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Sensory Motor Development in Autism

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1. Introduction

Autism is a syndrome that emerges in the first three years of life and is defined by a pattern of qualitative abnormalities in reciprocal social interaction, communication, and repetitive interests and behaviors. One of the characteristics which is most noticeable in those young children with autism who remain severely intellectually disabled is their propensity to engage in repetitive self-stimulatory actions, such as rocking, twirling objects or flapping their hand and finger. These actions appear to have no constructive use other than to provide some sensory stimulation (Attwood, 1993). Sensory and motor abnormalities commonly found in autism. These abnormalities have been described in the perception of sound, vision, touch, taste, and smell, as well as kinesthetic and proprioceptive sensations. These include reports of both hypo and hyper responsiveness to sensory input, raising the possibility that two groups of sensory responders may exist within the autism spectrum.

Comparing children with autism and children with other developmental disorders have concluded that prototypical developmental profile for children with autism is one of motor skills that are relatively more advanced than social skills, even when all delayed. Early hand-eye coordination significant predicted later vocational skills and independent functioning, while earlier fine motor skills predicted later leisure skills. Also motor development plays an important role in learning young children typically use motor skills to explore the environment, engage in social interaction, engage in physical activities, and develop basic academic skills. Unusual sensory responses are common concerns in children with autism. Given that most educational environment involve many sensorial demands, such as: noise level in classroom (O'Neill & Jones, 1997; Dawson & Watling, 2000).

These problems make the life of the child and his/her family more difficult and they prevent the child from learning new skills and having interaction with the environment. In solving sensory problems, it is important to support autistic children in gaining different sensory experiences. Sensory integration therapy program is important children with autism. Because the sensory integration therapy provides a child-centered and playful approach that is often appealing to even the most unmotivated or disengaged child (Case-Smith & Brayn, 1999; Fazlioglu & Baran, 2008).

This chapter will focus on sensory and motor development in autism, which are aimed at determining sensory problems that characterize the disorder. In addition, this chapter will comprehensive sensory integration therapy approaches, given the intensity and importance of these intervention in treatment planning.

2. Definition and development of sensory integration

Sensory integration theory was developed by Jean Ayres during 1970s. The aim of this theory is to stimulate specific locations of the body in order to ensure coordinated function of sensors. Ayres developed this theory in an attempt to better explain the relation between the sensory process, neural functions and behavior. Sensory integration treatment is used for children with autism as well as those with hyperactivity, cerebral palsy and premature birth (Fisher & Murray, 1991; Kranowitz, 1998; Bahr, 2001).

Sensory integration is a neurological process which compasses the analysis, synthesis and organization of the data received from the body and the environment. Sensory integration takes place in central nervous system. Sensory integration takes role in developing body perception, selection of concurrent stimuli, and the ability to act in convenience with the environment. Sensory receptors receive all the data from the body. Data flows through the sensory neurons in the central nervous system. Brain promptly analyses, collates associates and integrates the respective sensory signals through neurologic processing. Consequently, motor neurons send a signal to the brain. The body gives a sensory motor response to the signal. For instance; when someone says "I love you", vocal response is "I love you, too" whereas the emotional response is euphoria. Normal child is born with a perfect sensory system. Sensory integration mechanism in childhood continues through lifetime (Kranowitz, 1998).

It develops through new activities in daily life, experimenting, effort and exploring the environment. Each new piece of experience stirs the sense of achievement in the child. Developmental mechanism of sensory integration does not change and the development is constant. An example for the development of sensory integration may be a building. First, the foundation of the structure is laid which is followed by the construction of the first, second, third and fourth floor respectively. Constitution of the sensory integration is similar. Dr. Ayres defines the integration mechanism in four levels:

First Level: This level constitutes tactile, balance and movement (vestibular), deep sensory (proprioceptive), visual and auditory sensory. Babies begin to show interest in sensorial information as of second month therefore forming a basis for future learning skills. In this period, initial informative is the skin. Touch stimulus produce a fine feeling on the skin and around the mouth. The child is delighted with sucking. As a result, a strong bond is formed between the mother and the child. Thus, the baby learns to eat, hug, friendship and positive reaction. The baby is informed about vestibular and proprioceptive sensories through movement. The baby predicts and imitates the mother's facial expression with immature visual expression, beginning to develop movements including eye movement. At this time, the baby starts to recognize close objects, learns to follow the movement of his/her relatives and gains the feeling of trust in them. In the absence of the guidance of these sensories, it is difficult for the child to focus eyebeam, follow or move an object (Temel, 1992). Vestibular and proprioceptive sensories also influence the posture and muscle tone. Baby's actions in this period are automatic and situation-based. The child learns new movements. Vestibular sensations are instrumental in attaining the skill of feeling safe against the gravity by the muscles and joints. The baby learns to establish connection with the surface when lying and crawling. Therefore, the child feels safe.

Second Level: Tactile, vestibular and proprioceptive functions are essential in obtaining sensorial balance. In the emergence of distortion in the functions of these three systems, the child may provide insufficient reaction to the environment. In connection, the child may be

observed to stage hyperactivity or introversion (Temel, 1992). Body perception (body awareness) consists of bilateral coordination of the body, hand preference (laterization) and motor planning (praxis). As of the first year, after achieving integration of the simple sensations in the first level, body perception and awareness start to develop. Body perception is the intellectual image of the position of body parts. Visual reactions assist in understanding how body parts move and their interactions with each others as well as developing a sense of self-identity. Developing body awareness enables bilateral integration. In this process, the child learns to use both sides of the body symmetrically. Bilateral integration is a neurologic function essential for developing bilateral coordination and behavioral skills. For instance; baby needs to develop bilateral integration in order to be able to swing or hand over the rattle.

Another function of bilateral integration is hand preference (laterization). Laterization is the detection that one side of the brain is favored. As laterization develops, the child begins to determine which hand is favored. The baby is then able to distinguish which hand is preferred. For instance, the baby may swing the rattle with one hand, while playing with his/her toes with the other hand. The child's body and neck rest above against the gravity. As head control develops, the baby's head rises and rotates around the body. Stabilizing the neck assists eye fixing. As a result, the child acquires the ability to gaze and inspect. First, the baby starts to creep, then crawls. Hands and legs act in coordination. The baby uses both sides of the brain while these movements stimulate the development of bilateral coordination, developing tactile, vestibular and proprioceptive sensories and motor planning (praxis).

Before engaging in a movement, the child thinks about how to do it. Afterwards, the baby actualizes the movement impulsively. For instance; development of motor planning is necessary for the child to roll on the ground. At first, the child practices turning and is able to roll without much effort afterwards. Thanks to the organization of the sensories, the child's activity level is better collated. Focusing duration and emotional intrepidness increases. In this period, the child may sit on the car seat and is able to distinguish between family members and foreigners.

