Case Study

Improvement in Sensory Modulation & Functional Disorders in a Female Pediatric Patient Undergoing Chiropractic Care

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Abstract

Objective: To describe the chiropractic care of a pediatric patient presenting with Sensory Modulation Disorder and Constipation.

Clinical Features: Patient is a 5 year-old female with history of birth trauma, developmental delays, sensory processing, sleep difficulties and other functional disorders. Objective indicators of vertebral subluxation identified via Activator Technique.

Intervention and Outcomes: Activator Technique was employed to reduce vertebral subluxations in the axial and appendicular skeleton. Following adjustments, the patient demonstrated more frequent bowel movements, less-fragmented more-restful sleep, improved mood and ability to focus.

Conclusions: Following chiropractic adjustments, the patient's nervous system was able to function at a higher level, resulting in improved bowel function, mood, ability to concentrate and engage with her environment. Additional research is needed to provide firm diagnostic criteria and a foundation for future interventions in cases of Sensory Modulation Disorder.

Key Words: Activator, Chiropractic, Sensory Modulation Disorder, Sensory Perception Disorder, Subluxation, Adjustment, Spinal manipulation

Introduction

Sensory Modulation Disorder

According to Ahn sensory processing in humans requires reception of physical stimulus, transduction of the stimulus into a neural impulse, and perception, or, the conscious experience of sensation.¹ Sensory systems include tactile, auditory, visual, gustatory, olfactory, proprioceptive and vestibular systems. According to Miller, Sensory Modulation Disorder (SMD) results when a person has difficulty responding to sensory input with behavior that is graded relative to the degree, nature, or intensity of the sensory information.² These behaviors represent an interaction between the internal environment, or the central nervous system’s (CNS) ability to process and modulate sensory input, with the external environment, or the sensory experiences available throughout daily life.³

Dunn describes ‘modulation’ as “the ability to monitor and regulate information in the interest of generating an appropriate response to particular stimuli”.³ In other words, SMD represents complex neurophysiologic phenomenon where one or more of the body’s senses exhibit some level of dysfunction.

These disorders reportedly occur in between 5 to 10% of children without disabilities, or as many as 40 to 88% of children with disabilities¹, particularly in children with Autism Spectrum Disorders.⁴ According to a survey by Ahn et al. 5.3% of American kindergarteners, over 220,000 individuals, may have sensory processing disorders. These disabilities are associated with named disorders ranging from dysfunctional self-regulation to pervasive developmental disorders, cerebral palsy, autism spectrum disorders (ASD),¹,⁵,⁶ Asperger’s Syndrome,⁷ Fragile X syndrome,⁸ in children without any formal diagnosis,⁸ and ADHD,⁸ although according to Ahn, ADHD and SPDs are distinct conditions.⁹ While ASD may be considered to have overlaps with SPD, Schoen et al. showed differences between the two groups.⁹

This lack of agreement has led to difficulty in classification of SMD. Since its earliest description in 1964,¹⁰ SMD has been refined as diagnostic criterion continue to be described as one of a complicated group of disorders. Due to the complexity of sensory modulation aberrations, it appears as though there is a continuum of these behaviors.¹¹ Within Sensory Modulation disorder, subtypes have been identified including sensory over-responsivity, sensory under-responsivity, and sensory seeking/craving.¹² In 2007, Miller presented a classification
system of which SMD is one branch of Sensory Processing Disorders (SPD), other branches are comprised of Sensory-Based Motor Disorder (SBMD) and Sensory Discrimination Disorder (SDD). SMD includes subcategories of Sensory Over-Responsivity (SOR), Sensory Under-Responsivity (SUR) and Sensory Seeking/Craving (SS). SMBD includes subcategories of Dyspraxia and Postural Disorders. SDD is comprised of disordered Visual, Auditory, Tactile, Vestibular, Proprioception, Taste and Smell sensations.2

Related research, however, has not always broken these disorders down precisely. As such, SMD may also be referred to as Sensory Defensiveness,10 Sensory Perception Disorder or Sensory Processing Disorder, for the purposes of this article, the terms will be used interchangeably as earlier descriptions did not prescribe to Miller’s classification.

