

COMPARISON OF EFFECT OF SENSORY INTEGRATION THERAPY AND THEORY OF MIND TRAINING ON REPETITIVE AND STEREOTYPED BEHAVIORS IN CHILDREN WITH AUTISM

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ABSTRACT

The aim of this study was to investigate the comparison of effects of sensory integration therapy (SIT) and theory – of - mind training (TOM) on repetitive and stereotyped behaviors in children with autism spectrum disorders (ASD). 36 children ages 6-12 with ASD were assigned to 2 intervention groups TOM (n= 12) and SI (n= 12) or a control group (n= 12). Participants of the TOM and SI groups received special training and therapeutic sessions. Control group received no special training and therapeutic programs. The repetitive and stereotyped behaviors of the participants were evaluated at pre test, post-test, and follow up (2 months after the interventions). Results identified significant reductions in repetitive and stereotyped behaviors at post-test and follow up times compared with pre test time. Results also indicated that was significant group – by- time interaction. Although both intervention groups demonstrated significant reductions in repetitive and stereotyped behaviors at post test and follow up, more significant reduction occurred in the SIT group, as rated by parents. We concluded that further research is needed to better understand the impacts frequency and duration of various treatments on behavioral problems in children with ASD.

KEYWORDS: Sensory integration therapy, Theory of mind, Repetitive and stereotyped behavior, Autism

Repetitive and stereotyped behaviors are one of the main diagnostic criteria in people with autism (American Psychiatric Association, 2000). These behaviors often refer to repetitive interests and motor or speech sequences that apparently are unchangeable in performance pattern and have no incentive function or adaptation with them (Smith, Press, Koenig & Kinnealey, 2005). These behaviors are not necessarily related to children with autism and can be also seen in blind people (Fazzi, Lanners, Danova, Ferrarri-Ginevra, Gheza, Luparia et al., 1999), intelligence disabled individuals (Baroff & Olley, 1999), schizophrenia (Morrens, Hulstijn, Lewi & De Hert, 2006), tourette syndrome (Olive, 2010) and even in children with typical development (Thelen, 1979). However the severity and frequency of these behaviors are more in autism children as compared to other disorders. Bodfish, Symons, Parker and Lewis (2000), found that approximately 75% of children with autism showed high levels of stereotypic behavior and exhibited a variety of different response forms.

In accordance with results of researchs, repetitive and stereotyped behaviors have no danger for suffers in themselves, but since these behavior in suffers have relationship to with appearance of considerable is orders in learning process, acquisition of social skills (Jones, Wint & Ellis, 1990), adaptation function, sleep problems (Schreck, Mulick & Smith, 2004), increase stress in the

family (Bishop, Richler, Cain & Lord, 2007) and appearance of self injuries behaviors (Kennedy, 2002), also can have considerable social, personal, and educational implications and often limit the ability to participate in normal life routines (Smith et al., 2005) it seems obviously necessary for researchers to determine ways and effective strategies in decreasing and treating these behaviors.

To help explain behavioral problems such as repetitive and stereotyped behaviors, a number of hypothesis have been proposed in the literature. One hypothesis is that abnormal behaviors are caused by a defect in the nervous system in which sensory stimuli are processed and integrated abnormally (Ayres, 1972; Ayres & Tickle, 1980; Schaaf & Miller, 2005). Behaviors such as stereotypic movements, aimless running, aggression, and repetitive behaviors have been correlated with these sensory processing abnormalities (Dawson & Watling, 2000; Watling & Dietz, 2007). Sensory integration therapy (SIT) is an extension of this hypothesis and further speculates that, given the nervous systems ability to change (neuroplasticity), providing specific forms of sensory stimulation in the appropriate dosage may improve the nervous system's ability to process sensory stimuli. Ultimately, the improved nervous system may then result in reduction behavior problems and more efficient learning (Baraneck, 2002; Lane & Schaff, 2010;

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Schaaf & Miller, 2005). Because sensory integration (SI) is an extensively used treatment approach for children with autism (Watling, Deitz, Kanny & McLaughlin, 1999), it is essential to establish the effectiveness of interventions to implement evidence-based practice. 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 and repetitive and stereotyped behaviors (Pfeiffer, Koenig, Kinnealey, Sheppard & Henderson, 2011; Fazlioglu & Baran, 2008; Smith et al., 2005; Case-Smith & Bryan, 1999; Linderman & Stewart, 1999). But some 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).

