

CASE STUDY

Chiropractic Management of a Child with Attention Deficit Hyperactivity Disorder & Vertebral Subluxation: A Case Study

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Abstract

Objective: To investigate the chiropractic care of a child with ADHD and review the related literature.

Clinical Features: A 3 ½ year old male child diagnosed with attention deficit hyperactivity disorder and a history of birth trauma and ear infections presents with signs of vertebral subluxation.

Interventions and Outcomes: Vertebral subluxations were addressed using toggle recoil adjustments to reduce an Atlas subluxation. Dietary advice, supplements and proprioceptive exercises were given to the patient as part of the care plan. Patient's mother and teachers reported a decrease in hyperactivity and an increase in attention. Paraspinal thermal scans improved after one month of care.

Conclusion: While research on chiropractic care for children with ADHD is limited, some studies have shown improvement in these children while under such care. This is an important area in need of further study and should include the investigation of a combination of chiropractic, nutrition, exercise, and other CAM treatments.

Key Words: *Chiropractic, attention deficit hyperactivity disorder, ADHD, compulsive disorders, chiropractic, adjustment, subluxation, thermography, children, CAM, birth trauma*

Introduction

Experts now consider Attention Deficit/Hyperactivity Disorder (ADHD) to be the most commonly encountered neurobehavioral disorder of childhood. Among the most prevalent chronic health conditions developing in childhood, ADHD may persist over the entire life span.^{1,2}

Diagnostic methods have been especially controversial in recent years as the perceived prevalence of the disease varies as the diagnostic criteria changes over time. Some studies show a 4%-12% prevalence rate among school-aged children with males being three times more likely to be diagnosed with ADHD than females.¹

The health care system and parents have made a significant push for pediatric care providers to not only properly diagnosis ADHD but to manage it as well. Much of this push is due to the drastic increase in prescriptions for stimulant medications being given to school-aged children with an ADHD diagnosis over the past decade. The fear of over-diagnosing and over-prescribing these powerful medications has been a significant part of the reassessment of how the syndrome is diagnosed.^{1,2}

Regardless of the controversy in diagnostic criteria, ADHD is clearly a problem for school-aged children with

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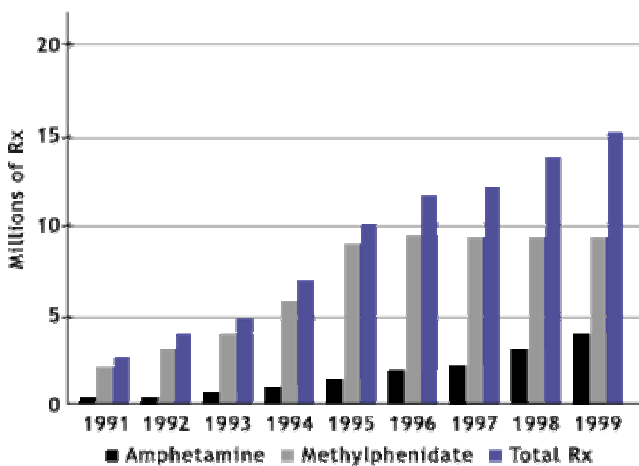
psychostimulant drugs being the most common form of treatment for ADHD.

It is reported that about 70% of children undergoing psychostimulant therapy, such as Ritalin, show improvement in symptoms, but the side effects may outweigh the benefits. Side effects of these drugs include but are not limited to: growth rate reductions, cardiovascular effects such as an increase in blood pressure and heart rate, insomnia, reduced appetite, anorexia, stomachaches, sleep disturbances, and dizziness.⁴

According to the Drug Enforcement Agency (DEA), methylphenidate prescriptions rose dramatically in the 1990's and are now at about 11 million per year. Amphetamine prescriptions such as Adderall, have increased recently, from 1.3 million in 1996 to close to 6 million in 1999. According to the DEA the vast majority of prescriptions for amphetamine and methylphenidate are for children diagnosed with ADHD.⁵ (See Graph 1)

Graph 1

AMPHETAMINE AND METHYLPHENIDATE PRESCRIPTIONS (IMS HEALTH, NATIONAL PRESCRIPTION AUDIT PLUS)



