



Sensory Integration Therapy in children with cerebral palsy: A review article

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Abstract: Cerebral palsy is a term used to describe a series of permanent mobility and postural disorders that limit activities and it caused by a non-progressive lesion in the developing fetus or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, perception, cognition, communication, behavior, epilepsy, and secondary musculoskeletal problems. There are many approaches used in the treatment of children with CP such as drugs, surgeries, physiotherapy, occupational therapy, speech therapy, Botox therapy, hydrotherapy, hippo therapy, domestic massages, sensory integration therapy (SIT) etc. among which SIT shows promising results and it is widely accepted around the world.

Conclusion: Sensory Integration Therapy is an effective method to use in treatment of children with cerebral palsy. Esraa E. Elkiky, Elham E. Salem, and Mai Abas. **Sensory Integration Therapy in children with cerebral palsy: A review article.** *N Y Sci J* 2022;15(6):43-47] ISSN 1554-0200(print); ISSN 2375-723X (online) <http://www.sciencepub.net/newyork>. 7. doi:10.7537/marsnys150622.07.

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Introduction

Cerebral palsy (CP) is a neurodevelopmental condition that affects muscle tone, movement and motor skills. This is not a single disease but rather a heterogeneous clinical syndrome resulting from injury to the developing brain [1]. Although the disorder itself is non-progressive, the clinical manifestations change with time as the brain matures [2].

Cerebral palsy is a term used to describe a group of long-lasting impairments of movement and posture deficits that emerge in the developing fetal or infant brain, leading to restrictions in activities such as independent walking, stair climbing, running, or walking on an uneven surface [3].

Cerebral palsy children have a delayed development due to abnormal muscular tone. They also have somatosensory issues and postural and coordination problems [4].

Etiology and Risk Factors

Cerebral palsy is a common cause of physical disability in children, with reported prevalence ranging from 1 to 4 per 1000 live births and a higher prevalence in males than in females [5].

The etiology of CP is very diverse and multifactorial. The causes are congenital, genetic, inflammatory, infectious, anoxic, traumatic and metabolic. The causes could be prenatal (e.g. infection, gestational diabetes), perinatal (e.g. asphyxia, birth injury) or postnatal causes (e.g. CVA,

high fever, meningitis, encephalitis). As much as 75% - 80% of the cases are due to prenatal injury with less than 10% being due to significant birth trauma or asphyxia [6].

Prematurity and low birth weight appear to be the most important risk factors, with the risk of CP increasing as gestational age and birth weight decrease, also cystic periventricular leukomalacia (CPVL) is considered as a risk factor for developing CP, with 60 percent to 100 percent of CPVL patients having CP [7].

Hypoxia-/ischemia-related brain damage is a major factor for morbidity and mortality not only in the adult but also in the pre- and perinatal period where it clinically frequently presents as cerebral palsy (CP) [8].

Classification

Cerebral palsy is commonly classified based on the nature of the movement abnormality and the anatomical or topographic distribution of the motor abnormalities [9].

The classification, according to movement patterns, includes spastic, dyskinetic (dystonia or choreoathetosis), ataxic, and mixed forms [10].

Spastic CP is characterized by at least two of the following features: 1. Abnormal posture pattern and/or movement 2. Increased tone 3. Pathological reflexes.

Dyskinetic CP is characterized by both: Abnormal posture patterns and/or movement, and

movements that are involuntary, recurring, and occasionally stereotyped. It is either dystonic or chorea-athetotic CP.

Ataxic CP is characterized by: loss of organized muscular coordination so that movements are performed with abnormal force, rhythm, and accuracy, and abnormal posture patterns and/or movement. It has no subtypes [11].

The topographical classification is: [12]

- **Quadriplegia (Tetraplegia):** All limbs and parts of the body are involved. The arms are just as affected as the legs, if not more so. A lot of them are asymmetrical (one side more affected).
- **Diplegia:** Involvement of limbs, with arms much less affected than legs. Asymmetry may be present.
- **Hemiplegia:** Limbs and body on one side are affected.

Signs and symptoms

The common symptoms of CP are spasticity, involuntary movements, unsteady gait, and balance problems [13].

The clinical picture of CP includes neuromuscular dysfunctions, such as the loss of selective motor control and muscle tone disturbance, causing an imbalance between agonist and antagonist muscles, coordination disturbance, sensory alterations and weakness [14].

Children with CP have different sensory integration problems. The term sensory integration, as it is used here refers to both a theory, originally developed by Ayres and a neurological process that enables the individual to take in, interpret, integrate, and use the spatial-temporal aspects of sensory information from the body and the environment to plan and produce organized motor behavior [15].

Motor problems of CP are usually accompanied by many problems such as sensory, perception, cognition, communication, behavior, gastrointestinal problems, Hearing and vision abnormalities, impaired oral-motor function, urinary incontinence, pressure ulcers, osteoporosis, and secondary muscular issues [16,17].

Sensory integration problem is one of the most important problems which seen in children with CP. Sensory integration problem has been decreased functional ability of children on activities of daily living [15].

Problem in sensory integration leads to sensory integration dysfunction (SID) which is defined as " the inefficient neurological processing of information

received through senses causing problems with learning, developmental and behavior [18].

About 90% of children with CP present with sensory dysfunction such as tactile and proprioceptive deficits. The impaired central nervous system in CP produces not only abnormal muscle tone as well as sensory disturbances [19].

