

Efficacy of the sensory integration therapy on language development in autism spectrum disorder children

Original
Article

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ABSTRACT

Introduction: The aim of this study was to find the impact of sensory integration therapy on language development in autism spectrum disorder (ASD) children.

Patients and Methods: Sixty-eight ASD children were enrolled in this study, their ages ranged from 36 - 114 months, 56 males and 12 females, divided into two groups (group I received language therapy sessions together with sensory integration therapy sessions, group II received language therapy sessions only) went through two stages of evaluation before and after receiving their sessions with one year apart. All children were subjected to the Stanford Bienne Intelligence Scale 5th edition Arabic version, Childhood Autism Rating Scale (CARS), language assessment by Modified Preschool Language Scale -4th edition Arabic form (PLS-4), sensory profile assessment by Short Sensory profile (SSP).

Results: The language abilities improved equally in both groups of the study, although receptive language abilities show little improvement in group I, it was of non-significant statistical difference, the improvement in their language abilities was mostly related to the language rehabilitation program.

Conclusion: The immediate treatment effects of sensory integration therapy (SIT) were diffused as it focuses on preparing the child's primitive abilities to attend and learn rather than practice and explore specifically targeted behaviors. It should be combined with other approaches to reach a comprehensive one that may produce the desired outcomes. Future studies are required on larger samples to clarify if SIT has more long-lasting and generalized effects or not.

Key Words: Autism spectrum disorder, sensory integration therapy, sensory profile.

Received: 11 December 2022, **Accepted:** 16 January 2023

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ISSN: 2090-0740, 2023

INTRODUCTION

Autism spectrum disorder (ASD) is considered one of the commonest developmental disabilities, characterized mainly by impairments in social performance and communicative skills, repetitive stereotypical behaviors, and restriction in interests and activities, with a combination of sensory, cognitive, behavioral, and communication features which persist throughout life^[1]. Caminha & Lampreia specified that there is a significantly high prevalence of sensory processing dysfunctions in ASD^[2].

Sensory processing means how the central and peripheral nervous systems deal with the incoming sensory input from different sensory organs; visual, auditory, smell, taste, tactile, proprioception, and vestibular information. Sensory processing dysfunction is the neurological dysfunction affecting the adequate reception, modulation, integration, discriminat*ion, or organization of sensory stimuli, and the behavioral responses to the sensory input^[3].

The latest version of the DSM-5 incorporated sensory processing issues as one of the primary features to set the diagnosis for ASD^[1].

Sensory integration therapy (SIT) is a common method of therapy developed to enhance the abilities of the child to perceive and integrate sensory input to explore more organized and adaptive behaviors^[4]. SIT has a positive effect on motor skills, social interactions, attention, behavior modification, linguistic and pre-linguistic communicative skills, mastering reading, participation in play activities, and identifying personal^[5].

Therefore, the need for further explicit assessment of sensory integration intervention among ASD children has been increased to identify its gains in social and verbal interactions. This study aimed to estimate the impact of sensory integration therapy on language development in autism spectrum disorder children.

PATIENTS AND METHODS:

2.1. Ethical consideration:

Informed consent has been obtained from the participants recruited in the current research. The confidentiality, as well as the privacy of participants, were guaranteed. During the study design process, deceptive methods were excluded. The subjects had the option not to complete the research at any time. The Ain Shams Institute's Ethical Committee of Human Research approved this research (reference number; FWA 000017585). The current study received the approval of the Research Ethical Committee of the Faculty of Medicine, Ain Shams University, the approval number is FMASU M D 221/2019.

2.2. Study design:

An experimental, Interventional prospective study from August 2019 to August 2022, done on 68 children who previously received the diagnosis of ASD, were randomly selected and divided into 2 groups, with 34 children in each. Both groups enrolled in two stages of evaluation one year apart:

1-Stage one: pre-intervention assessment.

2-Stage two: post-intervention assessment.