The diagnosis is not recognized by the DSM-IV or ICD-10, however, it has been recognized by the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood, Revised; the Diagnostic Manual for Infancy and Early Childhood (of the ICIDL); and the Psychodynamic Manual (PDM task Force).2 Over the last few decades, there has been a growing body of evidence to support subjective and objective diagnostic criteria.

Methods of evaluation include clinical observations, self-reporting and developmental and sensory histories10 as well as parent reporting. Evaluations made by parents may be subject to a variety of biases,8 but are valuable in that parent-based reporting includes a longitudinal and contextual aspect to surveillance.11 Combinations of these evaluation methods are promising in the detection and identification of SMD.

Surveys which may be useful include the Short Sensory Profile (SPP) is a 38-item evaluation to measure functional behaviors. It is filled out by the parent of a young patient. It represents a scaled down version of the Sensory Profile which contains 125 items. As an evaluation of the impact of sensory experiences on a child’s ability to function within their environment, it is an important assessment.13

Parents make global ratings of their children ranging from 1 (always: the child responds in this manner every time) to 5 (never: the child never responds in this fashion). It has been used to identify SPD and Autism.6,14 Other tests include: Adaptive Social Behavior Ratings (ASBR): a 31 item set of evaluating social behaviors; Child Behavioral Checklist: a 113 item checklist to delineate ‘internalizing’, ‘externalizing’ and ‘total problems’; Infant Toddler Social and Emotional Assessment (ITSEA): a measure of social-emotional and behavioral problems and competencies in infants and toddlers; Sensory Integration and Praxis Tests15; Miller Assessment for Preschoolers15; FirstSTEP15; Sensory Over-Responsivity Scales: a 76 item inventory to describe all sensory domains and; Test of Playfulness (ToP): a measure of 29 items on a 4-point (0-3) scale.

Due to the complex neurologic basis of the SMD, electroencephalogram (EEG) and event-related potential (ERP) have both been utilized in detection of aberrant neurology in this condition.16 It has been found that children with SMD exhibit more frequent and larger amplitude electrodermal reactions and habituated more slowly to sensory stimuli than age and gender-matched controls.17 ERP compares electrophysiological sensory gating responses. These correlate to the ability of the body to input sensations.18

**Constipation**

Constipation is a common condition, particularly in the very young and the very old, however it may affect persons of any age. Constipation has been defined as a delay or difficulty in defecation, present for 2 or more weeks.19 In the pediatric population, it is responsible for 3% of general outpatient visits and 25% of gastroenterology consultations,19 making it the second most referred problem of the pediatric gastroenterologists.20

As it is a costly disorder,22 and may become chronic in nature as 30% of affected children will continue to have symptoms beyond puberty21 it may result in a diminished quality of life.24

The etiology of constipation is not well understood, although it is commonly believed to be functional in nature. According to Kent, improper bowel function may be related to vertebral subluxation compromising mechanoreception and increased noxious stimulation, affecting autonomic function.25 Chiropractic has been shown in the literature to be an effective treatment for some cases of constipation,20 particularly so when in addition to conventional treatments.26 No chiropractic techniques have been identified to best manage constipation, though there have been examples of generic high-velocity low-amplitude (HVLA) and even “non-force techniques such as cranial work, or use of the Activator.20

**Case Report**

**History**

The patient’s gestation lasted 41.5 weeks and was unremarkable. The birth was extremely complicated. Following rupture of the amniotic sac, labor lasted 24 hours in a local hospital. During labor, the patient became lodged in the pelvic inlet. This led to elevation in fetal heart rate and emergency cesarean section. As reported by the patient’s mother, “Even after they opened me up after C-Section they had difficulty getting her out – she was wedged in.” The mother was placed on morphine and other medications during the delivery process.