Third Level: Sensory integration is a sustained and continuous process. Each level of integration enables the use of previous level (Temel, 1992). As the child grows, perception and understanding of the information received through the senses reaches higher levels. Expansion of the baby's environment urges the organization of sensory perception and distinguishing skills. In this level, the child has developed the ability to follow a speech completely and understand the language. Listening to a language user is the key skill in developing the ability to speak and understand the language. Hearing and language center of the brain is assisted by the vestibular system as to what is heard. Therefore, a problem in the vestibular system may lead to deficiencies in language development. Sensory integration disorder may prevent the child from feeling the position of the tongue inside the mouth as well as lip movements. Similar to speech and language, visual perception is a product of early sensory integration (Temel, 1992). In this period, visual senses convey significant importance. During this stage, the child has developed the ability to interpret visual input, understand people's and object's position in the space as well as eye-hand coordination. The child can use paints, produce simple drawings, catch a ball or pour juice into a glass. Development of eye-hand coordination contributes to the development of visual motor integration. As an example, we may point to the child's ability to place jig-saw pieces. At the age of three, the child's simple skills continue to develop and improve. The child is then ready to build a structure made of blocks.

Forth Level: The latest product of sensory integration is the academic skills. These include complex motor skills, organizing focus, organizing behavior, specialization of both sides of the body and the brain, visualizing an event, developing self-identity and self-control. These skills develop in time. Reaching the age of six, the child's brain is sufficiently proficient for such skills. Proficiency refers to the brain attaining greater efficiency in special functions while being potent and purposeful. In this level, the child's eyes and ears stand as primary teachers. Also, the child has organized the ability to distinguish concerning the touching sense.

Proprioceptive, vestibular and touching senses assist the development of motor coordination. In this period, the child can jump, run and play games with friends. The child can also button up, pull zipper and may use on hand more than the other. The child can also copy shapes and symbols using a pencil, may visualize past and future situations (for instance; we played football last night; I will have a bath tonight). Social skills are also developed in this period. The child can share ideas or toys with other people. Sensory integration is continually organized and structured throughout the life. When faced with exotic situations, the child learns to adapt and cope through sensible ways. The child holds positive feelings for him/herself and is ready for school attendance (Fisher & Murray, 1991; Kranowitz, 1998; Bahr, 2001).

3. Effects of sensory integration deficiency

Sensory integration deficiency (SID) is the inability to sufficiently perceive brain senses. SID is not considered as brain damage. This condition is named J. Ayres, "brain dyspepsia" (Royeen & Lane, 1991; Kranowitz, 1998; Bahr, 2001). The inability of the brain in processing sensory input sufficiently causes difficulties in effective management of behaviors. In cases when sensory problems are severe, the child may suffer from mental defects. Although sensory integration deficiency is a functional insufficiency, this condition does not mean total annihilation of the functions. Children with functional defects possess the same neuron count as healthy people, but the neurons cannot function cooperatively (Temel, 1992).

We may speak of four neurologic mechanism disorder considered to be related to autism in children with sensory integration deficiency. First of these is the deficiencies in registering and integration of sensory information (canalecstasia). Second are the problems concerning the proper transfer of stimulants to the right locations. The third one is anti-social behavior such as behavioral disorders and inability to initiate bilateral relations which are considered to be in connection with serotonin system disorders. The forth neurologic disorder observed in children with autism is the perceptual selectivity issue. The child may have difficulty in focusing on a specific point (Waterhouse *et al.* 1996). There are a variety of factors believed to cause sensory integration deficiency. These are:

First factor; it refers to the case when the brain has difficulty in responding to too much or too little sensory information. Excessive information input is called h*ypersensitivity*. In this case, aversion from the sensory stimulant may be observed. A low level of sensory information input is named *hyposensitivity*. In such cases, excessive self-stimulating may be needed.

Second factor; it is the neurologic organization disorder. In this case;

- Brain may not receive senses due to connection failure.
- Brain may receive sensory signals, but reception may be inconsistent.
- Brain may receive sensory signals consistently, but cannot establish the appropriate connection necessary to respond to other sensory signals.

The child's extraordinary answer to an ordinary question may reveal hypersensitivity, hyposensitivity or a combination of both. In case of hypersensitivity, the child may react with fear, irritability and protesting, negative, dissocial or introverted behavior. The child may be distracted by perceiving all the stimulants in the environment. Hypersensitive child feels disturbed when touched, avoids people and the environment. Changes in daily routine, crowd and noise are likely causes of anxiety. The child experiences difficulty understanding gestures during communication. The child may also have difficulty focusing on a purposed activity.

Recent research proposes that hypersensitivity may relate to cerebellum. Brain doesn't need the sensory signals from a movement to know the location of the body and the limbs. When limbs are moving, cerebellum predicts the consequences of the body movements and on this basis, sorts out sensory signals occurring from a touch to the body. For instance; while reaching out to grab an object afar, if we accidentally hit our other arm, we feel no anxiety or fear. In this moment, cerebellum determines the cause of the action as self or external based on predicting the results of previous motor action. It is predicted that faulty movement interpretations of sensory signals by cerebellum may be the cause of hypersensitivity (Fuentes & Bastian, 2007). In research conducted on autistic individuals, consistent cerebellar damage and Purkinje cell loss was observed which is supportive of this prediction (Bauman & Kemper, 2005).

In hyposensitivity, the child need more stimulants even to develop simple skills. Hyposensitive child is prone to touching and feeling.

Children may not demonstrate all these symptoms. For instance; the child may have a vestibular disorder while having a fine muscle tone. The child may also carry symptoms of the above mentioned disorders but may not be SID. The child may simply be undergoing emotional problems. A child may be both hypo and hypersensitive. For instance, a child may be oversensitive for a soft touch while he/she will not cry when receiving an injection (Royeen & Lane, 1991; Kranowitz, 1998; Talay-Ongan & Wood, 2000).

This factor; it is the motor, language, sensory product deficiency. Brain is inefficient in processing these signals. Therefore, it is more difficult to receive feedback. In connection with insufficient feedback, difficulty in looking and listening, failure to focus on people and objects, difficulty in processing new information, memory problems, and difficulty in learning and bilateral interaction with people will be observed.

Although sensory integration disorder has a genetic background, it is also believed that air pollution, devastating viral infections as well as chemical wastes taken into the body may cause these functional disorder (Temel, 1992). In some cases, sensory integration problems are seen intensively. These cases are:

- Autism,
- Attention deficit hyperactivity disorder,
- Difficulty in learning,
- Hearing and language problems,
- Articulation disorders,
- Visual problems,
- Nutrition problems,
- Sleeping disorders,
- Allergies.