Application of the therapeutic modality between the two stages, Group I of children received sensory integration therapy sessions (1 session/week for one year) and language therapy sessions (2 sessions /week for one year), while Group II received language therapy sessions (2 sessions /week) only.

Inclusion criteria:

Included children who were previously diagnosed as ASD according to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V) criteria, ages from 3 to 10 years old, their intellectual disabilities ranged according to Stanford Bienne Intelligence Scale 5th edition, Arabic version^[6] from below average to a moderate degree, and the severity of their ASD symptoms ranged from mild to severe according to Childhood Autism Rating Scale CARS^[7], their language age ranged from one year or above according to PLS4 Arabic edition^[8]. While exclusion criteria excluded children with associated medical syndromes, hearing impairment, visual disabilities, other types of disabilities, epilepsy or active seizures in the last six months, and other psychological disorders.

2.3. Study Tools/ Procedures

Both groups of autistic children received their diagnosis after passing through the following assessment

protocol of delayed language development applied by the Phoniatrics Unit, ENT Department, Faculty of Medicine, Ain Shams University^[9] which include: A)- Personal History taking (name, age, gender, schooling, parental consanguinity, and similar conditions in the family). B) - perinatal, developmental, and past history (head trauma, fits, ear disease & others). C) - History of present illness. D) - Communicative assessment was carried out by a phoniatrics consultant subjectively and objectively in order to determine the passive language skills (eye contact, comprehension of simple and complex commands), active language skills (the length of sentences, the syntax, the semantic, the phonology and the pragmatics). A routine objective cognitive assessment of the children's cognitive abilities was carried out through standardized Arabic cognitive assessment tools: Stanford-Binne Intelligence Scales-fifth Edition-The Arabic version, which provides an Intelligence quotient (IQ). Language assessment was done utilizing the Standardized Arabic test Modified Preschool Language Scale -4th edition Arabic form (PLS-4) which gives language age (receptively, expressively, and total), Sensory Profile was assessed using the Short Sensory Profile (SSP), it consists of 38-item caregiver questionnaire includes the items that demonstrate the most discriminative power of sensory processing disturbances, its score is on a 1-point to 5-point scale, seven domains are found in a normative sample which is Tactile Sensitivity, Taste/Smell Sensitivity, Movement Sensitivity, Under responsive/ Seeks Sensation, Auditory Filtering, Low Energy/Weak, and Visual/Auditory Sensitivity^[10].

3. Statistical Analysis:

The collected data was revised, coded, demonstrated in tables, and introduced to a PC using Statistical Package for Social Science (SPSS 20). Data were analyzed according to the type of data obtained for each parameter. Descriptive statistics were used: Mean, Standard deviation (\pm SD), for numerical data the range was used, while for non-numerical data, the Frequency and percentage were used. Analytical statistics were done using: The Student-(t) Test, was used to examine the significance of the statistical difference between the two-study group means. While the relation between two qualitative variables was examined by the Chi-Square test.

RESULTS:

Table 1 shows the mean and standard deviation of age and gender among the two studied groups. There was a non-significant statistical difference between them.

Table 2 shows IQ and CARS for the two study groups after the study intervention, with non-significant statistical differences as regards IQ (P -value=0.873), and CARS (0.626).

Table 3 shows receptive, expressive, and total language age by PLS-4 Arabic edition for the two study groups before and after the study intervention, with a *p-value* of high significant statistical difference.

Table 4 illustrate short sensory profile scores for the two study groups' pre- and post-study intervention, with a *p-value* of high significant statistical difference for group I

for all items except Movement Sensitivity, while for group II *p-value* was of non-significant statistical difference for all items.

Table 5 showed a comparison between both groups' post to the study intervention as regards language age (receptive, expressive, and total), *P-value* for language age was of non-significant statistical difference.

Table 1: Demographic data for the two study groups:

Mean	Group I		Group II		t*	P value	
	Mean	SD	Mean	SD			
Chronological age (Month)	73.65	22.68	63.76	23.20	-1.776	0.08 (NS)	
	N	%	N	%	X ^{2**}	P value	
Gender	Male	30	88.2%	26	76.5%	1.619	0.203 (NS)
	Female	4	11.8%	8	23.5%		

*Student t-test, **Chi -square test (FE: Fisher exact), NS: non-significant

Table 2: Comparison between both groups as regards IQ, and CARS post the study intervention.