Another hypothesis is that abnormal behaviors are caused by a defect in the theory of mind (TOM). The term TOM (Premack & Woodruff, 1978) refers to the child's ability to assign thought, feelings, ideas and intention to others and to use this ability to anticipate the behavior of others. This ability is critical to the comprehension of one's own and other persons behavior. Consequently is a critical in communication, affective and social relationships with others (Watson, Nixon, Wilson & Capage, 1999). The TOM often emerges in normally developing children throughout preschool years, while children with autism tend to experience significant retards in its acquirement (Peterson, Wellman & Liu, 2005). It is now well confirmed that individual with autism exhibit remarkable impairments on tasks of TOM (See Baron-Cohen, Tager-Flusberg & Cohen, 2000; Hill, 2004). Leslie (1987) believed that deficits in imagination, or in pretend play at least, would occur as a result of a theory-of-mind deficit if pretend play requires the same representational processes as does attributing beliefs to others. Jarrold, Butler, Cottington & Jimenez (2000) argued those deficits in imagination and pretend play in individuals with autism leads to repetitive behaviors and a preference for stereotyped routines.

To date, most research studies in this area, only have shown effects TOM training on social skills (e.g., Heddenbach, Koot, Clifford, Gevers, Clauser & Bo, 2012), and research studies haven't focused on effectiveness of TOM treatment on decrease of stereotype and repetitive behaviors. However, the theory-of-mind account struggles to explain some aspects of autistic behavior.

Since on average autism spectrum disorder diagnoses are identified at age 5.7, it highlights the need for effective treatments at later ages (Shattuck et al., 2009). The use of more effective and evidence-based treatment when choosing intervention is essential and ethical requirement of implementation of treatment. However, the empirical evidence for the effectiveness of TOM intervention (Koenig, De Los Reyes, Cicchetti, Scahill & Klin, 2009) and SIT (Pfeiffer et al., 2011) is limited and inconclusive. Too, many studies were hampered by small samples, absence of randomized controlled trials and use of wide of single-subject and case study designs (e.g., Baranek, 2002; Watling & Dietz, 2007; Feng, YuLo, Tsai & Cartledge, 2008). To address these gaps in the area, and because investigators have not yet experimentally studied the role played by TOM training on improvement in repetitive and stereotyped behaviors in children with autism spectrum disorders, in the present study our main goal was to examine the effectiveness of Ayres's sensory integration compared to a training based on theory of mind for reducing repetitive and stereotyped behaviors for Children with autism. A second purpose of the study was that the improvements in repetitive and stereotyped behaviors in participants assigned to the intervention groups would be maintained at 2-month follow-up. Specifically, the research questions were (a) Dose participation in SIT affects on reducing repetitive and stereotyped behaviors at post test and follow up times? (b) Dose participation in experimental group TOM affects reducing repetitive and stereotyped behaviors at post test and follow up times? And (c) Which intervention is more effective in reducing repetitive and stereotyped behaviors at post test and follow up times?

METHODS

Participants

Participants were 36 children with ASD (33 boys and 3 girls) ranging in age from 6 to 12 years (M = 8.88 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 = 88.08; SD = 10.17) 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 two experimental (TOM=12, SI=12) or control (n=12) group. Table 1 shows the participant's IQ, chronological age 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 TOM group	IQ of SI group	IQ of control group	Gender
1	87	88	89	Boy
2	99	95	100	Girl
3	87	89	87	Boy
4	109	106	108	Boy
5	96	94	93	Boy
6	74	75	77	Boy
7	86	79	81	Boy
8	81	86	84	Boy
9	73	71	74	Boy
10	93	96	99	Boy
11	79	80	76	Boy
12	89	95	96	Boy
Mean±SD	87.75±10.48	87.83±10.13	88.66±10.77	-

Intervention (Experimental task)

TOM Training program

The TOM training is a daily intervention, including 100 sessions of approximately 45 minute. The interventional program is based on TOM interventions developed by Howlin, Baron-Cohen, &Hadwin (1999) and Steerneman, Jackson, Pelzer &Muris (1996) which included 200 optional exercises, and all the sub-stages of TOM were clearly represented in the intervention.