Sensory have to function cooperatively. It is crucial that the brain receives balanced and systematic information (a well-balanced diet). Brain feeds on the functioning of many

sensories. Dr. Ayres points to three important body-based sensory systems. These are tactile, vestibular and deep (proprioceptive) sensories. These sensories convey important tasks for the healthy development of a child. The functions of these sensories can be divided into three categories;

1. *Proprioceptive sense:* It is the processing of the information concerning the body position and body parts. It contains information relating to movement positions received from the muscles, joints and bonds. Proprioceptive stimulants are followed by motor response such as stimulation or inhibition.
2. *Surface sense:* Information of touch, heat, pressure and pain is seized by receptors localized in the skin. Information concerning surface sense is transmitted to corresponding areas of the central nervous system.
3. *Cortical sense:* An example for the cortical sense is the ability to recognize 3D objects by touching (stereognosis). If the child has developed stereognosis, he/she can figure out the surface shape, size or solidity of an object (Kayihan, 1989; Royeen & Lane, 1991; Kranowitz, 1998).

4. Sensory problems in autistic children

Autistic children experience a variety of problems.

4.1 Auditory problems

Autistic children may show complex reactions to sound while showing no reaction to some sounds during early childhood which leads their parents to believe that the child has hearing impairment. Children with autism may seem unable to hear. In some cases, the child may not even react to his/her own name. In light of the research conducted on this subject, it was found that autistic children cannot separate sounds in noisy environments and are disturbed by it. During the hearing tests conducted, it was revealed that autistic children possess a normal hearing ability while experiencing problems perceiving complex sounds such as speech. Children with autism do not pay attention to the speech language. They can express their wants through mimics and objects. Auditory problems in autistic children are related to speech tone and pitch (Miral *et al.,* 1994, Grandin, 1996a).

As a result of the hearing tests conducted; peripheral hearing impairment may be detected in some children, though it is generally seen that these children have no organic problems with their hearing ability (Klin, 1993). However, autistic children may fail to react to some sounds as they are not sufficiently sensitive to environmental sounds stimulants. Auditory reactions may manifest as being irritated in crowd and blocking ears in the presence of high levels of sound. In a study conducted by Rosenthall et al., hearing ability of 199 adults (153 male, 46 female) was evaluated. 7.9% of the test group showed mild hearing impairment while 1.6% had hearing problems in one side and 3.5% had hearing issues on both sides. Consequently, it is observed that hearing impairment is uncommon among autistic children (Rosenthall-Malek & Mitchell, 1997).

Autistic children may be easily irritated by high levels of sounds and stressed out by strong sound tones. Therefore, they may refuse to be present in noisy environment. In connection with extreme sensitivity to sound, autistic children may have difficulty in following intentional instructions. These children experience difficulty in oral communication which may restrain them from following simple commands which may lead to communicative

problems (Attwood, 1993; Piggot & Anderson, 1993; Kavon & McLaughlin, 1995; Bettison, 1996; Hughes, 1996; O'Neill & Jones, 1997; Duchan, 1998; Grandin, 1998; Huebner & Emery, 1998; Koegel *et al.,* 1998; Gresham *et al.,* 1999; Mudford *et al.,* 2000; Anonim, 2003; Fazlioglu, 2003).

4.2 Visual problems

Some autistic individuals experience severe visual disorder. Most of autistic individuals, who cannot speak, may pretend not to see in different environments. Visual problems are caused by visual disharmony and color separation disorder. These individuals experience difficulty in spotting objects with darker colors. In addition, they may not be able to recognize shadows. Their vision may be compared to a TV with static. They also experience problems in perceiving visual signals. In autistic children, eyes and retina usually function properly. These individuals can succeed in visual evaluation tests. Their problem results from the failure to transmit visual input to the brain (Attwood, 1993; Grandin, 1996a; Senju *et al.,* 2003).

Although children with autism do not look at human face and many objects in their environment, it is known that they may view moving, rotating or shiny objects for long times. It is observed that some are irritated by light and feel more comfortable in dark rooms. It is also known that some autistic children may cover their ears when encountering light and covering eyes in the presence of high levels of noise. Visual problems in autistic children manifest as weak eye contact, sideway looking, blinking and light irritability (McConachie & Moore, 1992; Wainwright-Sharp & Brayson, 1996; Mitchell, 1997; Case-Smith & Miller, 1999).

Research conducted on controlling attention when executing an action shows that autistic children have limited skills in utilizing information received from the stimulants as well as focusing on a single determinant in selecting a stimulant. A number of researches conducted over the issue of over-selectivity revealed that mental age in autistic individuals is influential in the ability to select a stimulant from a specific distance. Autistic individuals can focus attention on a single, narrow area by distinguishing only one attribute of the stimulant in the process of determining the color and form of the stimulant in the space. This attribute is called "tunnel vision" in autistic children. In relation with this, it is prominent that failure to focus attention on a single subject and inability to focus quickly on a new subject are observed effects of this disorder (Rincover & Ducharme, 1986; Martineau *et al.,* 1992; Waterhouse *et al.,* 1996; Belmonte, 2000).

4.3 Tactile sensory problems

Tactile system is a necessary skill in daily life which ensures protection from danger and distinguishing the differences between the objects. The first of these skills is the touch sense. Normal child learns tactile individuation on the basis of how environmental elements feel. The child begins to recognize the world by feeling the warm touch of the mother, lightly grown firm beard of the father and the sound of pebble stones when walking. Children with sensory integration disorders experience difficulty in focusing on the varying attributes of people and objects as well as distinguishing between them. These children avoid touching to the point that it is possible. Since their palms are over-sensitive, they tend to inflect their fingers. Although they want to touch objects to learn, they cannot distinguish between their visuals. Thus, these children cannot develop fine senses since they cannot attain experience

through tactile sensory. Movement and touching are the first teachers for a child. If the child is having problems with tactile sense, it may not be possible for them to learn through touching. Most of these problems affect the child's academic success and language development (Kranowitz, 1998).

Tactile senses allow the child to subconsciously realize body parts and their interactions with each others. The child will develop fine body awareness when tactile senses are functioning properly. Acquisition of body awareness will allow the child for easy and intentional movement. The child will know what the situation is about, as well as what he/she should do about it. In cases where the disorder manifests, the child will undergo various difficulties. For instance; the child may have difficulty directing limbs when getting dressed (Kranowitz, 1998).

Motor planning is a prerequisite for all the new movement abilities. The child will plan his/her movements with an intentional effort, will learn to successfully perform the move through continuous practice. Therefore, the child's tactile sensory is integrated. For instance, the child may feel the gymnastic ladder through hands and feet and may successfully climb it. The more objects the child discovers and touches, the better he will fare in executing different body movements, motor planning and motor skills. Attaining proficiency in a motor skill enables new experiments. For instance, after successfully climbing the ladder the child may use this skill for climbing and skinning down a tree. Children who are vulnerable tactile sense may experience dyspraxia. Dyspraxia is one of the sensory processing disorders caused by inability to coordinately execute movements. These children may not be able to execute the movement or will experience difficulty in organizing or planning the movement. Thus, they tend to avoid activities necessitating motor planning. Children with tactile disorder may develop gross motor skills late. They may also fail to learn movements and play purposeful games (Kranowitz, 1998).

