

The Effects of Sensory Integration Therapy on Physical and Motor Activity of Children with Autism Spectrum Disorders in Shiraz

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Abstract

Introduction: Autism is one of the developmental disorders of the central nervous system followed by several sensory motor problems. The present study aims to investigate the effect of sensory integration therapy on the physical and motor activities of children with autism.

Methods: This descriptive study was carried out with 20 students selected in the first, second and third grades aiming to diagnose autism disorder in the academic year 2017 in Shiraz. Data collection was performed using the “physical activity of Iranian students” questionnaire in the form of teacher and parent observation record registration at three levels (daily activity, organization and motor ability). The level of motor skills was determined using the gross motor development test (basic, equilibrium, and kinetic skills) prepared by Khalaji and Khajavi (motor development professors). The presented study employed sensory integration approaches by modulating individual and group treatments in these children (sensory diet and creating the sensory atmosphere) in 12 sessions for 60 minutes. The results of the pre-test and post-test data were analyzed through performance analysis based on non-parametric data via Wilcoxon test ($p \leq 0.05$).

Results: Our finding showed that there is a significant difference between the viewpoints of parents and teachers regarding the level of activities before and after intervention ($p < 0.05$). So, sensory coherence increases the level of daily activities of children with autism disorder. Moreover, there is a significant difference between the viewpoints of parents and teachers regarding motor skills before and after intervention ($p < 0.05$).

Conclusion: the results of the current study showed that the use of sensory integration therapy improves daily, organized and motor activity, as well as the basic and balance skills of children with autism and may require longer courses of treatment to improve kinetic skills.

Keywords: Autism, Sensory Integration, Physical and Motor Activity

Introduction

Autism spectrum disorder (ASD) is one of the central nervous system growth and developmental disorders that is characterized by disruption of social communication and communication skills and the presence of behaviors, interests and stereotypic movements (1). Sensory-motor problems such as muscle tone, subtle motor skills, balance and motor integrity are among the main symptoms of autism spectrum disorders that affect different parts of their lives (2). Sensory

processing patterns in autistic students include issues such as low recording, sensory sensitivity, sensitivity to probable differences, and sensory avoidance which make autistic children have different patterns in sensory processing (3). Children with autism spectrum disorder have more sensitivity to normal stimuli for a variety of neurological reasons. They may overreact or underreact to stimuli such as light, sound, touch etc. In these children, learning is based on the perception that comes from what they see or hear and get

confused by their incorrect perception of the world (4). Appropriate integrated sensory and motor activity can help develop the social behaviors of children through physical growth and the development of motor behaviors which lead them towards acceptable and desirable social standards (5). Sensory integration is one of the therapeutic interventions for people with autism spectrum disorders and targets the symptoms associated with these disorders including sensory integrity therapy and auditory training interventions with game and art therapy. In fact, many of the nerves cooperate through sensory integration in order for a person can communicate with the environment efficiently (6). In one study, it has been argued that aerobic activity can be a non-invasive and non-pharmacological way of improving the symptoms of children with attention deficit and hyperactivity disorder (ADHD) (7). In a study to assess the effect of basic gymnastic exercises on motor skills in children with autism, it was suggested that between 50% and 70% of children with autism have a significant delay in basic motor skills (8). According to the results, it can be asserted that the chosen exercise program could possibly improve the control skills of children with high-performance ASD (9). The SPARC movement training program can be a good movement experience for children with developmental coordination disorder with appropriate training opportunities. Therefore, it is suggested to be used by schools to develop motor skills in children (10). One study showed that cognitive-motor exercises improve motor skills in children with ADHD through strengthening the cognitive-motor system infrastructure (11). There is evidence that the SPARC Motor program can improve motor skills in mentally retarded children (12). It was highlighted in previous literature that 91 percent of children with autism are at lower inactive levels. Interestingly, girls were more inactive than boys and as they grew up, their physical activities had also decreased.

