years, $SD= 1.54$).

Inclusion criteria were a clinical diagnosis within the Autism spectrum (including autistic disorder, Asperger syndrome and pervasive developmental disorder not otherwise specified (PDD-NOS)), according to the Diagnostic and Statistical Manual of Mental Disorders (DSM). This diagnosis is based on multidisciplinary assessment by a specialized team (psychiatrists, psychologists, and educationalists). All children had IQ scores over 70 ($M= 88.25$; $SD= 10.23$) as measured for children. Participants were selected from students attending to 2 autism institution in Isfahan city. They were matched in to pairs based on gender and IQ. The pairs were randomly assigned in to a therapeutic ($n=12$) or control ($n=12$) group. Table 1 shows the participant's IQ and gender. All participants received their routine medical care from their own health care providers. Before joining the study consent was obtained from parents and children. The Ethics Committee of College of Psychology, University of Isfahan approved the project.

Table 1*Participant's characteristics (intelligence and gender) at the pre – intervention time*

NO	IQ of SI group	IQ of control group	Gender
1	88	89	Boy
2	95	100	Girl
3	89	87	Boy
4	106	108	Boy
5	94	93	Boy
6	75	77	Boy
7	79	81	Boy
8	86	84	Boy
9	71	74	Boy
10	96	99	Boy
11	80	76	Boy
12	95	96	Boy
Mean ±SD	87.83±10.13	88.66±10.77	-

Intervention (Experimental task)

The SI treatment interventions were based on a theory and interventions originally developed by Ayres (1991). This training program was divided in to 10 main areas, that consist of (1) touch and tactile activities, (2) motor- vestibular activities, (3) activities for improvement proprioception sense, (4) activities for improvement flexion, (5) extension activities, (6) activities to strengthen the balance, (7) activities to promote motor planning, (8) activities for bilateral motor coordination, (9) activities for increase adaptive interaction, (10) activities to integrate the senses.

The treatment interventions were based on the individual needs of each child but included the 3 key therapeutic strategies identified in the fidelity tool (Parham et al., 2007) that a therapist would use when providing SI-based treatment to a child that consist of: (1) providing the child with environmental modifications and sensory opportunities during the treatment session, (2) fostering adaptive responses and providing the just-right challenge, and (3) promoting the therapist–child relationship. This training program organized for 100 sessions. Sessions supervised by certified therapists. To assist treatment integrity therapists received training in the procedure and teaching. The programs was developed and sequenced in a hierarchy according to the easiest to the most difficult.

Material

Sensory - motor performance scales (SMPS)

For assessment of sensory- motor performance used subscale of sensory- motor performance of Conners's neuropsychological performance scale. The Conners's neuropsychological performance

scale was developed for assessment of neuropsychological problems in children 5 to 12 years of age (Conners, 2004). The SMPS consists 19 items that were divided into four areas: (1) motor functions, 8 items, (2) tactile functions, 4 items, (3) visual functions, 3 items, and (4) auditory functions, 4 items. For each item, caregivers (or parent/teacher) are asked to mark 1 of 4 choices that best expresses the child's specific behavior (0: indicates that the behavior never observed, and 3: indicates that the behavior frequently observed). Internal reliabilities for the SMPS, calculated using Cronbach's alphas, ranged from .70 to .85.

Social interaction scale (SIS)

The social interaction subscale of Gilliam Autism Rating Scale-Second Edition (GARS-2) (Gilliam, 2006) was used to measure the changes in the severity of social dysfunction of the participants in both groups. GARS-2 has been widely used in research studies and educational program (Owens, Granader, Humphrey, & Baron-Cohen, 2008; Worley & Matson, 2011). The social interaction of GARS-2 contains 14 items that describe specific, measurable, and observable social behaviors. It incorporates observations, parent or teachers interviews, and questions completed by the examiner according to their interpretation. For each item, caregivers (or parents/teachers) are asked to mark 1 of 4 choices that best expresses the child's specific social behavior using objective frequency-based ratings of four points (0: indicates that the behavior never observed, and 3: indicates that the behavior frequently observed). The items of the subscale ask caregivers how often a child: 1. Avoids eye contact; 2. Stares/looks unhappy when praised; 3.

Resists physical contact; 4. Does not imitate; 5. Withdraws/remains aloof; 6. is unreasonably fearful; 7. has no affection; 8. has no recognition (looks through people); 9. Laughs, giggles and cries inappropriately; 10. Inappropriately using of toys/objects; 11. Does things repetitively/ritualistically; 12. Becomes upset when routines changed; 13. Have tantrums when given commands; and 14. Lines up objects and becomes upset when disturbed. Higher scores indicate a higher level of social deficiency. Caregivers, parents, and teachers are asked to rate the individual based on the frequency of occurrence of each social behavior under ordinary circumstances in a 6-h period. The current study concentrates on the total raw score in the social interaction subscale of GARS- 2. The subscale is both reliable and valid and has excellent

psychometric properties (Worley & Matson, 2011).