Children will also experience difficulty in using simple tools (such as scissors, paint brush, fork and spoon). They also have difficulty in developing independent life skills (such as spilling food when eating). In addition, these children may have articulation issues. Since they have not matured linguistic skills, they experience insufficiency of fine motor control in the tongue and lips. Consequently, they tend to use signs rather than words (Kranowitz, 1998).

Tactile system accommodates an important role in the development of perception. Visual perception is the brain interpreting what is seen. The child will save the attributes and correlations of objects into his/her memory by touching. Therefore, most of the experience concerning tactile sense is also related to visual perception. When the child is unable to receive tactile stimulants, the brain cannot feed on basic information concerning the sense of touching, therefore experiencing difficulty in analyzing and interpreting tactile senses.

Tactile system is highly influential in child's learning skills in the school. Most objects in the world need to be hand operated (such as art materials, rhythm instruments, chalk, pencil). Tactile experience constitutes the foundation of the child's lifetime knowledge formation and guides the acquisition of new skills. Since they will avoid touching senses, children with tactile system disorder may experience difficulty in learning new skills (Kranowitz, 1998).

Tactile senses are essential in organizing relations with other people. It forms the foundation of the formation of the bond between the mother and child, touching others and enjoying being touched. When we are close to people, we learn how to communicate, how to play and how each individual's character differs from one another. Therefore, we can develop

meaningful relationships. If the child has tactile vulnerability, he/she may not respond to physical connection appropriately. Children with tactile system experience problems in socializing. They may send negative signals to the environment and fail to establish friendship. Thus, the child will prefer to be alone (Parush *et al.,* 1997; Kranowitz, 1998, Halker, 2001).

Tactile system disorder occurs when signals received through the skin are not sufficiently processed in the central nervous system. Children with tactile disorder may refrain from touching objects and people or being touched. These children cannot realize the difference between dangerous and pleasing situations. They may also have difficulty in distinguishing the physical attributes of objects. Children with tactile system deficiency may manifest one or more problems concerning tactile sense integration (Royeen & Lane, 1991; Kranowitz, 1998; Bahr, 2001).

Normally developing infant will react to the mother's touch or speech in form of voice or smile. In later months, the baby will lift arms to be cuddled. The baby enjoys engaging in human relations. However, autistic children reacting to being touched or cuddled refuse physical connection and avoid having relations with the environment. Although autistic children may provide various reactions to the sensory stimulants in their environment; it is revealed that they tend to use tactile and olfaction senses when recognizing a new object. It is observed that these children may hold, smell and sometimes bite or lick an unrecognized object to learn about it. Some autistic children enjoy touching, while others prefer to be touched. In some cases however, the child may strongly refrain from both. For some children, the mildest touch is enough to be scared. These children may be scared by soft touches while showing no reaction to painful situations. This kind of case is caused by a disorder in the body's self-anaesthetizing system which is called "opiate system". Some autistic individuals may strongly refrain from self-care activities such as hair cut, washing face, nail clipping along with wearing braided cloths (Grandin, 1996b; Kientz & Dunn, 1997; Korkmaz, 2000a).

4.4 Vestibular systemic problems

Vestibular system provides information about the individual's head and body location as well as their relation in the space. This system receives sensory signals from joints, eyes and body concerning movement and balance. These signals are sent to the central nervous system to be used. Vestibular system also provides information about whether the individual is moving or stable, movements of the objects and their relation to the body as well as the direction and speed of the individual's movement. Vestibular signal receptors are located in vestibular in the inner ear. These receptors record each movement and the changes in the position of the head. These receptors are stimulated by movement and gravity.

Dr. Ayres states that the gravity has a universal power in life and plays an important role in every movement. Receptors concerning gravity are responsible for a variety of tasks such as retaining stance, ensuring the reception of movements so as to enable sufficient movement and evading hazards by perceiving vibrations in the air. Vestibular and auditory senses contain movement and acoustic vibrations. Vestibular system is a consolidative system. Activities related to this system form a basis for other experience. If the vestibular system is not functioning properly, problems may present in the interpretation of other senses.

Vestibular disorder occurs when the signals from the inner ear are not sufficiently perceived by the brain. Children with vestibular disorder are inefficient in integrating information concerning movement, gravity, balance and space. These children are oversensitive or

insensitive to movement. They may also present both cases. These children may not develop postural response, may never crawl, or may be delayed from learning to walk. They may collapse on their seat and their head may fall on the hands when seated. In kindergarten activities, they will be clumsy, uncoordinated and gawky. They often fall down when walking, will hit the furniture and collapse when moving. Also, their eye movement is affected by the insufficiency of the vestibular system. In accordance they may experience visual problems. For instance, they may be inefficient in focusing sight on a moving object. These children may not develop the brain functions requisite for moving the eyes sideways. In line with this, reading issues may be observed.

Vestibular disorder may also cause difficulty in understanding a language. Linguistic issues may lead to problems in communication and learning to write and read. Children with vestibular vulnerability cannot calm down. The reason for this is the failure in the child's brain in utilizing vestibular signals properly. Children with vestibular systemic disorder experience a variety of problems concerning the integration of sensories (Fisher, 1991; Kranowitz, 1998; Bahr, 2001). These children;

1. May be oversensitive to movement. This case can manifest itself in two ways;
   - Failure to tolerate movement
   - Insecurity towards gravity.
2. May be insensitive to movement. They will have high tolerance to movement and desire to move.

Autistic children may demonstrate slow walking, unusual walking, shorter strides, increasing knee flexion as well as unusual upper extremity positions (Vilensky *et al.,* 1981). Children experiencing such difficulties may feel vulnerable when their feet are not on the ground. This insufficiency of basic sense causes the child to form gravitational insecurity. Gravitational insecurity is the abnormal reactions like stress or anxiety towards the possibility of falling. The movement is not fun, but scary for the child. When the child's head moves, he/she will respond as 'I am falling, 'I can't control myself'. The child reacts to this situation by avoiding or fighting back. The child may be nervous or angry and may avoid moving, may refuse to ride a bike or play with the slide. Children with similar problems frequently present emotional and behavioral problems. They continuously worry about falling down (Fisher, 1991; Kranowitz, 1998; O'Roidon, 2000; Bahr, 2001).

Vestibular system also provides information about how to stand. To remain standing, brain conducts a subconscious physical adaptation resulting in the balance, sustenance of this balance and easy movement. Children with vestibular systemic disorder present problems with balance and movement. It is observed that these children are uncoordinated and clumsy in activities that require movement (Gillberg, 1989; Fisher, 1991; Ghaziuddin *et al*., 1994; Miyahara *et al.,* 1997; Brasic & Gianutsos, 2000; Rinehart *et al.,* 2001; Korkmaz, 2003).

These children experience problems when rolling a football and pressing someone during the game. Their grip is weak and need to spend a lot of energy resisting the gravity. Autistic children do not develop and preference. They occasionally use right or left hand to eat, write or hurl an object. Bilateral coordination issues may cause the child to experience problems jumping from a high place using both feet, catching a ball with both hands and clapping. They may also have difficulty holding a paper fixed when writing or using a scissor with one hand. Bilateral coordination deficiency is commonly misinterpreted as learning difficulty (Fisher, 1991; Kranowitz, 1998; Ryoichiro *et al.,* 2000; Bahr, 2001; Dewey & Hauck, 2001).