This training program was divided in to three stages. Each containing one of the components of TOM. The training in the first stage includes emotions recognition (happiness, anger, fear and sadness), identifying situation-based emotions, desire-based and belief-based emotions, expressing one's own emotions, body signal, complex emotions (for example shame, disappoint and guilt), imitation and pretense. In the second stage, namely, elementary TOM understanding, Training program includes simple and complex perspective taking, belief and false belief. In the third stage of training, advanced TOM understanding or second order reasoning involves usage of irony and humor. All of the skills were taught by three steps. In the first step tasks represented through perfectly objective and operative, for example by role-plays and game activities. In the second

step skills were taught through semi abstract for instance by using picture and video tape and ultimately in the third step skills were represented through abstract, for instance using of telling story and imagination.

SIT program

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 proprioceptionsense, (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.

Materials

Repetitive and stereotyped behaviors scale (RSBS)

For assessment of repetitive and stereotyped behaviors used subscale of repetitive and stereotyped behaviors of Gilliam’s autism rating scale. The Gilliam Autism Rating Scale – Second Edition (GARS-2) was developed for use in screening and diagnosis of individuals with autism (Gilliam, 2006). GARS-2 has been widely use in research studies and educational program (Owens, Granader, Humpphrey& Baron-Cohen, 2008; Worley & Matson, 2011). The GARS-2 is for use with people aged 3 to 22 years of age. The GARS-2 contains three subscales: stereotyped behaviors, communication and social interaction, and is based on definitions of autism from the Autism Society of America and the diagnostic criteria of the DSM-IV-TR. The three

subscales are summed to provide an autism index. The subscale of repetitive and stereotyped behaviors involve 14 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). Three subscales showed adequate internal consistency, as did the total scores, with estimates ranging from .84-.94.

Procedure

The participant is recruited from Isfahan Autism Center and Ordibehesht Autism Center, two rehabilitation centers for autism children and adolescent in Isfahan, The Iran.

After getting informed agrees from parents, children were matched based on IQ and gender was randomly assigned to intervention groups or a control group.

The scale repetitive and stereotyped behaviors administered to the parents, were assessed prior to trainings and within 5days after completion of the treatments. We collect follow up data 2 month after ending the interventions.(See table 2).

Table 2: The experimental design

Groups	Pre-test	Intervention(day1–day 150)	Post-test (day 155)	Follow up (day 215)
Experimental (TOM & SI)	RSBS was assessed	Participants were trained for 100 sessions	RSBS was assessed after five days of no training	RSBS was assessed after 60 days of no training
Control	RSBS was assessed	Participants did not participate In TOM and SI training programs	RSBS was assessed	RSBS was assessed

Before administering the test, we required the participant parents and caregivers to precisely observe the participants at home for five days. Before conducting the interventions training courses was set up for certified trainers whom we recruited to implementation TOM and SI programs to the participants. Furthermore, therapists received ongoing clinical supervision and training throughout the study. The participants of the experimental groups, furthermore daily programs of centers, received training programs 1 session/day, 5 day/week for 20 weeks (100 sessions). While the participants of waiting list control group only received daily programs of centers.

Statistics

To determine the effects of the intervention on the dependent variables, we used a repeated measures of ANOVAS (3 group X3 time points) with time as the repeated factor. If between time factors (pre test, post test and follow up) was significant difference, Pairwise Comparisons were used to determine which time factors are significant. If interaction between time factor and group (SI, TOM and control groups) was significant, Pairwise Comparisons were used to determine which groups have significant difference. We set statistical

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

RESULTS

In order to examine the differences in severity repetitive and stereotyped behaviors between the groups at the pre-test time, we performed an variance analysis test on the scores of repetitive and stereotyped behaviors. We found no significant difference at pretest, $F(2) = .85$, $p = .43$.