Moreover, the level of physical activity of these patients has a negative relationship with the severity of their disorder in cognitive-sensory awareness. Also, their level of physical activity with their overall severity of disorder. Ultimately, their age, gender, and cognitive-sensory awareness are predictors of their level of physical activity (13). Given that children with ASD prefer oral hearing to verbal stimuli. Using music with various rhythms and non-verbal communication makes it possible to have an effective relationship with these patients due to the sensory integration in rhythmic movements (14). Children with ASD show abnormal and repetitive abnormal responses to olfactory and auditory stimuli and other abnormal stimuli. Therefore, their response to different sensory stimuli may not be coordinated with other individuals who will cause irregularities and even harassment (15). Using techniques such as music therapy that develops sensory-motor skills can improve social behaviors, intelligence and grammar in these patients. This inevitably helps them avoid stereotypical behaviors of patients with autism disorder (16). It has been shown that children typically develop a sensory-motorized game, then move on to functional games and then play a symbolic or imaginative role for behavioral development all of which increases their perceptions of their surroundings (17). Health problems associated with the lifestyle of children with ASD is much higher than those without growth defects. Similarly, obesity and overweight are more common in autistic children than in their normal peers, so these children need to be much more physically active than healthy people (18). Therefore, considering the importance and necessity of the issue, the present study aimed to investigate the effectiveness of sensory integration approach on improving the level of daily physical-motor activities of autistic children in Shiraz.

Methods

This descriptive study was carried out in 2017. The study population included students with autism spectrum disorder who were then studying in district 1 educational and training centers of Shiraz. They were put within the framework of children with autism spectrum disorder based the inclusion criteria of (ADI-R) diagnostic test and diagnostic interviews. The sample population of the study included a combination of 20 nursery school and primary school first and second graders who were selected using randomized and availability sampling method. The subjects went through 12 sessions of (for 60 minutes) therapeutic interventions for sensory integrity (based on sensory diet and sensory atmosphere). In the end, the results of the pre-test and post-test data were analyzed through performance analysis based on non-parametric data via Wilcoxon test ($p \leq 0.05$). The materials used in this study were: 1- Parents' and teachers reporting form on the level of physical activity. In this study, the level of students' physical activity in day-to-day, organized and professional activities and their proficiency in simple skills during general activities were set up as observation records (health registration form prepared at Daftaresalamat Research Center). The questionnaire was based on the metabolic categorical (MET) questionnaire and included 9 levels of activity from sleep and rest to severe activity. Considering the problems of autistic children, general and organized activities were set as the early activities. The parental observations were classified at three levels of weak (less than 1.5), moderate (1.5 to 3) and good (between 3 and 6). Physical activities either at the ordinary and daily level of activities (eating, dressing and walking) or at the organized level of activities (working on computer and doing homework) and motor capabilities for doing simple errands (learning simple motor activities, etc.) were evaluated as being weak both from the teachers and parents point of view. The validity of the questionnaire was

compared and validated using accelerometry and weekly recording of physical activity (19). 2. Special evaluation form for gross motor ability: In this study, this revised form was used to identify the development of motor skills in 3 to 11 year-old children. Moving skills (running, sprinting, hopping, jumping, Bouncing and gliding), balance skills (climbing up, sliding and balance on the board) and kinetic skills (jumping from height on both legs and over hurdles) were analyzed altogether (20). Sensory assessment (Obtaining information about the senses required to be taken into consideration and reinforced) was performed based on the various aspects of sensory integration disorder that affect the child's performance environment. It was outlined in Dunn's Evaluation Form (2000) which includes all senses. Dunn's Evaluation form classifies children with autism disorder into the following 3 categories; high-sensitivity, low sensitivity and sensory finder (21). Sensory diet includes special activities that teach the brain and develop the neural system. These activities regulate the nervous system. Relaxed exercises are among the activities that are suitable for people with high levels of consciousness and people with slow sensory responses. Sensory interventions are determined based on the degree, nature and extent of developmental problems in children. For Creating and using timed sensory chamber, one of the sensory problems of children with autism is that the intensity of their reactions to environmental stimuli lacks adequate and appropriate balance which causes sensory accumulation and saturation. As a result, creating a safe physical environment with suitable floor coverings, lighting and sound (noiseless) together with soft fixtures such as blankets and surfaces with different texture for sensory control can relaxing subjects and control them as long as they are aroused by problems. The vestibular stimulation exercises play important roles in maintaining muscle tone, movement

