

## SI DYSFUNCTION—VALLONE

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hamstrings, pectoral muscles, were all increased in tone) and an increase in the anterior to posterior curves of the spine from the cranial base fixed in extension to and including the sacral base anterior and the sacral apex palpating posteriorly.

Danny's gait, as described, was one third to one half of the length of a normal stride and he appeared to place his feet carefully and protectively as he walked, always looking at the floor. If you called his name and distracted him, he would stumble. Observing his crawl up 3 stairs in the office, Danny again appeared to be circumducting the right leg.

Motion palpation of the spine and extremities revealed Danny had reduced range of motion into flexion at the C01 and at C7/T1. The sacrum was fixed in nutation and the right innominate appeared superior and without rotation when compared to the left innominate and sacral base. There was no palpable flexion or extension in the right innominate. Compression of the right sacroiliac joint elicited pain. Craniosacral evaluation revealed increased dural torque with decreased flexion extension at the sphenobasilar junction. Examination of bilateral hips revealed normal range of motion of the femoral head in the acetabulum except for decreased extension of the right femur due to psoas tension. There were no audible or palpable clicks or irregularities in glide. Compression of the femoral head into the acetabulum did not elicit pain.

**Diagnostic Studies** — X-rays were recommended due to the history of in utero constraint to rule out congenital anomaly or hip dysplasia. Weight-bearing films were unremarkable for pathology. AP films demonstrated pelvic unleveling and the lateral films demonstrated the increased AP curves of the spine. No laboratory studies were performed.

**Treatment**— Danny was seen twice a week for two weeks, once a week for 4 additional weeks, once a month for 3 months then once more in 6 months. His treatment consisted of cranial sacral release of dural tension and stretching of the Iliopsoas muscles bilaterally before administering diversified chiropractic adjustments, modified for his size and age utilizing a drop table (cervical and lumbar) at the C01, C1/T7, sacral apex and right sacroiliac joints. This was followed by a suboccipital hold and intra oral contact on the hard palate to encourage flexion and extension of the sphenobasilar junction. The treatment ended utilizing a Logan Basic double notch contact to correct the sacral subluxation and balance the spine.

**Results** — Immediately after the first adjustment, Danny's gait changed, demonstrated by an increase in stride. Initially, this caused him to panic and crumble to the floor crying after 5 or 6 steps. When he got up, he very thoughtfully took several more steps still focused intently on the ground and placement of his feet but retaining the longer stride. There was a demonstrable left lateral shift in his gait as he attempted to decrease weight bearing on the right side.

By the third treatment, Danny's stride had lengthened and his confidence in his gait allowed him to explore uneven turf (the lawn or a graveled driveway) and it was noticeable that he was looking forward and around himself with inter-

est as he walked. His slumping posture had also improved dramatically. Danny continued to crawl up and down the stairs at home but he would no longer circumduct the right leg while climbing and his mother noticed an increase in his crawling speed.

Simultaneous to his chiropractic adjustments, Danny continued occupational therapy with a shift in concentration initially to increased vestibular stimulation. His occupational therapist found he was able to tolerate more and more movement and spontaneous activity without eliciting the startle response, fatigue or distress.

After five chiropractic visits, the occupational therapist reintroduced the challenge of an obstacle course which included a foam form of three steps followed by a small platform and three steps down. It was now possible for the occupational therapist to lead Danny up and down the 3 steps by holding one of his hands while he held onto a railing with the other. By the seventh visit, Danny attempted to and succeeded in climbing up five stairs at home all by himself.

By the twelfth visit, Danny's mother reported that he was navigating the stairs at home successfully and was playing tag and jumping off the swing set with regularity.

**Discussion** — Although sensory integration disorders may result from a myriad of causes and are often overlaid with other serious co-morbid states (autism, cerebral palsy, brain injury, etc.), the question is did Danny appear to have difficulty with coordination and movement resulting from underlying sensory processing dysfunction or poor joint biomechanics? It is this author's opinion that subluxation and poor joint biomechanics resulted in simultaneous increase and decrease in the mechanoreceptor stimulus from the joint and its associated muscles to the central nervous system, thereby affecting how the CNS interpreted and organized responses to the information (Slosberg).

The sensory system (including the proprioception from joints) provides the input that stimulates the Reticular Activation System of the brainstem to arousal. The RAS is responsible for the regulation of alertness, and coordination and regulation of focus (attention) and the efficient management of input and of output. The proper functioning of this system is essential to learning and to behavior management. Any movement disorder or dysfunction can result in an alteration in the sensory input to the RAS. Subluxation can result in an increased or decreased input of sensory stimuli to the RAS depending on the type and chronicity of the subluxation.

It is probable that Danny's subluxation pattern originated in utero during the time his lengthening body had to adapt posturally to limited space. It is unknown why he remained in the transverse lie for so long during the third trimester but it may have been due to the individual shape of his mother's uterus, the length of his umbilical cord or even the innate knowledge that a vertex position may have resulted in early labor due to his length as compared to his mother's size.

It is possible that Danny experienced increased input of pain each time he bore weight on the right sacroiliac joint, initially crawling, then walking and finally, challenged with stair climbing. His pain would conceivably be intensified when he attempted to climb stairs where he would have to lift the weight of his entire body

up using his right sacroiliac joint. Danny's ability to climb in an erect posture may have been limited due to the range of motion of the sacroiliac joint as well as the patterned response to pain.

It is also likely that the chronic subluxations that either developed in utero or in compensation for his weight bearing posture, resulted in decreased input to the central nervous system resulting in a failure to maintain appropriate arousal levels of the RAS.

Postural and functional mechanical disorders whether due to a sensory based motor disorder or subluxation can cause difficulty with balance, bilateral coordination and crossing the midline. It may affect muscle tone (including the balance between flexor and extensor muscle groups), thus posture (slumping) and may result in additional habitual movement patterns required to accomplish a motor goal (moving tongue while writing or carefully placing each foot as he steps to walk).

Sensory defensiveness may develop if a child experiences long term increased sensory input, such as pain, as elicited when compressing the right sacroiliac joint. This chronic input elicits the fright, flight or fight response, an innate survival mechanism. An individual with sensory defensiveness typically develops a highly aroused nervous system, which fails to recognize the input as non-threatening. The behaviors that result can range from aggression to avoidance or intolerance of activities (as in Danny's case). The cycle

of pain on weight bearing resulted in his altered gait, poor balance and apparent clumsiness (Stephens).

The goal of the chiropractic adjustments is to normalize joint function in the cranium, spine and extremities. The normalization of joint function will optimize neural integrity by facilitating afferent stimulus from the periphery through joint mechanoreceptor and stretch receptors in the muscles. If the chiropractic adjustment helps to improve input to the cerebellum and promote improved input to the vestibular system, as well as reduce errant bombardment of the RAS, the child's higher cortical centers will hypothetically be able to begin to integrate the sensory information more efficiently and develop more complex adaptive responses to challenges in their environment.

Once subluxation has been reduced and biomechanics normalized, the occupational therapist can provide the vital sensory input and experiences that children which SID need to develop and learn in a safe and controlled environment. The child's individually designed "sensory diet" involves a planned and scheduled activity program to meet the needs of the child's nervous system. A sensory diet stimulates the "near" senses (tactile, vestibular, and proprioceptive) with a combination of alerting, organizing, and calming techniques.

Motor skills training methods that normally consist of adaptive physical

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