At birth, the patient weighed 8lbs 4oz. and was 21.5 inches long. When questioned, the mother was unable to provide APGAR score, though she reported that the patient was alert and responsive within 12 hours following delivery. The patient was admitted to the ‘special-care nursery’ due to cyanosis during crying, leading to the diagnoses of ‘Holding (her) breath when she cried’, jaundice and a very sleepy infant. At that time, she was given preventive IV antibiotics due to the extended lapse between rupture of the amniotic sac and birth.

At 6 months, the patient first vocalized and was introduced to solid foods. The first solid foods introduced were Heinz brand baby cereals, 1st Rice and Barley. At 10 months, the patient
began to sit unassisted. At 17 months, the patient began crawling. During the 18th month, the patient began walking and was referred to a Pediatrician for Gross and Fine motor delays.

At 24 months, the patient was diagnosed with a partially accommodative esotropia, a type of strabismus, and a lack of peripheral and three-dimensional vision. The result of this was prescription of corrective lenses.

At 30 months, the patient had her speech assessed. The patient continued speech therapy via her Pediatrician and was referred to a local Child Development Center where she received speech, occupational and psychiatric therapies.

At 3 years old, the patient was prescribed lenses to correct strabismus, far-sightedness, and limitations of peripheral and three-dimensional vision. At this time she began horseback riding for 30 minutes, once per week.

From 3 to 5 years old, the patient received “PUFF” funding to attend a local Child Development Preschool where she received Occupational and Speech support in the classroom.

At 48 months, the patient was screened for chromosomal abnormalities via blood testing, which were unremarkable. She also was took a Peabody Developmental Fine Motor Scales assessment in which she scored in less than the first percentile. This test was repeated one year later at which time she reached the sixteenth percentile.

In 2010, the patient underwent various evaluations from multiple doctors. She was brought to a local occupational therapist for evaluation. The tests performed indicated significant difficulties with sensory processing and motor planning, as well as potential auditory processing difficulties.

The final diagnosis from this evaluation was that the patient was suffering from a severe case of Sensory Processing Dysfunction. In February 2010, the patient also visited her Medical Doctor, where she was diagnosed with constipation and possibly a yeast infection. The patient was prescribed an anti-yeast medication, which the parents did not initiate. Following the visit to the medical doctor, the patient began a course of two tablespoons per day of mineral oil per day as well as an elimination diet restricting wheat, dairy and sugar intake.

Intervention

When the child was 5 she was recommended to see a chiropractor by a neighbor. The reported health concerns at this time were constipation, limited energy, limited concentration, ADHD symptoms, OCD symptoms. The physical exam revealed postural distortions including anterior head carriage, right scapular winging and rounded shoulders. A thermal scan of the spine was performed, which indicated areas of autonomic dysfunction. (Figure 1)

The type of care performed was via Activator Technique, which utilizes prone leg-length analysis as an indicator of segmental dysfunction. A specific contact, high-velocity low amplitude adjustment was delivered to areas of subluxation via the Activator instrument.

The patient was initially adjusted 9 times within a period of 4 weeks, followed by re-assessment. Care has continued with decreasing frequency as function has improved. The patient has been adjusted 48 times in approximately 1 ½ years. Over the duration of care, at different times, the following segments were adjusted: Sphenoid, Occiput, C1, C2, C3, T4, T6, T8, T12, L3, L5, Pubic bone, Sacrum, the sinus’ and the left clavicle.

Outcome

During the 4th visit, after only 3 adjustments over the course of one week, the patient was reported to have noticeable changes, including increased frequency and ease of bowel motility, better energy and sleeping more soundly. Bowel movements continued to improve as of the 5th visit, but the patient began to show adverse behaviors including mood swings and temper tantrums. These adverse behaviors advanced to include vomiting, hives, coughing, lethargy and poor moods throughout the next 10 days, at which time it was noted the temper flare-ups were diminished, coughing and vomiting had ceased and that the patient’s energy was returning. Care continued and symptoms progressively improved.

During the 10th office visit, a reassessment was completed. At that time the patient was sleeping well again, more regular bowel movement intervals and absent mood swings, vomiting, coughing and/or hives.