coordination and vision. There is also a lot of ways for Vestibular stimulation. The cases that were used in this study were: rotation: rotation should be done once or twice a day with 5 rotations in each direction. Using gaming equipment (Swings, teeter tatter, horizontal Merry-go-round with suitable height and vertical carvings, tunnels and hanging from bars) Swivel chair (the child is put on a chair that can be rotated easily and from 10 to twenty rounds (while the direction is alternatively changed). Walking on the equilibrium railing (a fence with a height of 15 to 25 centimeters, a width of 20 to 30 centimeters and a length of about two meters. The work continues from walking step by step until the subject gains independence in walking). Sensory-motor exercises refer to children's motor plans, since the initial perceptual-motor development occurs during nursery and primary school years. Sensory motor activities are associated with a student's problem to combine his senses with proper motor activities. Systems include Atrial sensory systems (sensory balance and position status), tactile system (skin sensation), and the auditory system (auditory sense), the deep perception system (sensation in muscles and joints) and the visual system (sight). The present study was conducted on the basis of sensory integration approaches (sensory diet and creating sensory atmosphere) in 12

sessions (for 60 minutes) with individual and group therapy programs in these children.

Results

The first rsearch qestion was “Does treatment of sensory coherence improve the level of daily physical activities of children with autism spectrum disorder?”. This question is answered based on non-parametric data via Wilcoxon test. According to Z value which is significant in less than 0.05 error level, it can be said that there is 0.95 statistical differences between the viewpoints of parents and teachers regarding the level of activities before and after intervention. So that treatment of sensory coherence improves the level of daily activities of children with autism spectrum disorder. The second research question was “Does treatment of sensory coherence improve the level of motor skills of children with autism spectrum disorder?”. This question is answered based on non-parametric data via Wilcoxon test. According to Z value which is significant in less than 0.05 error level, it can be said that there is 0.95 statistical differences between the viewpoints of parents and teachers regarding motor skills before and after intervention. So that treatment of sensory coherence improves motor skills of children with autism spectrum disorder (Table 1 and 2 and Figure 1 and 2).

Table 1. Wilcoxon test for determining the impact of intervention on daily activities of the subjects

From the viewpoint of teachers	From the viewpoint of parents	Source
2.33	3.05	Z value
0.02	0.002	Significance level

Table 2. Wilcoxon test for determining the impact of intervention on motor skills of the subjects

Simple and skipping motor skills	Balance and equilibrium motor skills	Basic motor skills	Source
2.64	3.32	2.44	Z value
0.008	0.001	0.01	Significance level

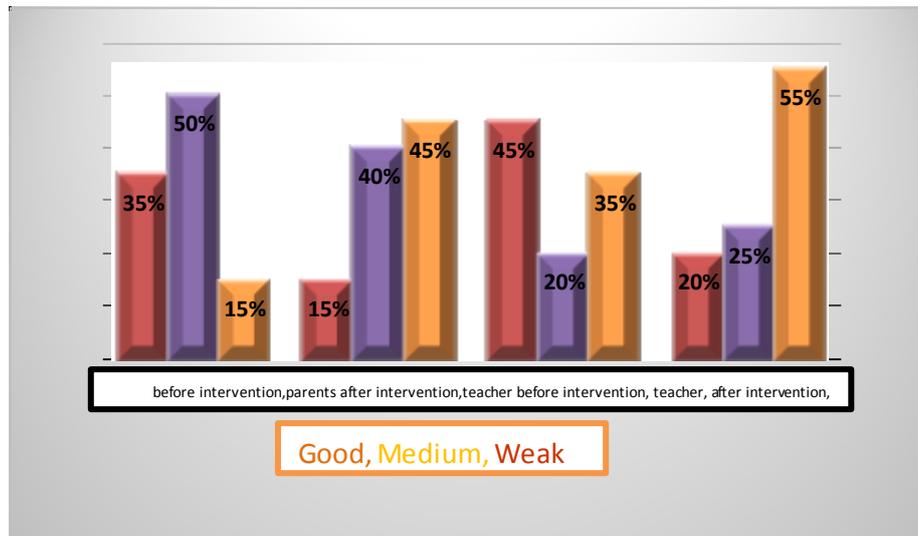


Figure 1. Physical daily activities from the viewpoint of parents and teachers before and