Vestibular system is essential in processing the hearing. Children with vestibular disorder commonly present language development problems. These children may experience difficulty in recognizing the differences and similarities of words. They also have problems listening or following the instructions of the teacher. They may have drawbacks asking or answering questions. After developing movement skills, they begin to speak but cannot present a fine speech craft. When balance, movement and motor planning skills are organized, language and speech craft also draw attention (Fisher & Murray, 1991; Manijiviona & Prior, 1995; Kranowitz, 1998; Bahr, 2001).

Vestibular system is greatly influential in processing the visual input. Observing the environment, moving around and active participation to sensory experience practices are necessary to attain visual-spatial processing skills. Children with vestibular disorder may experience problems with visual spatial processing skills alongside basic visual motor skills since the brain cannot efficiently integrate the signals received from the eyes and body. For instance, they may confuse or mistype the words when reading or writing. They may also confuse symbols when doing mathematics (like writing "+" instead of "x"). The movements of people and object around him/her may restrain the child. The child may experience difficulty in activities like climbing a ladder, finding jig-saw pieces, sticking stars on a paper or picturing an event. The child may fail to find the way to school cafeteria or may run in the wrong direction when playing basketball. The child acts like lost in the space (Hughes, 1996; Kranowitz, 1998).

Vestibular system also plays an important role in motor planning. Motor planning (praxis), is conceptualization, organization and realization of complex and unrecognized movements. Adapting behaviors for learning new skills may be challenging for the child with vestibular disorder. For instance, these children can skate, but cannot ice-skate. If the central nervous system cannot sufficiently process signals concerning balance and movement, brain cannot figure out how to act in these conditions. Therefore, the child cannot learn the new skills for planning (Reiss & Havercamp, 1997; Rogers *et al.,* 2003).

Vestibular system also influences the child's emotional confidence acquisition. Every child possesses emotional confidence from birth. However, children with vestibular disorder cannot feel this confidence after birth. These children suffer from gravitational insecurity in connection with hyper or hyposensitivity and cannot organize most of their lives. These children may have lower self-respect, and can experience difficulties in completing even the simplest work (Kranowitz, 1998; Bahr, 2001).

Vestibular system is related to the perception of the signals concerning the changes in the head's movement and position. Inner ear structure (semi-circular channel) upholds the task of perceiving these signals. People live unaware of the existence of this system as well as the signals it creates. However, motor coordination, eye movements and body stance require this system to function properly (Halker, 2001). Children with vestibular function disorder demonstrate insufficient motor planning (praxis). Autistic children also present certain movement disorders. Some autistic children have difficulty in accomplishing actions like climbing, standing on one foot, walking a straight line and jumping. These children may also experience difficulties in repeating an action consecutively, starting or ending the action on their own.

These disorders can vary in complex and simple movements (like flawy facial impression or body dangling). Variant movement disorders are determined for autistic individuals. These disorders can be categorized as follows;

1. *Motor function disorders:* Flexion dystonia, strained flexion in the hip and body, bizarre body posture, gnashing, making a grimace arbitrarily, anti-social facial impression, lack of eye contact, involuntary motor twitches, dyskinesia, motor stereotypes, vocal and verbal twitches, keeping arms stable when walking and other joint movement deficits can be evaluated in this category.
2. *Intentional movement disorders*: Slow moving, weakness in spontaneous movements, motor planning difficulties, consecutively repetitive spontaneous actions, examining objects by smelling, touching or tasting, walking disorders (walking slow, on tiptoes, on heel or by jumping) are in this category.
3. *Comprehensive behavior and activity disorders:* Catatonic movements, oversensitivity to environmental changes, aggression, hyperkinesis (hyperactivity), actions that include explosives and violence, indisposition to physical contact and interaction, suddenly stopping when performing an action, mutism (inability to speak), lack of ability to imitate, inability to start a movement on their own and negativism can be included in this group (Leary & Hill, 1996).

Autistic children usually provide disoriented responses to vestibular stimulants. These children generally experience visual and vestibular coordination difficulties. It is believed that vestibular systemic disorders can be related to problems in focusing or gravitating towards visual stimulants. Sensory information input disorders (modulation) are considered the first symptoms of autism. Communication and language disorders in social interactions stem from the difficulty in balancing the sensory output. These children frequently tend to engage in stereotypic actions to regulate sensory system (Case-Smith & Brayn, 1999; Korkmaz, 2000b).

Leo Kanner states that autistic children demonstrate normal motor development. These children show no abnormalities in physical appearance, but show variations in motor skill development in comparison to the contemporary. Research indicates that autistic children demonstrate difficulties in motor functions such as balance and movement, slow moving in later periods, decrease in stance consistency and oral motor disorders (Jansiewicz *et al.*, 2006; Minshew *et al.,* 2004; Page & Boucher, 1998) to distinguish from (Ozonoff *et al.* 2008).

However, researches comparing autistic children with other groups in terms of intelligence development deficiency show no difference with respect to motor skills. Reid's (1985) study determined no difference between autistic and retarded children in terms of actions like catching, jumping, hurling, running and balance. In a recent study conducted on 21-41 month old autistic children and retarded children defined no difference between the groups in terms of object manipulation, perception and visual motor integration (Provost *et al.,* 2006). Similarly, Rogers et al. found no differentiation between 2- year old autistic children and typical and atypical groups consistent in development in terms of fine motor development and motor planning. (Rogers *et al.,* 2003).

Although autistic children appear capable of developing numerous physical skills in time, some skills may develop very late. Motor skill development in autistic children is usually close to their chronologic age. These children may especially experience difficulties in executing an action in line with an instruction and consecutively. For instance; their lack in fine motor skills like paper cutting and putting cubes into a box are significant. Motor problems observed in autistic children are related to motor coordination problems. It is also expressed that their motor readiness levels for executing an action are low in comparison to the contemporary (Berninger & Rutberg, 1992; Attwood, 1998; Ryoichiro *et al.,* 2000; Beversdorf *et al*., 2001).

It is important to include exercises supporting basic movement skills in training programs for autistic children. Attaining movement experience provides children with essential information for perceiving their own body and recognizing the environment. Also, movement training can be useful for improving the child's ability to solve problems, expressing him/herself and seeking creative solutions to problems. Movement training can also be used to develop skills such as paying attention, focusing and mediating. Children can attain emotional and social gains through movement training. Through well-planned movement training, children can develop abilities to recognize other children, act in coordination and establish cooperation (Eichstaedt & Lavay, 1992).
Studies conducted in this subject prove that it is difficult for handicapped children to discover their environment through games and movement if left alone. Therefore, it is essential to assist the child in attaining various movement experiences. Learning basic movement skills is also important for the child to learn more complex behaviors. Development of these skills constitutes a foundation for the development of other body movements and attaining complex movements. Basic movement training can be provided through simple movement experience attained from exercise programs. In later periods, the child can be diverted to sportive and recreational activities. Thus, guiding autistic children to any branch of sports (especially swimming etc.) before school age can enable a positive development (Connor, 1990; Cornish & McManus, 1996; Darıca *et al.*, 2000; Korkmaz, 2000b).

