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EFFECT OF SENSORY PROCESSING STYLES INTERVENTION STRATEGIES ON REDUCING SYMPTOMS IN AUTISTIC CHILDREN

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ABSTRACT

Sensory processing is the neurological process that organizes sensation from person's body and the environment. This process causes that body effectively use the environment. In some clinical conditions this process may have been dysregulated. This sensory processing disorder was detectable in 78-90% autistic children. Sensory processing intervention can be applied in autistic children who might lead clinical improvement through sensory modulation. In this case study we evaluated whether sensory processing intervention had an effect on reducing symptoms in children with autism.

The intervention study included eight patients. These patients had a primary diagnosis of autism based on DSM-V, didn't have any comorbid neurologic disorder and were 3-6 years age. Sensory functions of children were measured by sensory profile. Their mothers completed the Sensory Profile by assessing the frequency of the child's responses to events as described in the 125 items. Each senses (auditory, touch, visual, movement, vestibular, taste and smell) that were in definite difference or probable difference sections; needed to get interventions. Mothers learned sensory processing interventions and applied these interventions daily. Intervention of each part took two weeks. Autism symptoms were measured by GARS-I (Gilliam Autism Rating Scale-I) in different time points including pretreatment, during the intervention, post-treatment, one and three months follow up.

Our findings show 16.64% decrease in rate of symptoms in one month follow up in all participants. This decrease includes reducing stereotype behaviors, echo and improvement of social interaction. However, it is not statistically significant. Only for two children decrease of rate of symptoms is significant. Outcomes of this study do not support a relation between sensory processing intervention and the reducing symptoms in children with autism.

KEYWORDS: Autism, sensory processing intervention, Dunn's model, sensory processing styles, symptoms, sensory profile.

INTRODUCTION

Sensory processing system process, interpret and respond to sensory stimulation in the environment. Every person has individual ways to respond to the sensory stimuli. If the sensory system is neurodevelopmentally normal, it performs successful responses to demands of environment that allows them to engage in everyday life (Humphry, 2002). However, some children have deviation from normal processing, integrating and responding to sensory stimulation, which might be due to underlying structural and biochemical abnormalities in the central nervous system (Bundy, Lane, Murray, Fisher, 2002). Dunn (1997) analyzed data from more than 1000 children and found two primary factors that contributed in sensory processing system including neurological threshold (high threshold vs. low threshold) and self-regulation strategies (active or passive). The different combination of these two factors led to four patterns of sensory processing abnormalities including low registration, sensation-seeking, sensory sensitivity and sensation avoiding. These abnormalities (over or under estimate) could be exist in perception of all different sensory modalities, including vision, taste/smell, sound, touch, as well as proprioceptive and kinesthetic (O'Neill and Jones, 1997; Gabriels, Cuccaro, Hill, Ivers, Goldson, 2005).

The unusual sensory responses are present in several clinical conditions including schizophrenia, fragile X syndrome, William's syndrome, attention deficit/hyperactivity disorder and autism (Khodabakhshi, Abedi and Malekpour, 2014).

The prevalence of sensory processing disorder was reported as high as 80 to 90 percent in autism spectrum disorder (ASD) (Rogers and Ozonoff, 2005, Horder, Wilson, Mendez and Murphy, 2013; Andrésa, Cerezuelab, Cerverac and Mínguezc, 2015). In addition, abnormalities in sensory processing had been found to be associated with higher levels of inflexible, stereotypic, and repetitive behaviors (Dawson and Watling, 2000). There are several interventions approaches for autistic children, like ABA (Applied Behavior Analysis), PRT (Pivotal Response Treatment), speech therapy, occupational therapy, sensory integration, music therapy, hydrotherapy and so on. ABA is a method that was described by Lovaas in 1987 and applied for children with developmental disability; particularly autism spectrum disorders (Ahmadi, Safari, Hematian and Khalili, 2012). It provides rewarding stimuli, to encourage positive behavior (Johnston, 2014) with more than 40 hours one to one intervention per week (Lovaas, 1987). ABA is reported to be effective for autistic children (Heyvaert, Saenen, Campbell, Maes and Onghena, 2014; Lovaas, 1987; Ahmadi, safari, hematian and khalili, 2012; parker, 2008). PRT is another behavioral intervention that focuses on improves rate of responding and positive affect. Task of this intervention is based on responsiveness of child to objects and stimulus in the environment (Mohammadzaheri, Koegel, Rezaee and Rafiee, 2014). In this study we tried to use sensory processing interventions, based on Dunn's model, to assess its effectivity in improving clinical symptoms in autistic children. Dunn's model is for children with and without disability (Dunn, 2007).