Management

Evaluation is very important in understanding and efficiently treating motor function problems that are the major factor influencing functional independence in CP [20].

The assessment should consider the terms of motor abilities besides the changes in the muscle tonus, co-contraction capacities of the muscles, involuntary extremity and body movements, stabilization of the extremities, balance, protective reactions, sitting balance, upper extremity and hand functions and sensory-perception problems [21].

A thorough assessment of the individual child's needs is essential. The appropriate treatment plan for each child will be influenced by the severity of their impairments and their individual activity limitations and goals as well as their preferences and social circumstances [22].

The effectiveness of any treatment will be influenced by the availability of physical therapy and the family's motivation. Assembling the relevant information for treatment planning is a multidisciplinary task involving not only an orthotist but also orthopaedic surgeons, developmental paediatricians, physiatrists, physical and occupational and speech and language therapists, social workers and others [22].

Sensory Integration Therapy

One approach to help children with CP achieve their optimal level of functioning is Sensory Integration Therapy (SIT), which is a treatment approach that was originally developed by Jean Ayres, and it aims to provide the child with graded sensory experiences [23].

Dr. Jean A. Ayres, a well-known occupational therapist, was one of the first to recognize the importance of sensory processing in everyday life. According to Ayres, sensory integration is a behavioral reaction to sensory information. She also investigated the relationship between sensory processing and the behavior of children with learning, developmental, emotional, and other impairments [24].

Sensory integration therapy, as developed by Ayres, involves the use of multisensory environments in which challenging goal-directed activities are designed to provide specific sensory input. During the

therapist-guided activity, the child is encouraged to show appropriate responses and behavior. The child's brain begins to process sensory stimulation more normally as a result of repetition, and he or she begins to interact effectively in sensory environments [25].

Ayres' meaning of sensory integration was related to the ability to process information from different sensory modalities during daily routines and activities (e.g., enjoying walking barefoot on the beach, riding a bicycle) [26].

Sensory integration therapy focuses primarily on three basic senses--tactile, vestibular, and proprioceptive. The three senses are not only interconnected but are also connected with other systems in the brain. The inter-relationship among these three senses is complex. Basically, they enable us to experience, interpret, and respond to various stimuli in our environment [27].

Tactile System: The tactile system includes nerves beneath the skin's surface that send information to the brain. This information includes light touch, pain, temperature, and pressure. These play a major role in perceiving the environment and protective reactions for survival [27].

Vestibular System: The vestibular system refers to structures within the inner ear (the semi-circular canals) that detect movement and changes in the head position. For example, the vestibular system detects whether your head is upright or tilted (even with your eyes closed) [27].

Proprioceptive System: The proprioceptive system refers to components of muscles, joints, and tendons that provide a person with a subconscious sense of body position. When proprioception is functioning properly, an individual's body position is automatically adjusted in various situations; for example, the proprioceptive system is responsible for providing the body with the necessary signals that allow us to sit properly in a chair and to step off a curb smoothly. It also enables us to manipulate objects using fine motor movements, such as writing with a pencil, drinking soup with a spoon, and buttoning a shirt [27].

Sensory integration therapy is a process occurring in the brain that allows the child to make sense of their world by receiving, registering, regulating, organizing and interpreting the information that received by their brains from their senses [28].

Sensory integration therapy is an active therapy in which large pieces of equipment like large rolls and balls, trampolines, and swinging hammocks are used to provide intense proprioceptive, vestibular, and tactile experiences [29].

Activities are designed to be "fun" and tap the inner drive of the child, incorporating sensory input such as swinging (vestibular), jumping, pulling,

pushing (proprioceptive) and deep pressure touch (tactile) as well as visual, auditory, olfactory, and gustatory input. It's thought that repeating typical responses to sensory stimuli creates new neural pathways [30] and provides the basis for successful participation in natural real-world environments [25].

Sensory integration helps in the development of a mental and physical framework within an individual's nervous system that allows them to properly perceive sensory input, regulate its responses, and understand the meaning of a texture, movement, or sound [4].

Along with NDT many therapists use SIT techniques because it allows the child to feel not only its body in multiple positions, but also its environment, which they are unable to accomplish due to their limited body movements [4].

Sensory integration and vestibular stimulation were effective in children with cerebral palsy [31].

By receiving specific and appropriate sensory cues during therapy, such children can increase their postural control, functional activities, and, therefore, may improve their interaction with the environment and social involvement [32,33].

According to the study done by Tahir et al., [4] sensory integration therapy is effective in children with cerebral palsy and developmental delay in improving emotional well-being and social participation.

The sensory integration therapy included goals of improving gross motor function and postural stability, its treatment effects are obvious in the postural set used for gross motor function [34].

The sensory integration therapy attempts to facilitate normal development and improve the child's ability to process and integrate sensory information (visual, perceptual, proprioceptive, and auditory). One important aspect of choosing the SIT is that the motivation of the child plays a crucial role in the selection of the activities. Most children tend to seek out activities that provide sensory experiences which will be beneficial to them at that point in their development [28].

Sensory integrative therapy, perceptual-motor training, vestibular stimulation and play therapy have been used as treatment programs according to the needs of the child with CP [23].

According to a study done by Padnani and Arunachalam [18], they concluded that sensory integration therapy were effective in improving gross motor functional abilities in children. Children who had received Sensory integration therapy plus conventional physiotherapy showed more improvement in gross motor functional abilities and spasticity as compared to those who received conventional physiotherapy alone.

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