Since these drugs are considered to be potential drugs of abuse under the Controlled Substances Act, the DEA sets quotas regulating the amount of drugs that may be produced each year to meet demands for legitimate use. The methylphenidate quota increased from 1,768 kilograms in 1990 to 14,957 kilograms in 2000, and the amphetamine quota increased from 417 to 9,007.⁵ (See Graph 2)

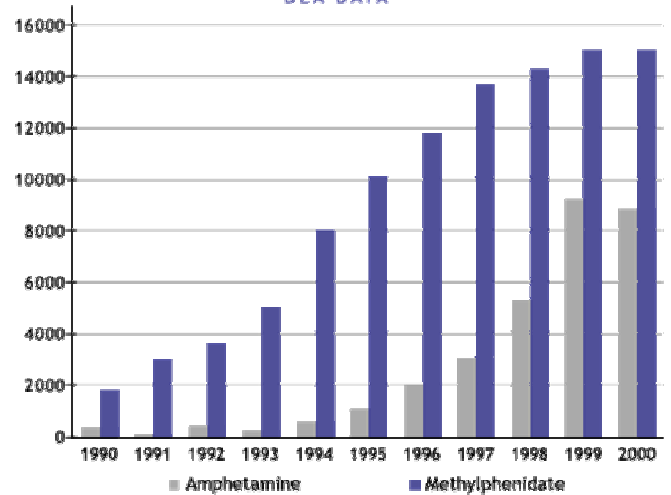
According to the United Nations, the United States produces and consumes 85 percent of the world's methylphenidate. The average per capita use of methylphenidate across the United State was 3,082 grams per 100,000 population; for amphetamine it was 1,060 per 100,000.⁵ (See Graph 3 and Table 1)

Chiropractic and Neurobehavioral Disorders

Parental concerns that drug therapy may not be in their children's best interests are one reason alternative treatments for ADHD are utilized in up to 64% of cases.^{6,7} Chiropractic is

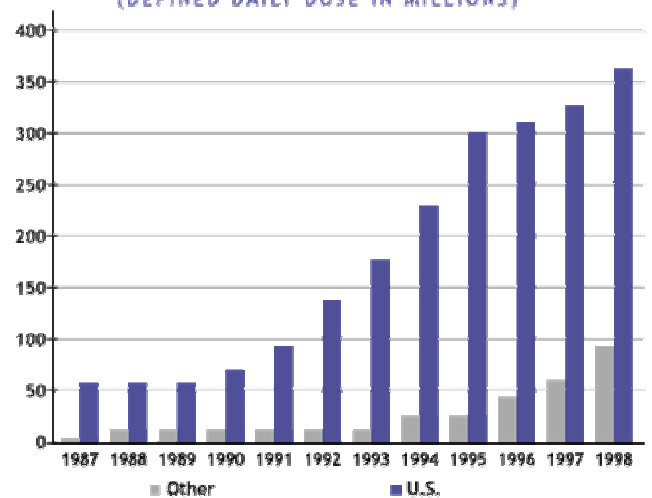
Graph 2

AGGREGATE PRODUCTION QUOTA (KILOGRAMS) DEA DATA



Graph 3

UNITED NATIONS DATA METHYLPHENIDATE CONSUMPTION (DEFINED DAILY DOSE IN MILLIONS)



one such alternative and according to Melillo and Leisman, childhood neurobehavioral disorders have many features in common:

“Attention deficit disorder (ADD), attention deficit hyperactive disorder (ADHD), pervasive developmental disorder (PDD), obsessive-compulsive disorder (OCD), Asperger’s syndrome, and Autism to name but a few, may be viewed as points on a spectrum of developmental disabilities in which those points share features in common and possibly etiology as well, varying only in severity and in the primary anatomical region of dysfunctional activity.”⁸

Melillo and Leisman outline a theory “...of developmental disabilities in evolutionary terms...” and argue that the move to bipedalism is responsible for the development and evolution of the human neocortex and the comparatively large human

Table 1

The top five ranking states in 1999 for methylphenidate and amphetamine use in grams per 100,000 population:

- New Hampshire (5,525)
- Vermont (5,005)
- Michigan (4,848)
- Iowa (4,638)
- Delaware (4,439)

The lowest ranking states for use of methylphenidate: were

- California (1,748)
- Hawaii (1,208)

For amphetamine, the lowest ranking were:

- New York (509)
- Hawaii (305)

brain. Postural muscles being the main conduit by which motor and cognitive binding evolve means that abnormalities in postural development or activity may disrupt cerebellar and cortical maturation.