	Group I		Group II		t*	P value
	Mean	SD	Mean	SD		
IQ Post	57.94	11.36	58.35	9.79	0.16	0.873 (NS)
CARS Post	34.21	3.90	33.75	3.79	0.489	0.626 (NS)

*Student t-test, NS: non-significant

Table 3: Language age pre -and post-study intervention for both groups by PLS-4:

	Group 1				Group 2			
	Mean	SD	t*	P value	Mean	SD	t*	P value
Receptive language age Pre	19.82	11.63	7.95	<0.001 (HS)	20.12	11.44	-5.782	<0.001 (HS)
Receptive language age Post	24.41	12.23			23.97	12.13		
Expressive language age (Month) pre	19.09	12.30	3.86	<0.001 (HS)	21.15	9.46	-5.274	<0.001 (HS)
Expressive language age (Month) post	20.53	11.96			24.00	10.74		
Total language age (Month) pre	19.59	11.64	6.90	<0.001 (HS)	20.32	9.93	-5.624	<0.001 (HS)
Total language age (Month) post	22.35	11.65			23.82	11.18		

*Paired sample test, HS: highly significant.

Table 4: Comparison between the two study groups as regards sensory profile scores pre-and post-study intervention.

	Group 1				Group 2			
	Mean	SD	t*	P value	Mean	SD	t*	P value
Tactile sensitivity pre	21.76	6.08	4.79	<0.001 (HS)	25.24	4.00	0.239	0.812 (NS)
Tactile sensitivity post	25.97	5.27			25.21	3.96		
Taste/smell sensitivity pre	16.03	5.37	2.93	0.006 (HS)	16.29	5.13	-2.104	0.043 (NS)
Taste/smell sensitivity post	17.68	3.55			17.21	4.68		
Movement sensitivity pre	12.56	4.06	1.44	0.16 (NS)	13.85	2.34	-1.307	0.20 (NS)
Movement sensitivity post	13.15	3.30			14.21	2.64		
Under responsive/seeks sensation pre	15.53	4.17	5.45	<0.001 (HS)	16.76	4.16	0.722	0.475 (NS)
Under responsive/seeks sensation post	18.03	3.82			16.50	4.57		
Auditory filtering pre	12.38	4.57	4.89	<0.001 (HS)	15.94	7.05	-1.034	0.309 (NS)
Auditory filtering post	14.38	4.49			16.18	7.05		
Low energy/weak pre	21.38	8.02	3.38	0.002 (HS)	23.12	6.89	-0.78	0.441 (NS)
Low energy/weak post	23.88	6.86			23.24	6.84		
Visual/auditory sensitivity pre	15.91	6.27	5.19	<0.001 (HS)	18.47	5.28	-1.-74	0.29 (NS)
Visual/auditory sensitivity post	17.79	5.60			19.00	5.80		
Total short sensory profile score pre	115.56	19.07	6.90	<0.001 (HS)	129.68	20.16	-1.456	0.155 (NS)
Total short sensory profile score post	130.88	18.98			131.53	20.37		

*Paired sample test, NS: non-significant, HS: highly significant.

Table 5: Comparison between groups I and II as regards language age post the study intervention:

	Group I		Group II		t*	P value
	Mean	SD	Mean	SD		
Receptive language age Post	24.41	12.23	23.97	12.13	-0.149	0.882 (NS)
Expressive language age (Month) post	20.53	11.96	24.00	10.74	1.259	0.213 (NS)
Total language age (Month) post	22.35	11.65	23.82	11.18	0.531	0.597 (NS)

*Student t-test, NS: non-significant.