4.5 Proprioceptive systemic problems

Proprioceptive system provides information about the movements and the body position. This system assists the integration of signals concerning touching and movement. Proprioceptive signal receptors are situated in tissue connection spots in the muscles and joints. This is required for skills like catching or throwing a ball and ladder climbing.
Proprioceptive system functions; the system contributes to body awareness, motor planning and motor control. Proprioceptive system is also influential in body language and effective control of body parts. It enables abilities like straight walking, sprinting, ladder climbing, carrying a luggage, sitting, standing, and leaning upside down. It also assists in feeling emotionally safe. Proprioceptive system means the perception of unconsciously executed body actions (for instance; automatically sitting straight on a chair). In addition, conscious body positions are frequently engaged. Developing body awareness also forms the child's computative and mathematics skills (Fisher, 1991; Kranowitz, 1998; Bahr, 2001).
In the presence of proprioceptive systemic disorders, the child may not attain sufficient information concerning the body position and body parts. Proprioceptive system is also necessary in attaining the information needed for regulating the movements concerning gross and fine motor skills. Children with proprioceptive problems may have trouble in executing an action coordinately. For instance, the child may have difficulty in switching from one action to another (Kranowitz, 1998).
Proprioceptive system allows us to distinguish between the actions. Distinguishing between actions refers to feeling the magnitude of pressure that causes muscle contractions and relaxation. During an activity; we can predict the quantity and quality of muscle movements. Thus, we can adjust the amount of energy to be assigned when lifting a light ball or a heavy bucket. When this system malfunctions, the child cannot receive sufficient signals from the muscles and joints, consecutively failing to distinguish between the actions. Proprioceptive system also provides information about unconscious body movements such

as sitting and standing up. Children who are experiencing problems with this system may have difficulty in adjusting their posture during daily activities. Proprioceptive system is also essential in developing emotional confidence mechanism. Children with such disorders can develop insufficient self awareness. Consequently, the child will lack the emotional confidence (Kranowitz, 1998).

Proprioceptive disorder is usually accompanied by tactile and vestibular system disorders. Children with proprioceptive disorder have difficulty in interpreting perceptions concerning the position and movements of head, arms and legs. These children receive common instinctual perceptions insufficiently. Since they have problems with fine and gross motor muscle control and motor planning, their body awareness and body position perception are also insufficient. These children may be very clumsy. They may attack everyone and everything. They may cause conflicts when walking on a street, having bath or playing in the garden. They also experience difficulties in managing objects. When gripping an object, they apply excessive or insufficient pressure (For instance, they oftly break pencil leads and their toys). They also have problems carrying a heavy object (For instance; they have difficulty when carrying a bucket). Since they lack fine body awareness, they need to follow their own body movements with eyes. They cannot complete even the simplest actions like directing the body when getting dressed, buttoning up or pulling the zipper without visual assistance. Since they lack fine postural balance, they may be afraid to move within an area. Each new movement and position may startle them, consecutively causing emotional insecurity (Kranowitz, 1998; Bahr, 2001).

Proprioceptive system constitutes joint, muscle and body awareness. Autistic children usually experience insufficiencies in fine and gross muscle skills. These skills are disorders that are included in the proprioceptive system. Most autistic children do not recognize their body position in the space. Consecutively, they may be relieved by jumping on the trampoline and riding on a swing. Some children may enjoy massage and deep pressure. These activities may assist in motivating and reorganizing the child before learning new skills (Halker, 2001).

5. Sensory integration operating scope and effects on autistic children

In sensory integration treatments prepared for autistic children, it is important to prioritize that the family understands the child's behaviors, and emotional needs so as to provide the necessary environmental regulations in the school and at home as well as allowing the child to organize and utilize the signals received from the environment (Williamson & Anzalone, 1997).

The fundamental aim of sensory integration treatment is ensure that the child controls sensory stimulants -especially inner ear balance system (vestibular)- received from the muscles, joints and skin in order to allow the child to reform the corresponding reactions that integrate these senses. Children with advanced handicaps, -especially autistic children- are likely to need more instructions than others. When conducting treatment for these children, stimulants needed by the child must be provided at the same time performing exercises to permit the child to realize his/her own emotions. The aim of this therapy is not teaching motor activities, but to assist the child in attaining motor skills, academic skills and positive behaviors necessary throughout the life (Temel, 1992).

In a case of sensory integration deficiency, the child must be evaluated before initiating treatment. When conducting the evaluation, sensory perception deficiencies, effects or

sensory perception deficiencies on motor skills and the level of sensory integration development must be determined. This evaluation will provide necessary information about the child. This will ensure information about whether the child needs this kind of treatment, or on which course he/she will need intensified therapy. Evaluation should include the following courses;

- Fine and gross motor development level
- Visual motor integration (such as making jig-saw, copying figures)
- Visual perception
- Neuromuscular control (balance and posture)
- Response to sensory stimulant (tactile, vestibular, proprioceptive)
- Bilateral coordination
- Motor planning.

When it is understood that the child's problems can be explained using sensory integration theory and setting special targets, treatment can be initiated. Some children may demonstrate a lack of enthusiasm for participating in activities within the treatment course. Others may orally express reluctance to engage in an activity. Activity may be boring or too simple for the child. Therefore, the first course of action must be investigating the reason for the child's lack of motivation. If the planned activity is difficult for the child, it must be adjusted for his/her skill level. If the child thinks the activity is difficult even if it is not, he/she must be encouraged. While encouraging, the child must never be forced. If the underlying cause of the child's lack of motivation is hypersensitivity, the child must be given time to calm down.

Another important issue in the treatment is when to conclude the activity. If the child is participating in an activity that helps the child to attain adaptive skills, the activity should be sustained. The therapist should follow the child's guidance in decision-making.

In correcting problems about tactile system, the first action must be to determine whether the child is hypersensitive or hyposensitive. Consecutively, activities that can solve the problems should be selected. Examples for these activities can be; massage, hugging, pressuring, brushing or scrubbing the legs, hands and back as well as books that encourage touching, sand, beans, rice game, salt ceramics, drawing different figures using shave foam, rolling on different surfaces, playing with blowing toys, drinking juice using pipette and chewing. Through these activities, the child's hypersensitivity or hyposensitivity can be curbed. Therefore, the child can achieve different tactile experiences (Kranowitz, 1998).