Postural evaluation indicated no change in anterior head carriage, though the patient was reported to be “doing better”. A thermal scan (Figure 2) of the spine was performed at this time indicating a reduction in areas of autonomic dysfunction. Subjectively, the patient was reported to have experienced an episode of sleepiness, vomiting, hives, coughing and changes in moods. This episode of unpleasant behavioral and physiologic effects was followed by resolution of this episode with the benefit of the patient experiencing more consistent bowel movements.

During the 43rd office visit, another progressive exam was performed.

The patient was subjectively reported to have experienced overall health changes over the course of chiropractic care as being “much better”; these changes include better: sleeping, moods, coping skills, and bowel movements. The patient was reported to have increased ability to sleep through the night following adjustments, and to wake up more rested. The patient was also better able to cope with frustration. The patient’s immune function was reported to have improved as she “rarely gets sick, if ever”. Bowel movements were reportedly “more consistent”. The patient was better able to focus, resulting in the ability to read books. Other changes were also noted at this time.

The patient’s previously diagnosed medical conditions also showed signs of improvement. Both the strabismus, peripheral and three-dimensional vision were reported to have improved by 80%.
According to the patient’s medical doctor: “The most significant thing about this case is the patient’s nearly immediate ability to focus, concentrate, use her words more effectively, and control her emotions post adjustment. This has made a tremendous difference in the parent’s ability to cope with their daughter’s challenges.”

**Follow-up**

About 7 months after starting chiropractic care, the patient was brought to a clinical psychologist for evaluation three times. The patient underwent 8 assessments: the Stanford Binet Intelligence Scale: Fifth Edition (SB5), Wechsler Individual Achievement Test – Second Edition (WIAT-II), Autism Diagnostic Observation Schedule (ADOS), Autism Diagnostic Interview-Revised (ADI-R), Conners’ Parent Rating Scales-Revised: Long (CPRS-R:L), Conners’ Teacher Rating Scales-Revised: Long (CTRS-R:L), Family Interview, and Student Interview. For specific results of these tests, refer to Tables 1 through 4.

In summary, these tests indicated that the patient did not meet the diagnostic criteria of Autism Disorder, though the patient does meet the criteria of Pervasive Developmental Disorder, Not otherwise Specified (PDD-NOS). There were particular concerns with delays or struggles with verbal communication, reciprocal social interaction, speech, fine motor and gross motor development, organization, planning and social skill development. It was noted that there have been improvements in verbal communication and reciprocal social interaction.

One year after starting chiropractic care, the patient underwent another battery of tests by another occupational therapist. There were four tests at this evaluation: the Bruininks-Oseretsky Test of Motor Proficiency, the Test of Visual Motor Skills (Gardener), the Test of Visual Perceptual Skills (Gardener), and the Sensory Processing Measure (SPM) – both Home and School Forms. The results of these tests indicate that the patient continues to deal with “significant sensory processing and motor planning, gross and fine motor, visual motor, and visual perceptual difficulties, all of which interfere functionally with her consistent attention, self-regulation, and occupational performance”.

The results also highlight functional deficits with refinement of movement, coordination, efficiency, and accuracy expected for her age. The examiners also specifically mentioned refined tactile/touch sensation from the tactile system, the proprioceptive and kinaesthetic system and vestibular system. It was the opinion of the therapists that the patient used her vision to compensate for vestibular, proprioceptive and kinaesthetic awareness and processing difficulties, reducing ability of eye-hand coordination and accuracy.

The patient continues to seek occupation therapy twice per month, speech therapy twice per month, horseback riding once per week, swimming lessons once per week and tutoring for three and a half hours per week. She has continued being checked for subluxation by her chiropractor once every three to four weeks.

**Discussion**

**Etiology: Sensory Modulation Disorder**

The etiology of Sensory Modulation Disorder is not well understood, as research continues to delineate SMD from other SPDs. This ability to the ability to modulate sensory responses to the environment is initiated early in life and serves as a protective and discriminative mechanism. Schneider, describes how sensory over-responsiveness, a subtype of SMD, is linked to prenatal stress and fetal alcohol exposure. It is known that the brain may show anatomic changes to functional stimuli following small changes in the environment. Schneider identified that prenatal stress or fetal alcohol exposure affects the dopamine system. As dopamine levels are affected, anatomical areas of the brain including the prefrontal cortex, nucleus accumbens, basal ganglia, nigrostriatal dopaminergic neurons, and the thalamocortical system are influenced.