DISCUSSION

Autism Spectrum disorder is a known neurodevelopmental disorder for decades. The latest inclusion of the sensory processing difficulties among ASD children in the DSM-5 criteria^[1], increased the focus on Sensory Integration therapy. Many of the studies about the influence of SIT on different areas of functioning among ASD children were done in a subjective manner, on reviewing the literature, there is no objective study that determines the effect of such therapeutic modality on communicative abilities as a whole and more specifically on language test results, intellectual test scoring, severity grading of ASD and the sensory profile these children have. This study was done to find the impact of sensory integration therapy

on language development and maturation among Egyptian ASD children, and how would this improve the overall outcome of the rehabilitation program, especially in the social domain and participation in daily life.

The results from the current study revealed a non-significant statistical difference in their IQ testing score and in the severity rating of ASD symptoms as measured by CARS in group I when compared to group II who did not receive the sensory integration therapy (Table 2), while language abilities improved in both groups from pre- to the post-stage nearly to the same level among the studied group (Table 3), although receptive language abilities showed little improvement in group I, on comparing both groups

post to the study intervention it was statistically of non-significant statistical difference (Table 5).

There is also a significant improvement in sensory profiles of group I of children receiving sensory integration therapy pre -and post-their sessions (Table 4). The improvement was in the specific sensory modalities which included: (i.e. tactile sensitivity, taste/smell sensitivity, under-responsive, auditory filtering, low energy, and visual sensitivity), this is not observed in the domain of movement sensitivity as the children of the sample has no impairment in this sensory modality from the beginning.

It is clear that improvement in their linguistic abilities was mostly related to the language rehabilitation program they received. This finding went with what has been illustrated by Randell *et al.*, who concluded in their series that the role of SIT is foundational for further rehabilitative intervention. They determined that children with ASD need a multidisciplinary approach for rehabilitation to reach the target goals of improving language abilities and social interaction not only a single modality therapy^[11].

In contrast to these results, Weitlauf *et al.* mentioned that SIT can improve autistic symptoms that are reflected in other aspects of their abilities, such as social skills and interaction, and academic performance^[12].

Among group I of children, it was noticed that there were improvements in their eye contact, imitation, identification of more items among various semantic groups, and engagement in pretended play to some degree that may have a better outcome on the long term for verbal and non-verbal language maturation.

SIT is a clinic-based intervention where the sessions are introduced as play activities to encourage the child to participate and interact with others and enhance his sensory processing system and motor planning to elicit the proper adaptive responses^[13,14].

Play activities are an effective medium of occupational therapy, enhancing the child's motivation (volition), habits (habituation), and skills (performance capacity)^[15]. these activities are intrinsically motivated, internally controlled, unique for each child, and freely chosen.^[16]

Play activities and sensory integration were assumed to develop interdependently, play activities act as the bridge between sensory integration and occupational behavior; as it consists of the adaptive behaviors that enhance sensory integration to develop. The outcome is improvement in Imitation, exploration, and repetition of new actions with intrinsic motivation^[17].

Typically developing Sensory processing abilities, particularly being aware of the body, balancing, and touching that are introduced during SIT would help the children to engage more in pretend play, since they affect the body position, and improve the manipulation of toys to execute a well-developed flow of play^[18]. it also helps to develop praxis skills, hand-eye coordination, and visual perception and increases self-esteem and self-confidence^[19]. Utterly, they will help in the development and maturation of verbal and nonverbal language through the course of therapy sessions.

According to the current study, a non-significant statistical difference was shown among group I regarding their IQ testing scores when compared to group II who did not receive the sensory integration therapy (data are shown in Table 2). To our knowledge, the intellectual abilities of ASD children were poorly studied in the literature. Baum *et al.* assumed that alteration in sensory processing may negatively affect cognitive function and clinical symptoms of ASD^[20].