They add to this a relationship between cognition and motor functions and the suggestion that the same mechanisms enabling coordinated movements also affect sophisticated cognitive processes. The authors assert that motor incoordination and disruptions in executive functions are a common thread in most developmental disorders. The alterations in executive functioning stem from the inability to bind motor and cognitive functions, resulting from understimulation of the cerebellum and thalamus. Further, region specific brain effects result from a dysfunction of hemisphericity whereby there is a failure to achieve equal activity between the left and right hemispheres.

The authors propose that the cause of this chain of events is fundamentally an environmental one involving the more recent increase in sedentary childhood behaviors. Treatment, according to these authors, should focus on improving motor performance along with cognitive training and behavior modification.⁸

Case Report

Patient History

The patient is a three and a half year old male presenting to the clinic for evaluation and management of symptoms related to ADHD. Mother stated the child had expressed symptoms of ADHD for the past one and a half years and was referred to a psychologist by his teacher for tantrums and biting issues during school. He suffered from frequent falls, ear infections and respiratory syncytial virus.

The history of frequent falls included falling out of bed as many as three times in a night. The patient had his adenoids removed, had bilateral myringotomy tubes inserted and was

also placed on antibiotic therapy numerous times as a child with the mother stating "...he has been on them too many times to count". His birth was traumatic, long, and complicated - he crowned for 3 hours and sustained a fractured left clavicle during the birth process.

The patient's mother related at the beginning of care that she was trying to avoid putting her child on psychostimulants and that this was why she was seeking chiropractic care for him.

Chiropractic Exam

Edema was noted at the C1/C2 level and the posture analysis revealed a right head tilt, right head rotation, and a right elevated shoulder. There was a decrease in right cervical rotation noted during active range of motion.

Paraspinal thermal scans were performed using the Insight Subluxation Station® to measure temperature differentials along the spine at 25-paired anatomical points. Temperature differences of one to two standard deviations above normal were observed at C2, C7, T1-T3, T5-L3, and L5-S1. There were also temperature differences of three standard deviations above normal noted at C1, C5 and L4. (See Figure 1)

Figure 1 – Initial Thermal Scan



Alterations in skin temperature patterns are associated with dysfunction of the autonomic nervous system related to vertebral subluxation and are routinely used as an outcome assessment in subluxation based care.⁹⁻⁴³

No other abnormalities were noted. He was diagnosed with upper cervical subluxation, edema neuromuscular incoordination and functional leg length discrepancy.

Chiropractic Care - Intervention

Muscle testing was done to further characterize the patient's Atlas subluxation.^{44,45} During this procedure the patient is asked to lie on his back with his right arm extended to 90 degrees. The patient is then told to resist the doctor's pressure as she tries to push the arm into extension. Consistent timing, pressure and position are used at all times. The patient is asked to repeat this with his head extended, flexed, rotated to the right, rotated to the left, laterally flexed to the left and laterally flexed to the right. The muscle test revealed a weak arm when

the patient laterally flexed his head to the right indicating Atlas laterality on the right.

The patient was then placed in the side lying position with his right side up. Utilizing a drop headpiece, the pisiform of the contact hand was placed on the patient's right transverse process of Atlas. A light thrust into the patient's Atlas was utilized and the headpiece dropped. Post treatment muscle testing was performed and noted to be normal following the adjustment. The patient was also instructed in cross crawling including marching in place, bringing knees up and opposite arm as leg to the ceiling like a soldier. Later in his care plan he was instructed in additional proprioceptive exercises including the use of a wobble board.

The initial care plan was for three times a week for three weeks. At that time the frequency was reduced to once a week for 8 weeks at which time his care plan frequency was reduced to once every two weeks. In addition to chiropractic care to reduce vertebral subluxation the mother was advised on decreasing food additives and sugar. Omega-3 EFA supplements were also added.

Chiropractic Care - Outcome

Paraspinal thermal scanning was repeated after one month and showed a two standard deviation asymmetry at C1 on the right and a three standard deviation asymmetry at C2 on the right. All other areas of the thermal scan were improved. (See Figure 2)

Figure 2 – Follow-up Thermal Scan



Parents and teachers have reported improvement in the patient's attention and energy levels following the introduction of chiropractic care and his grades have improved. Mother reports the patient was able to win a chess tournament due to his improved attention and mother further states she is aware of an increase in hyperactivity if she waits longer than two weeks to get him adjusted. The patient remains under chiropractic care at a frequency of twice monthly and is not on any related drug therapies.