Procedure

Participants were recruited from Isfahan Autism Center and Ordibehesht Autism Center, two rehabilitation centers for autism children and adolescent in Esfahan, Iran.

After getting informed agrees from parents, children were matched in to pairs and were randomly assigned to an intervention or a control group. SMPS (Conners, 2004) and social interaction subscale of Gilliam Autism Rating Scale-Second Edition (GARS-2) (Gilliam, 2006) administered to the parents, were assessed prior to training and within one weeks after completion of the treatment. We collect follow up data 2 month after ending the intervention. (Table 2).

Table 2

The experimental design

Groups	Pre-intervention	Intervention (day 1–day 180)	Post-intervention (day 185)	Follow up (day 245)
Experimental	SMPS and SIS was assessed	Participants were treated for 100 sessions	SMPS and SIS was assessed after five days of no training	SMPS and SIS was assessed after 60 days of no training
Control	SMPS and SIS was assessed	Participants did not participate in therapeutic program	SMPS and SIS was assessed	SMPS and SIS was assessed

Before administering the scales, we required the participant parents and caregivers to precisely observe the participants at home for five days. Also parents monthly trained and conferred on how to improved sensory integration in their children. Before conducting the intervention a 12 h duration training course was set up for certified trainers whom we recruited to administration SIT to the participants. Furthermore, therapists received ongoing clinical supervision and training throughout the study. Participants of the experimental group received SIT 1 session/day, 4 day/week for 25 weeks (100 sessions). While the participants of the experimental group furthermore daily programs of centers were taught the SI skills, the participants of control group only received daily programs of centers.

To determine the effects of the intervention on the dependent variables, we used the repeated measures of ANOVAS (2 group X3 time points) with time as the repeated factor. If between time factors (pretest, posttest and follow up) was significant difference, paired t-tests were used to determine whether the therapeutic or control groups improved with time. We

set statistical significance at $p < 0.05$. All statistical analyses performed by using SPSS software (version 16).

Results

In order to examine effects SIT on the social interaction and sensorimotor performance (motor, tactile, visual, auditory and total function) in the post-test and follow up we performed repeated measures ANOVA test.

For social interaction the repeated measures ANOVA revealed that the factor of time is significant ($F(1, 47) = 11.52, p = .001, \eta^2 = .34$). The repeated measures ANOVA also revealed that the group – by- time interaction is significant, $F(1, 47) = 4.22, p = .034, \eta^2 = .16$. The paired sample t test, demonstrated a significant decrease in the experimental group at post intervention time compared to baseline, $t(11) = 5.34, p < .001$, but revealed no significant difference for the control group, $t(11) = 1.10, p = .29$. In experimental and control group, follow – up time compared to post intervention time, the social interaction scores

remained significantly unchanged, $t(11) = .19, p = .85$, $t(11) = .29, p = .77$, (Table 3).

Table 3
Results of social interaction in the groups

variable	groups	Baseline	Post intervention (20 weeks)	Follow-up (2 month)	Difference (20 week-baseline)	Difference (2 month-20 week)	Difference (2 month-baseline)
social interaction	therapeutic group	18.16± 6.04	16 ± 6.57	15.91± 7.05	2.16 ± .40 CI: 1.27, 3.05	.08 ± .43 CI: -.87, 1.04	2.25 ± .76 CI: .57, 3.92
	Control group	18.91± 3.89	18.41± 3.80	18.33± 4.31	.50 ± .45 CI: -.49, 1.49	.08 ± .26 CI: -.48, .65	.58 ± .33 CI: -.15, 1.32

The results of the repeated measures ANOVA test revealed that effect of SIT on total of sensorimotor performance in the factor of time is significant, $F(2) = 43.61, p < .001, \eta^2 = .66$. Also is significant group – by- time interaction, $F(2) = 24.36, p < .001, \eta^2 = .52$. Results showed that the effect of SIT on sensorimotor subscales is different. In the first subscale, motor performance, was significant factor of time, $F(2) = 55.03, p < .001, \eta^2 = .71$, and group – by- time interaction, $F(2) = 29.46, p < .001, \eta^2 = .57$. In the subscale of tactile performance, was significant factor

of time, $F(1.22) = 11.41, p < .001, \eta^2 = .34$, and group – by- time interaction, $F(1.22) = 9.34, p = .003, \eta^2 = .29$. There were no significant for two subscales of visual and auditory performance in factor of time and group – by- time interaction, ($P > .05$).