MATERIALS AND METHODS

Methods

Participant

Participants were 8 Iranian children with diagnosis within the Autism Spectrum Disorder (7 boys and 1 girl), ranging in age from 3 years and 2 months to 6 years and 3 months (*M≈4*, *Table 1*). Inclusion criteria were a clinical diagnosis within the Autism spectrum disorder according to fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-V). This diagnosis was based on multidisciplinary assessment by a specialized team; consist of psychiatrist and psychologists. In addition, each patient should diagnose with sensory processing abnormality in at least one domain. Children with a physical disability, known genetic or other neurological disorder (e.g., seizures) were excluded.

Procedure

This longitudinal study were evaluated the role of Dunn's model intervention as an add on therapy to patients who already receiving ABA therapy in "center for treatment of autistic disorders". First, were asked mothers to fill the sensory profile (based on their child's sensory behavior during the day) and GARS (pretest 1) at time point zero. As mentioned earlier, all of participants had at least one impaired sense. Two weeks later, right before receiving intervention, they refilled GARS (pretest 2) again. Since then, children were received interventions by mothers for each sense that showed dysfunction. During time of receiving interventions, the sensory profile once (intervention 1) and GARS two times (intervention 1 and 2) was filled. The time of filling is based on number of impairment senses, for example for children number 1 who had three impaired senses; every one month they filled GARS. Intervention for each sensory modality took two weeks. In first week, mothers monitored their child's behavior during the day in the environment (house, kindergarten, park, street, etc.). After that, they called therapist and based on the patterns of sensory processing abnormalities, got the appropriate intervention according to one of four pattern of Dunn's model. For second week, mothers did interventions during the day. Immediately after the end of interventions (post-test) the mothers filled GARS. After one month (follow up 1) and three months (follow up 2) mothers filled the sensory profile and GARS.

Materials

The Sensory Profile: The Sensory Profile (Dunn and Westman, 1995) is a questionnaire with 125-items that distinguishes sensory abnormality. This profile is filled by parents based on the frequency of patient's response to items in different sensory categories including auditory, visual, taste/smell, etc. This frequency is determined from a Likert scale from always (1) to never (5). Every sense can categorize in three parts, typically performance (processes normally), probable difference (partially impaired) and definite difference (totally impaired).

GARS: Gilliam Autism Rating Scale that was developed by James E. Gilliam (1995), uses for identifying children and adolescence with autism disorders and evaluating the progress during the timeline. GARS has four parts: stereotype behavior, social interaction, communication and developmental disturbance. It consists of 56 items and each item will be determined from a Likert scale from never (0) to mostly (3).

Dunn's Model Intervention: The package of intervention is consisting of several items for each sense that categorize based on four patterns of sensory processing abnormalities (low registration, sensation-seeking, sensory sensitivity and sensation avoiding; Dunn, 2007).

Statistical analysis

In order to examine effects sensory processing interventions on the symptoms of autism, in the post- test and follow up, we performed percent improvement for data of GARS. The data of this study was analyzed in SPSS.

RESULTS

Participants were eight children (seven boys and one girl). Mean of their age was three years and 12 months. All of them had at least one impaired sense; the average number of impaired sense was three. All of them were also received ABA intervention. In details five of them (children number 2, 4, 6, 7 and 8) had received ABA intervention six days a week and the rest (children number 1, 3 and 5) had three times a week. Six of them were received speech therapy (children number 2, 3, 5, 6, 7 , 8) and two of them were also received occupational therapy (children number 6 , 8) once a week. Their demographic data with more detail is shown in *Table 1*.