Discussion

Alternative Care & Neurobehavioral Disorders

According to recent research, patients with ADHD are using

many types of alternative treatments. In one study of 822 children, Bussing reported that 5% (44 children) used complementary care including homeopathy, massage, chiropractic and acupuncture in the treatment of their ADHD. 14 children, or 1.7% used chiropractic care as an alternative. Another study by Stubberfield involving 381 children showed 64% of patients utilizing alternative treatments that included exercise and diet.⁶⁻⁷

A promising alternative treatment for patients with ADHD is electroencephalogram (EEG) biofeedback. A recent published paper reviewed all research that supports EEG biofeedback as an effective and viable alternative to drug therapies in treating ADHD.⁴⁶ A standard EEG is recorded at 19 sites which are broadly associated with varying mental states.

Up to 90% of patients with ADHD show signs of cortical hypoarousal, a deviation from normal patterns. EEG biofeedback protocols were developed to inhibit the cortical slowing, and reward higher frequencies in patients with this hypoarousal. The goal in most of these cases was to normalize EEG activity in the regions that are assumed to be responsible for attention and behavioral control. Computer software analyzes the EEG signals, then displays signals to the patient that provide rewards or inhibitions in the form of visual or audio feedback. All literature that was reviewed showed improvement in attention and behavioral problems in patients with ADHD who received the biofeedback. EEG biofeedback is a well-researched, well-established alternative to drug therapies for patients with ADHD.⁴⁶

Chiropractic Care

In an evaluation of chiropractic manipulation as a treatment of hyperactivity in children, Giesen and his colleagues studied seven hyperactive children who exhibited evidence of vertebral subluxation and found that five of the seven children showed improvement in mean behavioral scores from placebo care to treatment. The authors stated that there was "impressive evidence" that the majority of children in their study improved under specific chiropractic care and they suggest that chiropractic has the potential to become an important non-drug intervention for hyperactive children.⁴⁷

In perhaps one of the most well known studies of vertebral dysfunctions and their ramifications in children, Biedermann studied 600 children who were diagnosed with what he called *Kinematic Imbalance due to Suboccipital Strain* (KISS Syndrome). He reports on improvements in a variety of symptoms following manipulation to reduce the upper cervical dysfunctions including: torticollis, microsomy, scoliosis, motor asymmetries, and slowed motor development.⁴⁸

In a similar report, Gutmann reports on three cases of *Blocked Atlantal Nerve Syndrome* and describes the clinical picture to include central motor impairment and development through idencephalic impairments of vegetative regulatory systems. The causation according to his report lay in the neurophysiological connections between the upper cervical spine and the brainstem.⁴⁹

Previous case reports on chiropractic, ADHD and other neurobehavioral disorders all show improvement of symptoms

with such care. Barnes reports on an 11 year old boy with medically diagnosed attention deficit hyperactivity disorder who experienced academic and behavioral improvements concomitant with reduced subluxations following the introduction of chiropractic, nutritional, visual and counseling therapy.⁵⁰

Phillips reports on a 10 year old boy with a chronic history of ADHD, otitis media, allergies and headaches. The child had a history of birth trauma, forceps delivery and plagiocephaly. The boy reportedly cried for over 3 months following birth and was diagnosed with colic. The child received diversified spinal adjustments and craniosacral therapy for 5 months with improvement in symptomatology beginning at the end of the 4th visit. By the 11th visit all reports of ADHD symptoms had abated and academic improvement in school was noted.⁵¹

Elster provides a report of a 9 year old boy diagnosed with Tourette Syndrome, ADHD, depression, asthma, insomnia and headaches undergoing chiropractic care to reduce an upper cervical vertebral subluxation. The author reports an immediate reduction in symptoms following the initiation of care followed by the complete absence of symptoms within six weeks of chiropractic care. Beyond reporting on the outcomes of this case, Elster reviews a significant body of literature that suggests traumatic head injury as a trigger for Tourette's, ADHD, depression, insomnia and headaches.⁵²