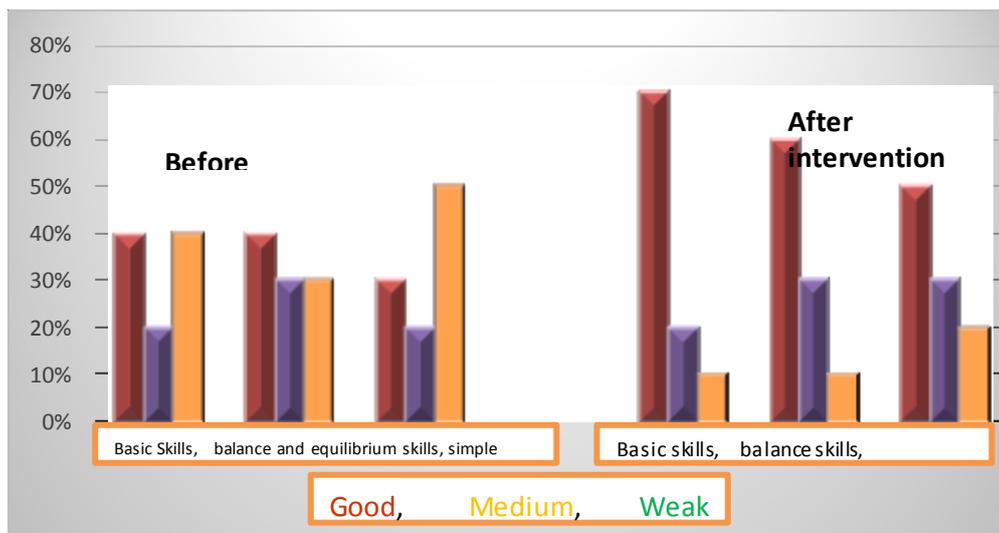


figure 2. Level of children's motor skills before and after intervention

Discussion

The results of this study showed that sensory integration intervention can improve and enhance daily activities, organized activities, motor abilities, basic skills and balance skills in children with autism spectrum disorders. However, it did not have an effect on improving their simple kinetic skills. The result of this study was similar to the study conducted by Hosseinzadeh *et al.* (19). The research findings emphasized a sensory

information processing disorder in children with high-functioning autism which reduces their participation in daily life activities as a result. No correlation was found between the sensory information processing and the rate of participation in children with autism and normal children which could be due to the presence of children with high-functioning autism (20). There is a significant difference between the mean scores of normal children and children with autism in 7 components of

sensation, agitation, low muscle tolerance, mouth sensory sensitivity, disregard, distraction, sensory impairment, subtle movements and perception. According to the obtained coefficients, it can be concluded that sensory and inactivity components have the highest correlation with behavioral problems in children with autism (21). Multivariate analysis of variance showed a significant difference between the two groups of children in motor performance patterns. It can be concluded that normal children have a higher rate of motor performance patterns. This leads to important suggestions in the area of education and mental health of these children. On the one hand, motor activity patterns play a key role in children's success (22). Mental impairment, anxiety and behavioral problems can cause sleep disorders in children with. On the other hand, proper sleep patterns and physical activity can improve sleep disturbances. Understanding sleep, factors affecting sleep, sleep problems and their treatment can be effective in improving sleep in these children (23). Learning motor movements after exercising with one limb is transferred to the limb of the other side. Due to defects in Corpus Callosum in people with ASD, learning from left hand to right hand and vice versa is normal in children with ASD (24). Motion dysfunction is a hallmark of Autism and Asperger. The lack of explicit motor learning and its consolidation in patients with autism spectrum disorders can be due to malfunctioning in the left hemisphere which affects explicit learning. This explicit motor learning impairment is an emphasis on motor disorders in people with ASD (25). Various studies have shown that audiometry systems play a role in selective attention. The findings of this study indicated that the activity of audiometry system in children with autism had decreased compared to normal children (26). Learning motor sequences that result in complex motor skills and even gestures in normal people is largely impaired in children suffering from autism disorder (27).

Consistent with the results of the study by Ahmadi and Safari's, it was shown that sensory motor training improves motor skills in children with autism (28). Additionally, Khodabakhshi and Abdie's studies also highlighted the effect of sensory integration therapy on social interactions and auditory performance in children with autism (29). In addition, a study by Pyfer *et al.* showed that sensory integration therapy improves disorder symptoms in children with autism (30). In a study by Long, the autism-related treatments were compared and it was shown that among 25 studies, three studies examined the effective role of sensory integration therapy, 8 studies had investigated the effectiveness of combined therapies and 14 studies indicated the ineffectiveness of sensory integration therapy in the treatment of autism (31). Consistent with the results of this study in a study by Dumas *et al.*, It was shown that sensory integration therapy improves disorder condition in teenagers (32). In a study by Smith *et al.*, it was shown that using sensory integration therapy had improved the disorder condition in children with autism (33). Watling *et al.*'s studies also confirmed the efficacy of Iaser's integrated approach to the treatment and improvement of the condition of preschool children with autism, especially in behaviors such as compliance, social interactions, eye contact, and vocalization (34).