Table 1: Demographic data of participant

	Sex	Age	Age of diagnosis	N. of impairment senses	Other interventions they were received
1	boy	3 years and 2 months	3 years	3	ABA
2	girl	4 years and 8 months	4 years and 8 months	3	ABA, speech therapy
3	boy	3 years and 3 months	3 yearsand 3 months	3	ABA, speech therapy
4	boy	6 years and 3 months	6 years	1	ABA
5	boy	3 years and 7 months	3 years and 5 months	1	ABA, speech therapy
6	boy	3 years and 10 months	3 years and 5 months	3	ABA, speech therapy, occupational therapy
7	boy	3 years and 11 months	3 years and 6 months	5	ABA, speech therapy
8	boy	3 years and 8 months	3 years and 5 months	4	ABA, speech therapy, occupational therapy

GARS had been evaluated in each individual at seven different time point. The mean of GARS scores for all participants were not significantly in three months follow up (*Figure 1*).

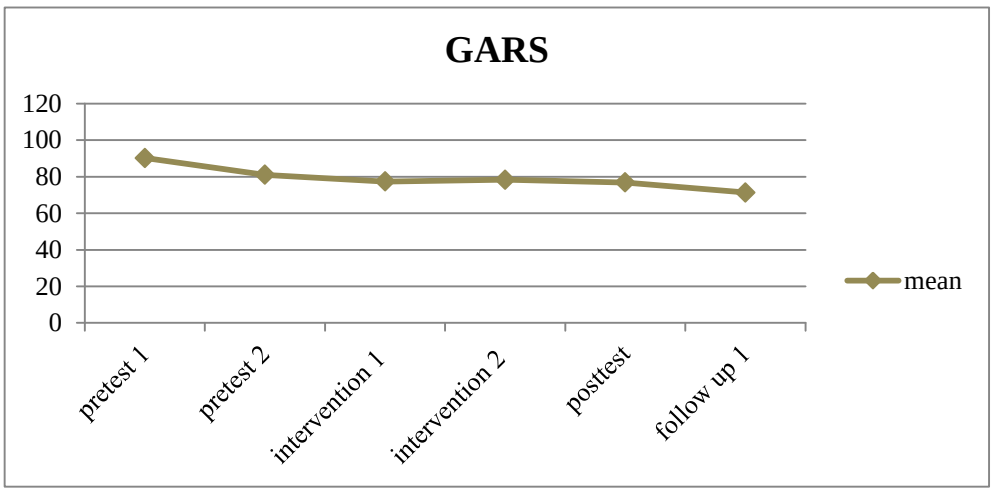

Figure 1: The mean of GARS scores during time points of study

In evaluating the participants individually, six of these participants had no significant change in autism symptoms (*percent of improvement < 25/00*) in three months follow up. In details patient number 6 and 7 had mild improvement but cases number 1, 4, 5 and 8 had no any change in their scores. Only two of the participants (children number 2 and 3) had significant improvement. The data of GARS are shown in *Table 2* for each individual.

Table 2: Scores of GARS, during time points of study

Cases	Pre-T1	Pre-T2	INT1	INT2	Post-T	Follow up1	Follow up2	Pct. Improvement	Sig
1	98	70	74	87	87	85	81	1/19	No
2	92	65	55	53	57	48	-	47/77	Yes
3	105	118	88	82	82	72	77	33/18	Yes
4	87	73	65	65	65	62	67	19/37	No
5	63	64	66	66	66	63	-	0/78	No
6	97	88	92	92	72	78	73	18/37	No
7	102	92	106	104	104	83	73	19/58	No
8	78	78	73	78	82	80	-	-2/56	No