As specific cognitive, sensory and motor functions can be localized in distinct areas of the brain, a patient with these changes may exhibit cognitive, sensory or motor deficits. Schneider specifies that these neural alterations and dopamine function have been linked to diminished inhibitory control, attention and behavior. Schneider also notes that “ascending dopaminergic projections from the substantia nigra and ventral tegmental area to the striatum provide critical signals and involved in reinforcement of learning. The striatum also has effects on inhibitory control, perception, learning and attention”. and that “neuromodulatory circuits in the brain serve important roles in behavioral regulation by amplifying or attenuating signals between various neuronal networks. These neuromodulatory circuits are likely to be sensitive to prenatal perturbations, and can also have cascading effects on later development, possibly contributing to the phenotypic expression of over responsiveness to tactile stimulation”.

The autonomic nervous system has also been noted to be affected by acute musculoskeletal injury, resulting from the modification of nociceptors and sensory neurons. Changes to the nociceptors is believed to lead to deviant processing of sensory information leading to hyperalgesia and allodynia. It is believed that loss of sensory information may lead to a state of increased central hyperexcitability. The Gate Theory provides a template for describing how local and distant neurons in the dorsal horn may effect excitatory or inhibitory sensory systems in the body.

Due to the patient’s birth trauma, and subsequent diversity of symptoms, alteration of nociception or the dopamine systems may explain the evolution of the patient’s symptoms.

It is believed that learning takes place as the brain identifies sensory stimuli, stores them as references, or memories, and is able to coordinate functions and behaviors appropriately to them to facilitate higher-order behaviors and understanding. These functional behaviors are a result of habituation and sensitization to the environment. Due to the uniqueness of sensory inputs and individual neurology, it is understood that individuals respond uniquely to sensory inputs as it relates to type, intensity, affective tone of response and onset and offset.
of response. These neurologic thresholds indicate the quantity of stimuli required to evoke perception while behavioral responses indicate how the child responds to said-stimuli. It has also been demonstrated that different sensory systems may have an integrative effect on one another, so if prenatal stress may affect one sensory system, such as tactile sensitivity, so then deficits in one sensory system would produce alterations in others.

If learning is dependent on the ability to assimilate movement or environmental sensation to organize and plan behavior, and successful integration of various simultaneous perceived perceptual signals is crucial for social behavior. Due to these aberrant reactions, SMDs may affect a child’s ability to interact academically or socially.

**Assessment: Sensory Modulation Disorder**

When considering assessment for this family of conditions, there are a few scenarios outlined by Goldsmith et al, describing certain situations or conditions which may aggravate a child with these aberrant sensory processing functions: stiff new clothes, sweaters, labels sewn into collars, seams of socks, light tough to the face, fingernail trimming, tooth brushing, or listening to a vacuum or siren.

Children with these disorders may present with: responses of fear, avoidance, distraction, over-vigilance and/or aggression especially with stimuli are not self-initiated; hyperactivity, lethargy or inattentiveness; diminished social skills and participation in play; low self-confidence, deficient adaptive or daily life skills, decreased fine-, gross, and sensory-motor development and low self-esteem.

**Sensory Integration Therapy**

Sensory Integration (SI) therapy’s basic treatment assumptions developed by Ayer were summarized by Kinnealey and Miller as:

1. There is plasticity within the central nervous system: thus intervention procedures based on sensory integration therapy can effect changes in the brain.
2. The sensory integrative process occurs in a developmental sequence.
3. The brain functions as an integrative whole but is composed of systems that are hierarchically organized.
4. Evincing an adaptive response promotes sensory integration, and the ability to produce an adaptive response is based on sensory integration.
5. An inner drive exists to develop sensory integration which is manifested through participation in sensorimotor activities.