Conclusion

The results of this study showed that sensory integration treatment improves daily organized and motor ability of children with autism disorder. In addition, this therapy improves basic as well as balance skills at the same time and the lower effect of this therapeutic approach in improving kinetic skills was probably due to the need for more treatment sessions.

Ethical issues

Not applicable.

Authors' contributions

All authors equally contributed to the writing and revision of this paper.

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References

1. Boyd BA, McDonough SG, Bodfish JM. Evidence- based behavioral interventions for repetitive behaviors in autism. *J Autism Dev Disord.* 2012; 42 (6): 1236-1248.
2. Ahmadi A, Beh- Pajoo A. The efficacy of sensorimotor exercises on motor, social interaction, and communication skills and stereotypic behaviors of children with autism spectrum disorders. *J Res Behav Sci.* 2016; 14 (2): 219- 228.
3. Nesaeyan A, Kazemi F, Pishyare E, Hashemi Azar J, Farrokhi N. Sensory processing patterns of autistic children from teachers' point of view. *JNKUMS.* 2013; 5 (3): 653- 661.
4. Ahmadi Kahjoogh M, Farahbod M, Soortigi H, Rassafiani M. Sensory processing patterns in children with autism disorder from winnie dunn's perspective. *JOEC.* 2011; 10 (4): 385- 393.
5. CarolineA. Sensory processing disorder, to what extent does sensory integration affect learning? available. *J Am Occupational.* 2013; 5 (12): 224- 255.
6. Thompson SD, Raisorv JM. Individualizing in early childhood: the what, why, and how of differentiated approaches, meeting the sensory needs of young children. *J Natur Envir.* 2013; 11 (2): 55- 65.
7. Bahram ME, Assarian F, Atoof F, Taghadosi M, Akkasheh N, Akkasheh G. Effect of a 12-week interval running program on female primary school students with ADHD. *Feyz J.* 2014; 18 (2): 151- 158.
8. Rajabi F, Namazizadeh M, Badami R. The effect of basic gymnastics exercises on movement skills of children with autism disorder. *J Motor Behav.* 2015; 8 (7): 73- 87.
9. Keyhani F, Kosari S. The effect of a period of physical activity on the development object control skills in high function autism children's (HFA). *J Motor Behav.* 2015; 8 (6): 103- 116.
10. Jokar Tang Karami S, Sheikh M, Jamshidi A. The affection of a period of selected exercising program on improving manipulative skills in children with developmental coordination disorder (CDC). *J Motor Behav.* 2015; 8 (6): 15- 30.
11. Shahbazi S, Khazaei AA, Aghdasi MT, Yazdanbakhsh K. Effectiveness of perceptual – motor training on motor proficiency children with hyperactivity disorder. *MRJ.* 2016; 9 (S2): 51- 59.
12. Faal Moganloo H, Hosseini F, Mikaili Manee F. Effect of spark motor program on the development of gross motor skills in intellectually disabled educable boys. *J Birjand Univ Med Sci.* 2013; 20 (3): 262- 270.
13. Ghaheri B, Sheikh M, Memari AH, Hemayat Talab R. Investigating level of daily physical activity in children with high functioning autism and its relation with age and autism severity. *J Arak Uni Med Sci.* 2013; 16 (8): 66- 77.
14. Lang R, Machalicek W, Rispoli M, Reilly MO, Siagoofs J, Lancioni G, et al .Play skills taught via behavioural intervention generalize, maintain, and persist in the absence of socially mediated reinforcement in children with autism. *Res Autism Spec Dis.* 2014; 8 (2): 860- 872.
15. Green SA, Jeffry D, Natalie L, Jeffry J, David S, Leanna H, et al. Overreactive brain responses to sensory stimuli in youth with autism spectrum disorders. *J Am Academy Child Adolescent Psych.* 2013; 52: 1158- 1172.

