Vestibular Dysfunction In Sensory Integration Disorder

In this second part of our series on sensory integration dysfunction, we take a look at what vestibular dysfunction is and its pervasive impact.

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Vestibular Dysfunction
Unknown to many of us, we are endowed with two more senses in addition to the usual five: They are:
• The proprioceptive sense that allows us to perceive our position, weight, pressure and movement relative to other body parts and the environment; and
• The vestibular sense that deals with movement, gravity and balance via input through our inner ears.

Although sensory integration involves all the senses, it is the vestibular, tactile and proprioceptive systems that lay the groundwork for healthy development, for they provide fundamental meaning to sensations and purpose to movements.

Our Hidden Senses
In the previous issue, we explored what sensory integration disorder (SID) is, and in particular, dysfunction of the proprioceptive sense.

To recap, sensory integration refers to the way one responds to and processes sensations. It also includes one’s ability to plan his/her actions (motor planning). SID arises when a problem occurs in these areas.

SID was first studied in the 1960s by psychologist and occupational therapist Dr A Jean Ayres, who pioneered the link among sensory processing, learning and behaviour issues.

The Vestibular System
Keeping our oriented to gravity, the vestibular system works in tandem with our eyes, muscles and joints to facilitate balance and movement. It informs us which direction we are heading and how fast we are moving.

It also tells us whether we are stationary or in motion, and whether objects are moving or motionless in relation to our bodies.

Receptors for vestibular sensations are located in our inner ears. Stimulated by movement and gravity, these receptors register every movement we make and every change in head position to serve the following functions:
• To keep us upright
• To provide a sense of our motions so we can move efficiently
• To detect potentially threatening movements around us through vibrations in the air

In her book, Sensory Integration and the Child, Dr Ayres explains:

The vestibular system is the unifying system. It forms the basic relationship of a person to gravity and to the physical world. All other types of sensation are processed in reference to this basic vestibular information. The activity in the vestibular system provides a “framework” for the other aspects of our experience.

Vestibular input seems to “prime” the entire nervous system to function effectively. When the vestibular system does not function in a consistent and accurate way, the interpretation of other sensations will be inconsistent and inaccurate, and the nervous system will have trouble getting “started”.

Constituting the foundation on which skills like eye-hand coordination and auditory-language are built, these three systems interact with both the visual and auditory systems to develop meaningful associations between visual and auditory information, and what is experienced through movement and touch.

Many SID symptoms are believed to be a result of the central nervous system not regulating sensory input from the vestibular system.

Children with this sensory-based motor disorder are inefficient at integrating input about equilibrium, gravitational changes, movements and positions. They may:
• Be hypersensitive to movement and have:
  - Inaccurate movement, or
  - Gravitational insecurity, or
  - Be hyposensitive to movement, with increased tolerance and desire for movement (see inset on page 36 for associated symptoms)

As such, they tend to:
• Seek out unusual quantities of certain types of vestibular stimulation to compensate for their under-responsivity (hypersensitivity), or
• Reject vestibular input when over-responsivity (hypersensitivity) sets in

Both cases lead to interruptions in many functional and play-related activities.

Unable to match their behaviour to the intensity of the vestibular input, children with autism resist movement and are gravitationally insecure, often taking a long time to adjust to and partake in activities like swinging, running or climbing. Their behaviour, attention and emotions, thus become affected when they cannot move about in an organised way.

On the other hand, children whose vestibular dysfunction results in poor muscle coordination (or dyspraxia) may not develop the postural responses necessary to keep upright. They may sprawl on the floor, slump while sitting, and lean their heads on both hands when seated at a table. They may exhibit awkward, uncoordinated and clumsy movements, often falling, bumping into furniture and losing their balance.

Postulated to be a major organiser of sensation in all of the other sensory channels, the vestibular system also contributes to the development of word understanding and speech. Difficulties in academic learning and language have been found to result from a disordered vestibular system.

Dr Ayres hypothesised that as a result of their under-responsive vestibular functions, children with learning disabilities often have delays in articulation, speech and language acquisition.

Such conditions may be further compounded by visual problems caused by...
by their vestibular dysfunction. As eye movements are influenced by the vestibular system, these children may lack adequate gaze stability and the ability to focus on moving objects while staying still (or vice versa).

In school, they may become confused when shifting their focus between objects located at different planes, for example – from the whiteboard to the desk. Reading problems may also arise if brain functions imperative in coordinating left-to-right eye movements are under-developed.

Lastly, a vestibular disorder may also interfere with their social relationships, for they find it hard to manage personal space in terms of gauging their physical proximity to others, or judging where people are, especially in a crowd.

What Parents Can Do
Professionals who treat SID strive to improve the child’s ability to integrate sensory integration from the tactile, vestibular and proprioceptive senses. Children who can integrate input from these senses are more adaptable and ready for learning.

Age-specific techniques are used for assessment and treatment of vestibular dysfunction in children. Assessments generally include a history and physical exam, a hearing test, and possibly, brain scans to rule out other pathologies.

In addition, a vestibular therapist can help evaluate the child’s ability to use the vestibular system for balance and visual-motor control, as well as test the child’s developmental reflexes that have control mechanisms in the vestibular system.

Using these results, the therapist develops vestibular therapy exercises, which are tailored for the individual child. Such therapy can be effective for reducing or eliminating vertigo, improving visual-motor control, improving balance and coordination, and promoting normal development in children with vestibular disorders.

Examples of vestibular integration activities include: hopping on a big ball, rolling, riding a tricycle, spinning, sliding and jumping on a trampoline. The child can also be encouraged to sit, stand or walk on unstable surfaces such as seesaws, waterbeds and large balls. Tightrope walking, somersaulting and jogging make great choices as well. Swings and suspension systems, too, can be used to promote beneficial types of movement.

Generally, children with vestibular disorders respond well to such intervention because of their greater plasticity, i.e. the ability of their neurological systems to compensate for and adapt to vestibular deficits. Being less fearful of movement than adults, they are more inclined to participate well in the balance and movement aspects of therapy.

Sources:
• Issues and Applications of Sensory Integration Theory and Treatment With Children With Language Disorders. Daria M. Mauer. Language, Speech & Hearing Services in Schools; Oct 1999; Vol 30; ProQuest Health and Medical Complete
• The Right Diet for Sensory Integration Dysfunction. Sandy Keefe. NurseWeek; Mar 4, 2002
• The Sensory Processing Disorder Resource Centre (www.sensory-processing-disorder.com)
• Persons with Developmental Disabilities (PDD) Program (www.pdd.org.sg)
• Vestibular Disorders Association (www.vestibular.org)