Children who received adjuvant sensory integration therapy in this study showed a non-significant statistical difference in the severity rating of ASD symptoms as measured by CARS (data are shown in Table 2). The current study determined that in response to the conventional cognitive rehabilitation program both studied groups responded equally. These results were in the same direction as Crane *et al.*, who pointed out that there was no relation between the severity of ASD and the problems of sensory processing across the senses^[21]. Moreover, Magyar & Pandolfi stated that CARS is not a measure for the outcome of the rehabilitation program. It only gives an appropriate description of the severity of the autistic symptoms at the time of the observation and helps the professionals to find an appropriate rehabilitation program^[22].

Improvement of tactile sensitivity in group I unlike group II (Table 4) as an outcome of SIT will increase the self-knowledge of children, awareness of the child's own self and body image, the sense of his stability, and build his self-confidence. Moreover, upon touching another person it helps in breaking through the isolation that is a core symptom of autism^[23].

Sensory integration theory focused on the association between the neural pathways for receiving, modulating, and integrating sensory input, and the resultant adaptive behavior^[24]. Therapy involves activities that are rich in tactile, vestibular, and proprioceptive sensations which all improved in group I and would enhance the proper function of different areas responsible for the learning process, attention, coordination, speech, language maturation, and behavior adaptation^[25].

To summarize, the effect of SIT was marked in the domain of sensory processing among the examined children, while other domains like intellectual abilities, verbal communication and severity of ASD symptoms were related to a large extent to the conventional program.

In this aspect the current work went with what has been found by Case-Smith and Arbesman, also by Baranek, who reported that there is a low level of evidence that SIT interventions had a role in improving engagement in social life, constructing a purposeful play, and reduced hyper-reactivity in young children^[26,27].

Case-Smith *et al.* explained this finding and reported that SIT enhances and prepares the child's primitive abilities to attend and learn rather than practice and explore specifically targeted behaviors, so it should be combined with other approaches to reach a comprehensive one that may produce the desired outcomes. The immediate treatment effect was untouchable than behavioral interventions. They concluded that it is unclear whether SIT has a long-lasting and generalized effect on the long term or not. The current work lasted for one year which may not be enough to show these effects. Nevertheless, the inclusion of children with ASD in a comprehensive multidisciplinary approach is mandatory for better outcomes and to obtain the desired skills^[4].

Although the results from some previous studies on the effect of SIT were uncertain^[12,28]. A recent systematic review by Schoen *et al.* concluded that it has been considered an evidence-based practice suitable for ASD children between 4-12 years old, while younger children will benefit more because of the quick development of their nervous systems which leads to a better response^[29].

Finally, Watling *et al.*, mentioned that despite the lacking evidence for the efficacy of SIT, it remains a popular treatment. It is usually integrated with other approaches for ASD to reach a suitable individualized approach for each child, it is often proposed as a necessary treatment option for stereotypic behaviors maintained by automatic reinforcement^[30].

Unfortunately, A big limiting factor in this field is that many studies were unable to find the relation between the changes in the affected mechanism (e.g., auditory sensitivity, visual distortions, vestibular dysfunction) and the functional changes in behavior. Studies either demonstrate outcome measures of the proximate sensory behaviors (e.g., auditory sensitivity, arousal, tactile defensiveness) or the diffuse functional behaviors (e.g., social engagement, play skills,

academic performance), with difficulty in linking both in a systematic and measurable way.

CONCLUSION

The immediate effects of SIT were diffuse and unclear. Its importance might be attributed to its ability to enhance and prepare the child's primitive abilities to attend and learn rather than teach and explore a specific targeted behavior. It is unclear whether SIT has more long-lasting and generalized effects on the long term or not. It must be combined with other behavioral, motor, and self-care approaches to reach a comprehensive approach, therefore achieving the desired outcomes.

ACKNOWLEDGMENTS

We would like to thank all participants and their families in the current work for their valuable time.

ABBREVIATIONS

Autism spectrum disorder (ASD).

Childhood Autism Rating Scale (CARS).

Modified Preschool Language Scale - 4th edition Arabic form (PLS-4).

Short Sensory profile (SSP).

Sensory integration therapy (SIT).

American Psychiatric Association (APA).

Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V).

CONFLICT OF INTEREST

There are no conflicts of interest.

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