Young reports on a case of a 4-year-old boy who underwent chiropractic treatment and showed improvement in his ADHD symptoms. The child was diagnosed with an Atlas subluxation and adjusted with a hand held adjusting instrument. After six treatments his temper tantrums ceased and aggressive behavior abated. In addition to chiropractic the boy was also placed on an omega 3 fatty acid supplement, and was given proprioceptive exercises similar to those given to the patient in this case study.⁵³

In another case report, Lovett and Blum report on an 8 year old child with ADHD who was diagnosed with upper cervical and sacroiliac subluxations and showed improvement with the use of Sacro-Occipital chiropractic technique. The patient presented with headaches, neck pain, constant blood shot eyes, and ADHD like symptoms. Notably, all of these symptoms started after a fall 18 months previous. The patient's mother indicated that prior to the fall, the child had normal development, activity, and learning skills. The SOT adjustments drastically improved all of the patient's symptoms. Three spelling tests were also included in the report; one from before the care began and two from after. The improvement in writing and spelling demonstrate improvement of the patient's learning skills and visual motor tasks.⁵⁴

Two other case reports exemplify the improvement in attention disorders in patients undergoing chiropractic care. In the first report Pauli reports on nine adult patients complaining of attention issues who took the visual portion of the Test of Variables of Attention (TOVA). All patients showed improvement in their TOVA scores after undergoing Network chiropractic care.⁵⁵

In the second study Bastecki reports on a patient with cervical

kyphosis who underwent Chiropractic Biophysics technique. The patient was a 5-year-old diagnosed with ADHD and treated by a pediatrician unsuccessfully with methylphenidate, Adderall, and Haldol for three years. The child received 35 chiropractic adjustments over an 8 week period. Cervical curve measurements revealed a change from a 12 degree C2-7 kyphosis to a 32 degree C2-7 lordosis following chiropractic treatment. The child's facial tics resolved and his behavior vastly improved with the child's pediatrician stating that the child no longer exhibited symptoms of ADHD.⁵⁶

EEG Patterns in ADHD

One interesting case study looked at EEG patterns (brain mapping) before and after chiropractic adjustments.⁵⁷ A 15-year-old patient with ADHD and his family had found that upper cervical adjustments relieved his symptoms and they wanted some objective evidence to show his school administration. This patient also had a history of frequent falls as a child and adolescent. His EEG showed a lack of synchronization of alpha and theta frequencies, similar to the findings in the aforementioned study on EEG biofeedback and ADHD.

Immediately following the adjustment, his EEG patterns dramatically changed to resemble patterns which were closer to normal. Though his handwriting did not noticeably change, he was able to perform a written task with more speed and less hesitation. The examiners also noted that while speaking with his father and professionals regarding his EEG after the adjustment, his social communication, attention, and focus improved. Interestingly, EEG patterns change in similar ways after biofeedback therapy and chiropractic adjustments.

The Brain Reward Cascade

Related to the concept of evolutionary bipedalism and its motor and cognitive consequences is the concept of the *Brain Reward Cascade* and its relationship to addictive and compulsive disorders. Disorders such as Attention Deficit, Tourettes, Autism and others are considered part of the spectrum of reward deficiency syndromes tied to dysfunction of the D2 dopamine receptor.⁵⁸

Addiction and compulsive disorders are multifactorial, having genetic, psychological, physical and spiritual components. Recent research has shown a genetic component in the form of a defective gene for the Dopamine D2 receptor. When functioning optimally, the human organism is capable of producing a cascade of neurotransmitters within the Central Nervous System which results in a sense of well-being. This is called the *Brain Reward Cascade*.⁵⁸

People suffering from the defective gene are unable to produce a reward cascade and are then said to suffer from *Reward Deficiency Syndrome* (RDS). Those individuals are unable to produce a feeling of well-being and, consequently, turn to addictive substances or compulsive behaviors that momentarily make them feel better.

RDS can be manifested in mild forms such as chain smoking or in more severe forms such as in chemical addictions. Alcohol addictions, obesity, nicotine addiction, attention-

deficit/hyperactivity disorder, cocaine addiction, Tourette's Syndrome and post-traumatic stress disorders are centrally mediated *Reward Deficiency Syndromes*.