In order to examine training programs effects on the stereotyped and repetitive behaviors scale in the post-test and follow up we performed repeated measures ANOVA test. The repeated measures ANOVA revealed that factor of time has been a significant, $F(2) = 52.44$, p

$< .001$, $\eta^2 = .61$. In TOM experimental group, the paired sample t test , demonstrated a significant decrease in the post- test time and at follow up time compared to pretest, $t(11) = 4.42$, $p = .001$, $t(11) = 5.82$, $p < .001$. At follow – up time compared to time of post test, the stereotyped and repetitive behaviors score remained significantly unchanged , $t(11) = -.24$, $p = .80$. Also in SI experimental group, the paired sample t test , demonstrated a significant decrease in the post test and at follow up times compared to pretest, $t(11) = 9.34$, $p < .001$, $t(11) = 5.34$, $p < .001$. At follow – up time compared to time of post test, stereotyped and repetitive behaviors score remained significantly unchanged, $t(11) = -1.65$, $p = .12$. But in control group not showed significant difference for post test and follow up times compared to pretest, $t(11) = 1.44$, $p = .17$, $t(11) = 1.00$, $p = .33$ (Table 3).

Table 3: Results of the stereotyped and repetitive scale of GARS-2 in response to interventions in time factor .^a

groups	pretest	Post- test (20 weeks)	Follow-up (2 month)	Difference (20week-pretest)	Difference (2month–20 week)	Difference (2month-pretest)
TOM	11.00± 1.34	8.83 ± 1.14	8.91 ± 1.05	2.16 ± .49 CI: 1.08, 3.24	-.08 ± .33 CI: -.82, .65	2.08 ± .35 CI: 1.29, 2.87
SIT	11.58 ± 1.22	6.83 ± .78	7.66 ± .85	4.75 ± .50 CI: 3.62, 5.87	-.83 ± .50 CI: -1.94, .27	3.91 ± .73 CI: 2.3, 5.53
Control	13.41± 1.50	13.00 ± 1.42	13.08 ± 1.39	.41 ± .28 CI: -.21, 1.05	-.08 ± .28 CI: -.76, .55	.33 ± .33 CI: -.40, 1.06

a Data are mean± SD

The repeated measures ANOVA also revealed a significant group – by- time interaction, $F(4) = 13.51$, $p < .001$, $\eta^2 = .45$. In order to examine difference of training programs effects in different groups performed the pair wise comparisons of groups (LSD test). The LSD test showed a significant difference between TOM and

control groups,($P = .04$). Also the LSD test showed a significant difference between SI and control groups, ($p = .02$). The LSD test no revealed a significant difference between TOM and SI groups, ($p = .60$). Although SIT has led to a further reduction in scores of repetitive and stereotyped behaviors (Table 4).

Table 4: Total results of pair wise comparisons of groups

Groups(I)	Groups(J)	Mean difference (I- J)	Std. Error	Sig
TOM	Control	-3.58 .88	1.68	.04
TOM	SI	-4.47	1.68	.60
SI	Control		1.68	.02