16. Schwartzberg ET, Silverman MJ. Effects of pitch, rhythm, and accompaniment on short- and long-term visual recall in children with autism spectrum disorders. *Arts Psychother.* 2012; 39 (4): 314- 320.
17. Christensen L. Play and developmental outcomes in infant siblings of children with autism. *J Autism Dev Dis.* 2010; 40 (8): 946- 957.
18. Foss- Feig JH, Heacock JL, Cascio CJ. Tactile responsiveness patterns and their association with core features in autism spectrum disorders. *Res Autism Spect Dis.* 2012; 6 (1): 337- 344.
19. Hosseinzadeh K, Niknami S, Hidarnia A. Measurement and comparing school children physical activity with two methods of self - and parent reports. *J Health.* 2015; 6 (3): 304- 312.
20. Ghanbari S, Valipour M, Heydari F, Pourzamani Z, Jamali AR, Nemat Allahi S. Correlation between sensory processing status and the participation of normal and autistic (normal intelligence) school children in daily living activities. *J Rehabil Med.* 2017; 7 (1): 71- 76.
21. Dehghan F, Mirzakhani N, Alizade zarei M, Soleimani M, Sartipizade M. Relationship between sensory processing and behavior problems in children with high-functioning autism. *J Rehabil Med.* 2015; 4 (2): 19- 28.
22. Eslamdoost Nafuti M, Rezaee M, PashazadehAzari Z, Akbarzadeh- Baghban AR. Comparison patterns of motor function in high function autistic children and normal 7- 12 years. *J Rehabil Med.* 2016; 5 (2): 96- 105.
23. Ayazi R, Mirzakhany N, Rajaei S, Khalatbari J, Mohhammad Cheshme Gol SV. Sleep in children with autistic spectrum disorder. *J Rehabil Med.* 2017; 6 (1): 226- 233.
24. Izadi Najafabadi Nejati V, Mirzakhany Araghi N, Pashazadeh Azari Z. Intermanual transfer of motor learning in children with autism spectrum disorder. *Horizon Med Sci J.* 2013; 19 (2): 97- 103.
25. Izadi- Najafabadi S, Nejati V, Mirzakhany- Araghi N, Pashazadeh- Azari Z. Motor impairment in children with high-functioning autism and Asperger: evidence of motor sequence learning. *Feyz J.* 2013; 17 (1): 91- 99.
26. Delphi M, Bayat A, Delphi V, Ryahi F. Evaluation of auditory efferent system function in children with autism. *J Shahrekord Univ Med Sci.* 2013; 15 (4): 45- 53.
27. Gidley JC, Mostofesky SH. Evidence that the pattern of visuomotor sequence learning is altered in children with Autism. *Autism Res.* 2008; 1 (6): 341- 353.
28. Ahmadi J, Safari T, Hemmatiyan M, Khalili Z. Effectiveness of applied behavioral analysis approach on symptoms of autism. *J Res Behav Sci.* 2012; 10 (4): 292- 300.
29. Khodabakhshi M, Abedi A, Malekpour M. The effect of sensory integration therapy on social interactions and sensory and motor performance in children with autism. *Iranian J Cognition Edu.* 2014; 1 (1): 35- 45.
30. Pfeiffer BA, Koenig K, Kinnealey M, Sheppard M, Henderson L. Effectiveness of sensory integration interventions in children with autism spectrum disorders: A pilot study. *Am J Occup Ther.* 2011; 65 (1): 76- 85.
31. Lang R, O'Reilly M, Healy O, Rispoli M, Lydon H, Streusand W, et al. Sensory integration therapy for autism spectrum disorders: A systematic review. *Res Autism Spect Dis.* 2012; 6 (3): 1004- 1018.
32. Doumas M, McKenna R, Murphy B. Postural control deficits in autism spectrum disorder: the role of sensory integration. *J Autism Dev Dis.* 2016; 46 (3): 853- 861.
33. Case- Smith J, Bryan T. The effects of occupational therapy with sensory

- integration emphasis on preschool-age children with autism. *Am J Occup Ther.* 1999; 53 (5): 489- 497.
34. Watling RL, Dietz J. Immediate effect of Ayres's sensory integration-based occupational therapy intervention on children with autism spectrum disorders. *Am J Occup Ther.* 2007; 61 (5): 574- 583.