Autistic children with vestibular systemic problems may demonstrate motor planning and motor coordination problems. The child must be evaluated to determine these problems. Subsequent to the evaluation, appropriate activities should be selected. Activities like standing on one foot, walking the balance plank, swinging on the balance plank and riding on a swing can be provided for the child to improve balance sensation. In addition, the child can be encouraged to extend his/her experience by imposing activities like straight walking, variant walking imitations, somersaulting and climbing. Sensory vulnerability can be treated through providence of different experiences. Therefore, the child's needs must be determined in order to plan the program correspondingly (Kranowitz, 1998).

Autistic individuals with proprioceptive vulnerability may demonstrate problems like postural dysregulation, frequent falling, failing to adjust limbs when getting dressed and inability to carry heavy objects. The child must be supported with activities to improve proprioceptive system so as to overcome these problems. Examples for these activities can

be; riding the magic carpet, weight lifting (weights attached to hands, ankles and back) rope skipping, jumping on the trampoline, walking with a wheelbarrow, crawling games and dragrope game (Kranowitz, 1998).

6. Examples activities for sensory motor skill assistance

GOAL: Enabling interaction with objects of different attributes**.**
Expected Behavioral Gain:

1. Touching objects with different attributes.
2. Gripping objects with different attributes.
3. Walking on objects with different attributes.
4. Distinguishing between objects with different attributes.

Material: Bread paste, pudding, dry legumes, fresh fruits and vegetables, bowls.

1. *Activity:* Trainer sits the child down on a table in face to face position, places the foods in large bowls. While touching the food, trainer gives the command "touch". Trainer is to encourage the child to touch food types of different structures (bread paste, pudding, dry legumes, fresh fruits and vegetables). First, the trainer touches different types of foods, places the food on the child's palm and fingers, then asks the child to touch the food. While holding the child's hand, the trainer touches the food with the child. For the first attempt, the timeline should be limited to 2 minutes. Then, the time given for touching the child is gradually increased up to 10 minutes.

Material: Walking track.

2. *Activity:* Tracks made of different materials (e.g. rope, felting, plastic, emery, carpet, sand) are prepared. Trainer sets example for the child by walking the track. Then, the child is asked to walk the track from the start line till the finish line. Trainer assists the child by walking together while holding the child's hand. The practice is sustained until the child attains the ability to walk the track independently.

Material: Shag, velvet, flax and cotton materials.

3. *Activity:* Trainer sits down on the ground with the child in face to face position. Using gloves made of different materials (shag, velvet, flax, and cotton); trainer touches the child's limbs and face. While touching the child with the material, trainer counts from 1 to 10, later concludes the training. Trainer then uses as different material. Later, the child is directed to touch objects made of metal, wood, plastic, emery and glass. In follow up, the objects are placed in a box with all sides closed and round holes on the front side; the child is asked to reach into the box to grip and distinguish the objects (hard, ragged and soft) without looking. In the first stage of the activity, two objects (like a toy or ball) are placed in the box. These must be objects the child is familiar with.

Material: Touch box, hard, ragged and soft objects.

4. *Activity:* The child is asked to reach into the box to find and distinguish between the objects with different attributes (hard, ragged and soft). The child is orally and physically encouraged to distinguish between the objects. Trainer reaches into the box with the child, touches the objects and talks about their attributes. Trainer may point to the distinctive attributes of the objects. The child's behaviors are continuously rewarded with incentives in the first stage. In later stages, support and incentives are reduced. Incentives are only awarded when the child presents the correct answer.

Material: Sand pool, ball, toy car, cube.

5. *Activity:* Trainer sits down in the sand pool with the child in face to face position. Trainer shows an object to the child (such as toy car or cube). Then, the trainer hides the object in the sand and asks the child to find the object, encourages the child to find it. At first, the trainer finds the object and shows it to the child. Then, the object is placed in the same spot and the child is asked to find it. Trainer may hold the child's hand to pluck out the object. After attaining the ability to pluck out the object from the sand, the object is placed in different spots and the child is asked to find it. At first, the object is partially hidden so that the child can easily find it. Once the child independently finds the object, the number of objects hidden in the sand is gradually increased up to five.

Material: Heat tablets, water with different heat levels.

6. *Activity:* Trainer sits down with the child in face to face position. Plastic bottles of water with different temperatures (cold, warm, hot) are placed in front of the child. Trainer accompanies the child in touching bottles with different temperatures. Then, water with different temperature is placed in large cups. Accompanying the child, the trainer dives limbs inside the water cups with different temperatures. The trainer encourages the child orally and physically to touch the water. Then, the trainer places heat tablets with varying temperatures on the table and encourages the child to look at the tablets. While supporting the child physically, trainer touches the tables with different temperatures along with the child in order to improve touching behavior.

GOAL: Developing fine motor skills.

Expected Behavioral Gain:

1. Imitating fine motor movements.
2. Imitating objects and movements.
3. Forming shapes using blocks.
4. Stringing beads.
5. Using the scissors.
6. Placing screws on the board.
7. Copying symbols.

1. *Activity:* Trainer sits on a chair facing the child. Trainer sets an example by performing the action the child is expected to imitate. Then the child is given "do it" command (clapping, opening and closing hands, tipping with index fingers). If the child cannot perform the action, the trainer should provide physical assistance (for instance; helping the child to clap by holding his/her hands). Trainer gradually decreases the physical assistance to the child. The training is sustained until the child can independently perform the instructed action.

Material: Bell, blocks, bucket.

2. *Activity:* Trainer sits on a table with the child in face to face position. Two identical objects are placed on the table (e.g. two bells). Trainer takes one of the bells to ring it when the child is paying attention to the trainer, then asks the child to perform the same action. Trainer provides the child with "You do it" command. If the child cannot perform the action, the trainer should hold his/her hand to help doing it. Then, the action is performed repeatedly. Trainer should gradually reduce the assistance. In follow up, the trainer should direct the child to practice with different objects in a similar course of action (e.g. placing blocks in a bucket).

Material: Two triangles, two cylinders, blocks.

3. *Activity:* Trainer sits on a table with the child in face to face position. Similar blocks are placed on the table (e.g. two triangles, two cylinders). Trainer constructs a structure using blocks. Then the child is instructed to do the same using the block sets. While constructing structures using the blocks, physical guidance is provided to the child. In the first phase of the practice, one block at a time is placed (For instance; five blocks are placed on the table to the child's right). One block is brought to the middle of the table. The child is asked to select the same block and put it in the middle of the table. Trainer places different shapes of blocks and asks the child to imitate the same structure.

Material: Beads and strings.

4. *Activity:* Trainer sits on a table with the child in face to face position**.** Varying sizes of beads and strings with varying thickness are placed on the table. Training starts with big sized beads. Trainer sets an example for the child by stringing a big sized bead, then asks the child to do the same. Trainer holds the string and assists the child to place the beads by holding the child's hand. Then the bead and the string are given to the child. If the child cannot perform the stringing, physical assistance should be provided. Practice continues with different types of beads.

Material: Scissors and papers.