Many things can interfere with the normal function of the *Brain Reward Cascade*, including, but not limited to: genetic factors; loss of normal neurological function (vertebral subluxations)⁵⁸ due to physical, emotional and chemical traumas; illness, nutritional deficiencies; and drug and medication interactions.

In vertebrates, the vertebral motor units are intimately related with the *Brain Reward Cascade* by virtue of the nociceptive reflex from vertebral joints to the limbic system where the cascade takes place. Research has shown that the limbic system is not just in the brain, but also extends to the spinal cord - especially the dorsal roots and dorsal horn.⁵⁹

The amygdala and hypothalamus are two such nodal points, of course. Moreover, they are particularly rich areas, because they contain receptors for essentially every neuropeptide we so far have identified. If our reasoning is correct - that the presence of a heavy density of neuropeptide receptors identifies a part of the limbic system - our research suggests that the *usual picture of the limbic system should be extended to include the spinal cord, for a third area enriched with neuropeptide receptors is the dorsal horn of the spinal cord.* (Emphasis Added)

It was Freud, of course, who drew our attention to the possibility that the brain has a conscious part and an unconscious or subconscious part. Normally, one thinks of the conscious part on the top and the unconscious part toward the back. But we would go further 'back' (or down) and say that the subconscious is in the spinal cord and even 'lower.' Psychologists talk about deep subconscious processes. Clearly, the network of chemicals that I have attempted to describe suggests that the subconscious extends to one's T-cells, to one's monocytes, and in a kind of flowing wave, back to one's brain cells.⁵⁹

Chiropractic Care in Addiction

One study that looked at the effects of a subluxation based model of chiropractic care in enhancing the well-being of individuals suffering from addictive disorders involved a landmark randomized, placebo control, single blind study.⁶⁰ The study, involving the University of Miami School of Medicine and Exodus Treatment Center, demonstrated that chiropractic adjustment of the spines of addicts enhanced their ability to complete a 30-day treatment protocol at a 100% retention rate compared to 56% in the group not receiving chiropractic. The chiropractic group also had significantly lower anxiety levels and did not require as many visits to the nurse's station.

Chiropractic's ability to affect the drive of unconscious proprioception through the central nervous system coupled with its affects on the spinal limbic system are fertile areas for future chiropractic research.

Nutrition

It is also important to note how important a role nutrition plays in the treatment of ADHD. Omega-3 fatty acids are essential for proper brain development and function and modern diets have an improper ratio of fats, mainly lacking the essential omega-3. Research is beginning to show a direct correlation between deficiencies in omega-3s and childhood neurodevelopmental disorders such as ADHD. After three months of omega-3 supplementation, significant improvements in spelling, reading, and behavior were noted in those children compared to a placebo group.⁶¹ Nutritional health at a very young age plays an important role in proper cognitive development. Notably, a longer duration of breast-feeding is positively associated with improved cognitive development in children. A recent study associated long-term breast-feeding with higher social competence scores and lower ADHD symptom scores.⁶²

Conclusion

Attention deficient/hyperactivity disorder clearly impacts today's youth. Children with ADHD also have an increased risk of developing conduct disorder, antisocial behavior, and drug abuse later in life.⁶³ ADHD is also associated with a twofold-increased risk of burns, fractures, head trauma, and poisoning. This increase is linked mostly to children on stimulant drugs for the treatment of ADHD.⁶⁴ The goal of treatment is to improve function, decrease symptoms, and improve well-being. But how well are the common forms of treatment doing this? A recent study investigated health-related quality of life (HRQL) in children with ADHD. Of the children involved in the study, almost half took some type of stimulant medication and all these children were found to have significantly low HRQL.⁶⁵

This case, along with previous case studies and other research exploring chiropractic care and ADHD show a positive change in symptoms making this an important area in need of further study. Additional research into a combination of chiropractic, nutrition, exercise, and other alternative treatments to understand their effectiveness in helping these children is suggested.

References

1. Homer C, Baltz R, Hickson G, Miles P, Newman T, Shook J. Clinical practice guideline: diagnosis and evaluation of the child with attention-deficit/hyperactivity disorder. American Academy of Pediatrics. *Pediatr* 2000;105 (5): 1158-70
2. Brown R, Freeman W, Perrin J, Stein M, Amler R, Feldman H, et al. Prevalence and assessment of attention-deficit/hyperactivity disorder in primary care settings. *Pediatr* 2001;107(3):E43
3. Carrick F. Forward in Melillo R, Leisman G. Neurobehavioral Disorders of Childhood. An Evolutionary Perspective. 2004 Kluwer Academic/Plenum Publishers. New York.
4. Rapport M, Moffitt C. Attention deficit/hyperactivity disorder and methylphenidate. A review of height/weight, cardiovascular, and somatic complaint side effects. *Clin Psychol Rev* 2002;22(8):1107-31.