DISCUSSION

It is critically important found evidence – based treatment for autism because of the difference treatment that offered to this group, some of which can be dangerous to the child (Wadman, 2008). The purpose of current study was to investigate whether TOM training and SIT for children with autism leads to decrease their repetitive and stereotyped behaviors. After offering TOM training program and SIT to participants of experimental groups, data revealed a significant reduction in repetitive and stereotyped behaviors at post test and follow up times compared with pretest time. Data also indicated a significant group – by- time interaction. In other words, reducing repetitive and stereotyped behaviors scores at post-test and follow-up was significant in some of the groups. In TOM experimental group, the participants demonstrate a significant improvement in repetitive and stereotyped behaviors. Data also indicated 60 days after post intervention time, effects of intervention in group experiment remained significant. According to parents, the participants of control group showed no change in their stereotyped and repeated behaviors scores across the experimental period. To date, have not been studied the beneficial effects TOM training on stereotyped and repeated behaviors in individuals with autism. The effects TOM training on reducing repetitive and stereotyped behaviors can be explained directly and indirectly. The TOM maybe affects indirectly on the stereotypy by improve to social skills, so that researchers reported social skills deficit due to incident of stereotyped behaviors, aggression and property destruction (Matson, Fodstad & Rivet, 2009). The TOM training maybe by improvement imagination and pretend play in children with autism has led to a reduction in repetitive and stereotyped behaviors. As Jarrold & et al., (2000) argued that deficits in imagination and pretend play in individuals with autism leads to repetitive behaviors and a preference for stereotyped routines. The decrease in repetitive and stereotyped behaviors perhaps best be explained in terms of executive dysfunction. The concept of ‘executive function’ refers to the higher order control processes necessary to guide behavior in a constantly changing environment (Jurado & Rosselli, 2007). The behaviors proposed to be accounted for by the theory of executive dysfunction include; a need for sameness, a strong liking for repetitive behaviors, lack of impulse control, difficulty initiating new non-routine actions and difficulty switching between tasks (Hill, 2004; Rajendran & Mitchell, 2007). It

is now well established that individuals with autism show marked impairments on TOM and executive functions tasks (Baron-Cohen, Tager-Flusberg & Cohen, 2000). Perner and Lang (1999) proposed that meta representational capacity underlying ToM is a prerequisite for the development of executive control (see also Carruthers, 1996). However, we have to consider the possibility that the improvement in stereotyped and repeated behaviors is the result of improvement in TOM and subsequent is improvement in executive functions.

In SI experimental group, the participants demonstrate a significant improvement in repetitive and stereotyped behaviors. Data also indicated 60 days after post intervention time, effects of intervention in group experiment remained significant. Some previous studies found similar results when assessing the reduction of stereotyped and repetitive behaviors in children with ASD after SI interventions (Smith et al., 2005; Pfeiffer et al., 2011; Fazlioglu & Baran, 2008; Linderman & Stewart, 1999).

Individuals with autism have related (Shoener, Kinnealey & Koenig, 2008) that self stimulatory behaviors such as stereotyped behaviors often serve as a regulatory function, allowing them to process sensory inputs from the world around them and attend without the alternative, which is sensory overload. The reduction of autistic self-regulatory behaviors may be indicative of a better ability to process sensory stimuli in the environment without the need for regulatory strategies.

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 to that applications IT 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.

No significant differences were found between TOM and SI groups on scores of stereotyped and repetitive behaviors at post test and follow up times. Although both groups demonstrated significant reduction in the stereotyped and repetitive behaviors, SI group demonstrated more significant reduction than the TOM group in the attainment of goal as reported by parents. Many reasons could exist for the non significant results,

ranging from a lack of generalizability of the interventions in other settings to measurement issues. This study focused solely on reports of parents who observed the child in the home setting rather than in the setting where the interventions were provided. In addition, we have to consider the possibility that the improvement in repetitive and stereotyped behaviors problems in experimental groups not only result of interventions, but also this result may be the result a halo effect on the parent, who had positive expectations of the outcome of the treatment. Finally, the sensitivity of the measurement tool may have influenced their ability to detect difference. The other reason and a limitation for this current study was no use of observational measurement tools. Unfortunately, due to the size of the current sample, we were unable to identify predictors or moderators of treatment effects in a meaningful way. Therefore, a recommendation for future studies is use of observational tools, and ensures that participants are more homogeneous so that the difference of the interventions can be detected and clinically applied. With regard to interventions were implemented for a relatively long period 5 sessions per week for 20 week, this study provides support for using SIT and TOM interventions in children with ASD, although further research is necessary, It is important to determine the most appropriate frequency and duration for interventions to guide intervention planning

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