Table 3: Result of sensory profile, during time points of study

N. of child	Pre-test1			Intervention1			Follow up1			Follow up2		
	D	P	T	D	P	T	D	P	T	D	P	T
1	2	1	0	1	2	0	1	1	1	0	1	2
2	1	2	0	0	0	3	0	0	3	-	-	-
3	2	2	0	2	0	2	2	0	2	2	2	0
4	0	1	0	0	0	1	0	0	1	0	0	1
5	0	1	0	0	0	2	0	2	0	-	-	-
6	0	2	0	0	0	2	0	0	2	0	0	2
7	5	0	0	3	2	0	4	0	1	2	2	1
8	1	3	0	1	0	3	2	0	2	-	-	-

*D: Definite difference, P: Probable difference, T: Typical performance

Sensory profile was filled four times during project (pretest, during intervention and follow up 1 and 2). Score of impaired senses were categorizing in three groups. The first group was definite difference; it means that sense was severely impaired. The second group was probable difference; it means that sense was mildly impaired. Finally the third group had typical performance with normal function. The data of the sensory profile for each individual is shown in *Table 3*.

After receiving interventions, the impaired senses were categorizing in four groups. The first group was that senses totally improved, it means that before interventions they were in definite difference or probable difference groups, but after interventions they were in typical performance group. The second group was that senses partly improved, it means that before interventions they were in definite difference group, but after interventions they were in probable difference group. The third group was that senses no change in their functions, it means that before interventions they were in definite difference or probable difference groups, and after interventions they were in the same groups. The forth group was that senses got worth; it means that before interventions they were in probable difference group, but after interventions they were in definite difference group. Percent of totally improved in all senses are: 100% in visually, 75% in auditory, 33.3% in tactile, 25% in oral and vestibular, and no improvement in movement at the end of study. Totally, 48% of all senses are improved. Changes in function of senses after intervention are shown in *Table 4*.

Table 4: Result of sensory processing intervention

senses	auditory	visually	oral	tactile	movement	vestibular	total
Totally Improved	3	5	1	1	0	1	11
Partly Improved	1	0	0	0	0	1	2
No change	0	0	3	2	3	1	9
Get worse	0	0	0	0	0	1	1
Total	4	5	4	3	3	4	23
Percent of T.I sense	75%	100%	25%	33.3%	0	25%	48%

DISCUSSION

The purpose of this study was to determine whether sensory processing intervention can decrease symptoms in autistic children. Regardless of remarkable improvement in the impaired sensory modalities for each individual, we cannot find significant impact of sensory processing intervention on attenuating symptoms of autism in majority of our participants. In other word, these interventions only improve sensory processing disorders in autistic children, but cannot decrease symptoms in most of children. The finding of our study is consistent with the previously published data (Ayres and Tickle, 1980; Case-Smith and Bryan, 1999; Fertel-Daly, Bedell and Hinojosa, 2001; Piravej, Tangtrongchitr, Chandarasiri, Paothong and Sukprasong, 2009; Van Rie and Heflin, 2009; Bagatell, Mirigliani, Patterson, Reyes and Test, 2010; Hodgetts, Magill-Evans and Misiaszek, 2011; Pfeiffer, Koenig, Kinnealey, Sheppard and Henderson, 2011; and Case-smith, Weaver and Fristad, 2014) which showed benefit on autistic symptoms on few individuals. Based on our finding, Dunn's model intervention only improve sensory impairment other than attenuation of other symptoms of autism. However, two of our patients show significant improvement in their autistic behaviors after intervention. Regarding the fact that patients with autism spectrum disorders have heterogeneous underlying etiology, there is a possibility that selective patients with autism might benefit from Dunn's model sensory intervention. In this longitudinal study, the major limitation of the study was related to lack of appropriate control groups to omit the confounders' particularly simultaneous ABA intervention in our objects. Beside it, the other major limitations of our study are small number of participant as well as short-term follow up (just 3 months) that might lead type II error with non-significant findings. Further prospective case-control study is needed to evaluate the role of sensory modification on different aspect of autism presentation.

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