In order to examine existence or luck of significant difference in motor, tactile, visual, auditory and total functions between the groups at post intervention and follow up times compared to the pre-intervention, was implemented the paired sample t test, that the results are shown in Table 4.

Table 4
Results of motor, tactile, visual, auditory and total performances in the groups

Dependent variable	groups	Baseline	Post intervention (20 weeks)	Follow-up (2 month)	Difference (20 week-baseline)	Difference (2 month-20 week)	Difference (2 month-baseline)
Motor performance	therapeutic group	135.5± 3.03	9.08± 2.19	9.33± 2.05	4.42 ± .49 CI: 3.31, 5.51	4.16 ± .45 CI: 3.15, 5.17	-.25 ± .27 CI: -.86, .36
	Control group	13.33± 2.96	12.66± 2.60	12.66± 2.77	.66 ± .37 CI: -.16, 1.49	.66 ± .33 CI: -.06, 1.40	0 ± .32 CI: -.71, .71
Tactile performance	therapeutic group	7.0± 2.41	4.5± .79	4.58± .66	2.5 ± .52 CI: 1.33, 3.66	2.41 ± .69 CI: .89, 3.93	-.08 ± .28 CI: -.71, .55
	Control group	6.83± 1.11	6.75± 1.05	6.66± 1.49	.08 ± .33 CI: -.65, .82	.16 ± .42 CI: -.76, 1.09	.08 ± .19 CI: -.34, .50
Visual performance	therapeutic group	3.33± .65	3.16± .38	3.25± .45	.16± .20 CI: -.28, .62	.08 ± .29 CI: -.42, .58	-.08 ± .14 CI: .41, .24
	Control group	3.58± .79	3.41± .79	3.25± .45	.16± .11 CI: -.08, .41	.33 ± .18 CI: -.08, .74	-.16 ± .24 CI: -.36, .69
Auditory performance	therapeutic group	7.41± 3.55	6.0± 1.65	6.08± 1.83	1.41 ± .83 CI: -.43, 3.26	1.33 ± .78 CI: -.38, 3.05	-.08 ± .26 CI: -.65, .48
	Control group	6.41± 1.50	6.25± 1.48	6.25± 1.91	.16 ± .27 CI: -.42, .76	-.16 ± .36 CI: -.63, .97	0 ± .34 CI: -.76, .76
Total performance	therapeutic group	31.25± 6.83	22.75± 3.79	23.25± 3.69	8.5 ± 1.11 CI: 6.05, 10.49	8.0 ± 1.23 CI: 5.29, 10.70	-.50 ± .52 CI: -1.66, .66
	Control group	30.16± 4.44	29.08± 4.07	28.83± 5.30	1.08 ± .51 CI: -.04, 2.21	1.33 ± .48 CI: -.27, 2.39	.25 ± .76 CI: -1.42, 1.92

a Data are mean ± SD.

Discussion

The purpose of current study was to investigate whether SIT for children with autism leads to decrease their social interaction and sensorimotor problems. After receiving SIT program, the participants of experimental group demonstrate a significant improvement in social interaction. Data also indicated 60 days after intervention, effects of intervention in experimental group remained significant. According to parents, the participants of control group showed no change in their interaction social score across the experimental period. In this context, the result of our investigation was consistent with results researchers such as Linderman and Stewart (1999) and Fazlioglu and baran (2008).

This evidence-based treatment is critically important for autism because of the difference treatments that offered to this group, some of which can be dangerous and low impact to the child (Wadman, 2008).

Our findings raise the possibility that deficits in social interaction in children with autism could originate of impaired sensory integration system, so that treatment based on theory of sensory integration, lead to improvements in their social interactions. The results of this study support the underlying assumption of sensory integration theory that when children can modulate and regulate sensory information, they more easily reach and maintain an optimal behavioral state to engage in social interaction and participate in developmentally appropriate activities (Ayres, 1972, 1979). Children with autism are also unable to form a clear perception of their own body because they do not get adequate sensory information from skin, muscles, joints and the vestibular system. This makes it very difficult for these children to interact with their environment or with others when it is difficult for them to feel what their own body is doing. Again, this greatly impacts learning, development and social skills.