5. *Activity:* Trainer sits on a table with the child in face to face position. Trainer takes the scissors and sets an example for the child on how to use it, then encourages the child to do the same. When the child attains the ability to use the scissors, trainer helps the child practice using the scissors on cardboards or papers. When the child is able to use the scissors independently, the trainer instructs the child to practice straight, round, square and photo cuttings. During the practice, the child is instructed with "do it like this" command. The child is encouraged with oral and physical hints to perform the cutting. The child's actions are rewarded.

Material: Different sizes of screws and a board.

6. *Activity:* Trainer sits in front of the board alongside the child. Trainer takes a screw and places on the board, then gives the screw to the child and commands "you do it". The child is encouraged to perform the action. Then, the child is supported to place different sizes and numbers of screws on the board. When the child attains the ability to place different sizes of screws on the board, the trainer instructs the child to practice in forming patterns using the screws on the board. It is important to use big sized screws at first.

Material: Paper, shaving foam, finger paint and colored pastels.

7. *Activity:* Trainer places the drawing materials on the table where the child can see them. Using large papers, drawing practice begins. The child is encouraged to copy different patterns, digits and letters using different materials (such as working with finger paint, shaving foam and sand). Physical support should be provided as the child practices drawing and the child's drawings should be rewarded. Visual tips (e.g. dots) should be used to make the drawings easier to see. Later, the dots are removed and the child instructed to perform the correct drawing after seeing the example. The child should be encouraged to draw by holding his/her hand or giving instructions like top-down or left-to-right. Trainer practices with the child on drawing lines from simple to complex (such as horizontal drawing, vertical drawing, plus shape drawing, x shape drawing, writing letters on a straight line, drawing digits, drawing figures, drawing a child's face, drawing flowers, cars, a home, a labyrinth and human figures). Training is sustained until the child can draw the lines independently.

GOAL: Developing gross motor skills
Expected Behavioral Gain:

1. Imitating gross motor actions.
2. Participating in walking exercises.
3. Participating in running exercises.
4. Ball game.
5. Rolling.
6. Riding on a swing.
7. Climbing.

Material: The child's favorite food.

1. *Activity:* Trainer sits on a table with the child in face to face position and sets an example of the motor actions the child should perform (tipping on the table, clapping, stomping). Then, the trainer gives the child "do this" command. The child should be encouraged orally and physically to perform the action. Trainer should provide various incentives (e.g. chips, well done) for the child's effort to imitate the action and responses. Then the support in the training session should be gradually decreased. Incentives should be provided until the child's imitations become second nature.

Material: Colored adhesive tape.

2. *Activity:* The child is allowed to walk freely in a movement-free environment. A thick line is drawn on the ground (using colored adhesive tape). The trainer gives the child "walk" command. Trainer waits for the child to walk the line without stepping outside the line. Then, trainer instructs the child to practice rhythmic walking, tip-toe walking, heel-top walking, walking on the feet's outside, walking on the feet's inside and walking to a specific object (trainer commands "walk to the door"). The child should be encouraged to perform the appropriate action. The child's actions should be rewarded with incentives. In later sessions, support and incentives should be reduced to positive behaviors only.

Material: Rope, tape, chalk.

3. *Activity:* A circle is drawn on the ground with a large and thick line (using the rope, tape or chalk). The child is instructed to walk step by step and side by side before moving out of the line. The child should be encouraged to walk (trainer first sets an example for the child and provides physical and oral tips). The trainer should reward the child's actions with incentives. Later, the support and incentives should be reduced and only provided when the child achieves the goal.

Material: Rope, tape, chalk.

4. *Activity:* A zig-zag is drawn on the ground with a thick line (using rope, tape or chalk). The child is asked to walk the zig-zag without stepping out of the line. The child should be encouraged to walk and rewarded for his/her actions. In later sessions, the support and incentives should be reduced to accomplishing the track only.

Material: Ladder, different sizes of circles and boxes.

5. *Activity:* A walking band in the shape of a ladder is placed on the ground and the child is asked to walk by stepping inside the band only. The child should be encouraged to walk and rewarded for his/her actions. In later sessions, support can be gradually reduced in accordance with the child's need. Incentives should only be provided when the child completes the training. "Walk by stepping in it "practice should be extended to materials with different shapes and depths (such as colored circles, different sizes of boxes).

Material: Slalom sticks, traffic cones.

6. *Activity:* Objects are placed on the ground in a line allowing the child to walk in between (e.g. slalom sticks and traffic cones). The child is asked to walk through the objects. Trainer should set an example for the child to perform the action. The child should be encouraged to walk and rewarded for his/her actions.

Material: Ball.

7. *Activity:* Trainers stands facing the child. The child is given an object (a ball). The child is encouraged to walk the track and rewarded for his/her actions. As the amount of time the child walks decreases, support and incentives should be reduced. Later, the child should only be rewarded when he/she reaches the destination while holding an object. Then, the child is encouraged to walk with a filled object (a filled plate, a glass full of water) and rewarded for his/her actions. The support and incentives should later be reduced. The child should only be rewarded when he/she reaches the destination while holding an object.

Material: Balance plank.

8. *Activity:* The child is asked to climb up and walk the balance plank (20 cm above ground, 15cm wide and 2 mt long). The child should be supported in climbing and walking the plank. The child's actions should be rewarded. In later training sessions, the support and incentives should be reduced. Incentives should only be provided if the child can independently climb the plank and walk to the end.
9. *Activity:* Trainer sets an example for the child to imitate the walking of different animals such as; lamb walk, frog walk (jumping when crouched), duck walk (taking a step when crouching). Then the child is asked to imitate these movement patterns. The trainer should physically and orally encourage the child to perform the actions. In accordance with the child's ability to perform the actions, the support and incentives should be gradually reduced. Incentives should only be provided when the child achieves the imitated walking.

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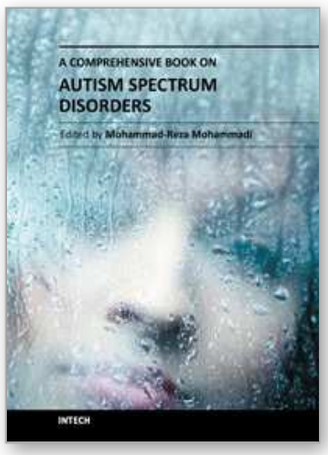

A Comprehensive Book on Autism Spectrum Disorders

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The aim of the book is to serve for clinical, practical, basic and scholarly practices. In twentyfive chapters it covers the most important topics related to Autism Spectrum Disorders in the efficient way and aims to be useful for health professionals in training or clinicians seeking an update. Different people with autism can have very different symptoms.Â Autism is considered to be a â€œspectrumâ€ disorder, a group of disorders with similar features. Some people may experience merely mild disturbances, while the others have very serious symptoms. This book is aimed to be used as a textbook for child and adolescent psychiatry fellowship training and will serve as a reference for practicing psychologists, child and adolescent psychiatrists, general psychiatrists, pediatricians, child neurologists, nurses, social workers and family physicians. A free access to the full-text electronic version of the book via Intech reading platform at http://www.intechweb.org is a great bonus.

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