SI therapy, therefore, is founded on neurologic processing of sensory information for learning higher level skills. Through somatosensory and vestibular activities, the central nervous system is better able to modulate, organize and integrate information from the environment, which yields a foundation for appropriate adaptation and higher-order learning.

According to Bundy, some researchers have found that SI therapy improves performance in motor, language and academics while other find it no more effective than tutoring or perceptual-motor training. These conflicts are part of why SI treatments remain controversial.

Though some empirical evidence for the use of SI therapy exists, Miller underscores the necessity for long-term comprehensive programs including pilot studies regarding the effectiveness of occupational therapy. Empirical evidence suggests treatments may be in the form of: sensory stimulation techniques, auditory integration training (AIT) and related acoustic interventions, visual therapies, sensorimotor handling techniques, or physical exercise; non-empirically supported therapies may include developmental motor therapies, motor skills training, or compensatory approaches. These SI therapy techniques, or combinations thereof, should be custom tailored to best fit the child’s particular needs.

When setting treatment goals for patients with SMD, Baranek suggests two main categories:

(a) to develop better sensory modulation as related to attention and behavioral control or (b) integrate sensory information to form better perceptual schemas and practice abilities as a precursor for academic skills, social interactions, or more independent functioning. Mailloux et al, give methodologies to the identification and measure of these goals.

**Chiropractic Adjustments**

Of the array of Complementary and Alternative Medicine (CAM) therapies available to children, chiropractic is the most popular practitioner-based CAM therapy and is referred to as pediatric chiropractic. Chiropractic is based on a philosophy which respects the body’s innate ability to heal and function, and recognizes that this ability is dependent upon integration via the nerve system.

This nerve system integration may be compromised when malalignment of the bones of the axial or appendicular skeleton occurs, and is referred to as subluxation. When subluxations occur involving the vertebrae, they are referred to as vertebral subluxations. The etiology of these subluxations is not well understood, but Kent has provided summaries of different theorems. The result of the presence of subluxation is inappropriate functioning of the body which may produce a wide variety of health conditions. The purpose of the chiropractic adjustment is to reduce or eliminate these subluxations and allow the body to return to a state of appropriate health and function. Clinical effects are thought to be related to mechanical, neurophysiologic and reflexogenic processes.

Out of the many different chiropractic techniques, Activator has become very popular. Out of 120 post-1980 graduates of Canadian Memorial Chiropractic College, 211 different technique systems were utilized. Activator was utilized in 17.5% of offices. 63% of Chiropractors with advanced certifications in pediatric adjusting utilize Activator technique. 41% of Belgian Chiropractors utilize Activator Technique.
In 2005, more than 100 studies of Activator Adjusting Instrument and Technique were in circulation. Initially, the cofounders Warren C Lee, DC and Arlan W. Fuhr, DC studied Logan and his technique and with the refinement of a dental impactor, and addition of the Derefield leg-checking procedures to assess for segmental dysfunction, the Activator Instrument and Technique were born.

Though there are many different methods of leg check analysis,42 the Derefield leg-checking procedure was added for pragmatic reasons, to assess dysfunction and distortion status after adjustments and to reduce necessity of radiographs. Over time, the leg-check analysis came to include different isolation tests, stress tests and pressure tests were added as they were developed by practitioners performing informal clinical observations. These prone leg-length observations and provocative tests evaluate the function of joints from the feet progressively upward to the cervical spine.41 Over time, interexaminer reliability determining the side of short leg has been shown to be high. Although determining the side of the short leg has shown promising interexaminer reliability,43,44 determining the degree of leg length difference has not.45

It has been documented that the Activator Instrument is able to alter the position of spinal segments.45-46 This has been hypothesized to lead to a reduction of IVF inflammation affecting the dorsal-root ganglion via improving blood and nutrient supply to the affected area.47 Changes in cutaneous temperature following adjustment have been recorded, implying that the sympathetic division of the autonomic nervous system may be affected.48

Chiropractic adjustments have been demonstrated to affect the parasympathetic division of the autonomic nervous system.49 Furthermore, it has been demonstrated that the autonomic nervous system response may be specific and sensitive to its effector organ.50 It has been noted that Activator adjustments creates immediate change, usually a reduction, in resting EMG levels in at least some patients with low back pain and tight paraspinal muscle bundles, indicating a somatomotor effect.51 According to Haavik Taylor, spinal manipulation can alter cortical perception and sensorimotor integration of information from the upper limb.52 This improved sensory system feedback is potentially a very important feature to cases of SMD.