Researchers have shown that behaviors such as stereotypic motor movements, aimless running, aggression, and self-injurious behaviors have been correlated with sensory processing abnormalities (Case-Smith & Bryan, 1999; Dawson & Watling, 2000; Linderman & Stewart, 1999; Watling & Dietz, 2007). Too, they have shown that SIT leads to a decrease in behavioral problems in children with ASD, such as sensory processing abnormality (Fazlioglu and baran, 2008), self-Stimulatory behaviors (Fertel- Daly et al, 2001), anxiety (Piravej et al, 2009). The problems can have considerable social, personal, and educational implications and often limit the ability to participate in normal life routines (Smith et al, 2005). So, in the present study, SIT may by reducing the behavior

problems, has led to the improvement of social interaction in the participants of the experimental group.

The improvement of social interaction in the participants of the experimental group in our study may also be explained from a neurochemical point of view and physical exercises (as a large part of SIT program). Neurochemical investigations have found abnormal levels of neurotransmitters, such as oxytocin and serotonin in individuals with autism correlated with social functioning (Kirsch & Meyer-Lindenberg, 2010). Oxytocin has been documented to be relevant for the modulation of complex emotional and social behavior (Pedersen & Prange, 1979), social attachment (Insel & Young, 2001), social exploration, recognition (Winslow & Insel, 2004), and trust (Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005). Further investigations have found that plasma oxytocin level is lower in autistic individuals and negatively correlates with intellectual, adaptive, and social functioning (Bean, 2006; Green et al., 2001; Modahl et al., 1998). Additionally, researchers have found inefficient metabolism of serotonin in different brain regions of individuals with ASD (Chandana et al., 2005). The results of a number of studies indicate that physical exercises improve synthesis and metabolism of oxytocin (Hew-Butler, Noakes, Soldin, and Verbalis, 2008) The results of a number of studies indicate that physical exercises improve synthesis and metabolism of serotonin (for a review, see Meeusen & Meirleir, 1995). Although we did not take any neurochemical and physiological data in the present investigation, we speculate that 25 weeks of SIT might have improved the synthesis and metabolism of brain key neurotransmitters and consequently might have consistently decreased social dysfunction in children with ASD.

After receiving SIT program, the participants of experimental group demonstrate a significant improvement in total score of sensorimotor scales. Results showed that the effect of SIT on sensorimotor subscales not equally. The participants of experimental group demonstrate a significant improvement in motor and tactile performance. Data also indicated 60 days after intervention, effects of intervention in experimental group remained significant. The results of effect of SIT on progress in domains of tactile and motor performance are consistent with those reported by Linderman and Stewart (1999) Fazlioglu and baran (2008), and Pfeiffer et al (2011). The results of this study not consistent with those reported by Carter (2005), Watling and Dietz (2007), Devlin, Leader and Healy (2009) and Davis, Durand and Chan (2011), who found no changes after implementation of SIT.

The positive results in motor and tactile performance scores for the present study can be attributed to receiving long term SIT by participants and comprehensive therapeutic program.

It appears that SIT with improving to main components of sensory integration theory has led to improvements in sensory and motor functions and social interactions. The first component is that all learning depends on the ability to receive and organize sensations from the environment, and to then be able to use this information to plan and organize behavior. Second is that individuals who are unable to process sensations accurately may then have difficulty producing appropriate actions based on these sensations. Again, this may interfere with learning as well as behavior. The third component of sensory integration is that meaningful activity can produce enhanced sensation and therefore adaptive responding, which can develop sensory integration in an individual who is lacking appropriate sensory integration. This will then lead to an increase in learning and appropriate behavior. According to Bundy, Lane & Murray (2002), the central nervous system is plastic. This means that the brain can change throughout a person's life. In this study, it seems that application SIT for long-term changes the conditions of the brain that cause the maladaptive behaviors. Therefore, SIT for children with autism seeks to expose children to different sensory experiences and improve sensory processing. Through this therapy, children will learn to better register and modulate sensations, and make more appropriate adaptive responses.

Also data showed that there were no significant for two subscales of visual and auditory performance in experimental group compared with control group. No progress in the visual and auditory subscales has to be considered relative to the low scores and fewer problems that children with high function autism on these domains before treatment- these left little room for improvement. Although the children showed progress on the domains, but this progress was not statistically significant.

Unfortunately, due to the size of the current sample, we were unable to identify predictors or moderators of treatment effects in a meaningful way. Another limitation of the current study was the absence of observational diagnostic instruments to measurement of the dependent variables.

In summary, the current study suggests that the SIT could be a promising intervention for reducing social interaction and sensory and motor problems in children with autism. The positive outcomes of SIT in this study indicate that teachers and parents can with this intervention improve social skills and sensorimotor performance in students with autism.

Acknowledgments

We wish to thank all the children, parents, and clinicians who were involved in the study. Finally, we extend our gratitude to Isfahan and ordibehesht autism centers, for their cooperation.

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Received: 04 / 10/ 2013

Accepted: 22 / 01/ 2014