According to an article by Taylor in 2004, a review of the available literature on the safety, efficacy and use of the activator instrument, a committee panel reached the determination that the evidence supported use of the activator in the application of spine related and extremity disorders and that it had been demonstrated across “a broad spectrum of conditions severity ranging from simple to complex and with significant co-morbidity pathology.”53

Benefits from the use of the Activator include improved: (a) cervical range of motion,54 (b) cervical lordosis,55 (c) quality of life,56 (d) activities of daily living,56 (e) Sacroiliac Joint Syndrome57 (f) and Temporomandibular Disorders (TMD),58,59 (g) trigger points with as much as a seven times greater effectiveness than myofascial band therapy or placebo,60,61 (h) urinary and bowel incontinence,62 (i) different types of pain including: long term benefit for subacute neck pain,63 neck pain,64 chest pain associated with Tietze syndrome,65 chronic chest pain,66 low back pain,66 hand, leg and foot pain,64 and headaches.64 Non-functional benefits to the use of an Activator include it’s reproducibility.20

Conclusion

Subjective reports indicate improvement of symptoms related to SMD and resolution of constipation. SMD may have lifelong effects, as the presence of this condition effects over time may have a compounding effect as sensation, habituation and learning are influenced. More research is currently needed along with firm diagnostic criteria to develop standardized testing and interventions for this patient population.

Occupational and educational therapies exist to attempt to and bring patients of this population back up to developmentally appropriate standpoints. Early intervention should produce the best prognosis. As the central dysfunction resides within the central nervous system’s ability to take in inputs and appropriately respond, Chiropractic should be considered to better allow the CNS to engage with the environment. Children with prenatal stress, particularly birth trauma, should be checked for subluxation by a chiropractor.

References


115 A. Vertebral Subluxation Res. May 5, 2015 Sensory Modulation


Tables

Table 1: Results of the SB5

<table>
<thead>
<tr>
<th>Cognitive Ability</th>
<th>Percentile</th>
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<td>Knowledge</td>
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<tr>
<td>Visual-Spatial Processing</td>
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<td>Working Memory</td>
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Table 2: WIAT-II

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<th>Standard</th>
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<td>Reading Comprehension</td>
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<tr>
<td>Psudoword Decoding</td>
<td>111</td>
<td>6:8</td>
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<td>Numerical Operations</td>
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<td>Math Reasoning</td>
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<td>Spelling</td>
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<tr>
<td>Written Expression</td>
<td>110</td>
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Table 3: WIAT-II Composite Scores

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<td>Reading</td>
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<tr>
<td>Mathematics</td>
<td>2nd</td>
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<td>Written Language</td>
<td>50th</td>
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Table 4: Results of Conners’ Parent and Teacher Rating Scales-Revised: Long (CPRS-R:L; CPRS-T:L)

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<th>Rating Form</th>
<th>Description</th>
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<tr>
<td>Parent Form</td>
<td>Ratings produced significantly elevated scores for learning problems and</td>
</tr>
<tr>
<td></td>
<td>social problems.</td>
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<tr>
<td>Teacher Form</td>
<td>Ratings indicated the presence of higher than average levels of requiring</td>
</tr>
<tr>
<td></td>
<td>extra explanation and instruction, and difficulty understanding some concepts</td>
</tr>
<tr>
<td>Inter-rater Comparison</td>
<td>Ratings indicate higher than average social and learning difficulties in the</td>
</tr>
<tr>
<td></td>
<td>home and school environment, which is consistent with historical information</td>
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Sensory Modulation
Figures & Legends

Figure 1: Initial Thermal Scan

Figure 2: Thermal Scan Approximately One Month After Start of Care