5. Committee on Education and the Workforce: Subcommittee on Early Childhood, Youth and Families. May 16, 2000. <http://www.dea.gov/pubs/cngrtest/ct051600.htm> Last accessed 5/1/2008.
6. Bussing R, Zima B, Gary F, Garvan C. Use of complementary and alternative medicine for symptoms of attention-deficit hyperactivity disorder. *Psychiatr Serv* 2002;53(9):1096-102
7. Stubberfield T, Parry T. Utilization of alternative therapies in attention-deficit hyperactivity disorder. *J Paediatr Child Health* 1999;35(5):450-3
8. Melillo R, Leisman G. Introduction *in* Neurobehavioral Disorders of Childhood. An Evolutionary Perspective. 2004 Kluwer Academic/Plenum Publishers. New York.
9. Hart J, Boone W. Pattern Analysis of Paraspinal Temperatures: A Descriptive Report. *J Vert Sublux Res* 2000;3(4).
10. Miller J. Skin temperature instrumentation. *Int Rev Chiropr*. April 1967;39-41.
11. Schram S, Hosek R, Owens E. Computerized paraspinal skin surface temperature scanning: A technical report. *J Manipulative Physiol Ther* 1982;5(3):117-122.
12. Ebrall P, Iggo A, Hobson P, Farrant G. Preliminary report: The thermal characteristics of spinal levels identified as having differential temperature by contact thermocouple measurement (Nervo Scope). *Chiropr J Austr* 1994;24(4):139-143.
13. Stewart M, Riffle D, Boone W. Computer-aided pattern analysis of temperature differentials. *J Manipulative Physiol Ther* 1989;12(5):345-352.
14. Plaughner G. Skin temperature assessment for neuromusculoskeletal abnormalities of the spinal column. *J Manipulative Physiol Ther* 1992;15(6):368.
15. Senzon, S. The Theory of Chiropractic Pattern Analysis Based on the New Biology. Abstracts of the Eighth Annual Vertebral Subluxation Research Conference Sponsored by Sherman College of Straight Chiropractic. *J Vert Sublux Res* 2000;4(1).
16. Hart, J.. Analyzing the neurological interference component of the vertebral subluxation with the use of pattern analysis: A Case Report. Abstracts of Association of Chiropractic Colleges Eighth Annual Conference. *J Chiropr Ed*, Vol. 15, No. 1, 2001.
17. Brand N, Gizoni C. Moiré contourography and infrared thermography: Changes resulting from chiropractic adjustments. *J Manipulative Physiol Ther* 1982; 5:113-116.
18. Rademacher W. A premise for instrumentation. *Chiropr Tech* 1994;6:84-94.
19. Palmer B. Chiropractic clinical controlled research. Vol. XXV. Hammond (IN): W.B. Conkey Co; 1951;587.
20. Duff S. Chiropractic clinical research, interpretation of spinal bilateral skin temperature differentials. San Francisco: Paragon Printing; 1976;vi-vii.
21. Kent C. The Mental Impulse: A Strategy for Clinical Assessment. Abstracts of the 2007 International Research and Philosophy Symposium Sponsored by Sherman College of Straight Chiropractic. *J Vert Sublux Res* January 22, 2008.
22. Hart J, Omolo B, Boone W. Thermal patterns and health perceptions. *J Can Chiropr Assoc* 2007; 51(2).
23. Hart, J. Five minute thermal pattern analysis and health perception. *J Vert Sublux Res* May 3, 2007.
24. Hart, J. Five-Minute Thermal Pattern Analysis and Health Perception: A Follow-up Study. *J Vert Sublux Res* September 26, 2007.
25. Hart, J. Six minute acclimated thermal scans and health perception. *J Vert Sublux Res* July 30, 2007.
26. Richards D, McMillin M, Mein E, Nelson C. Correlations between paraspinal temperature variation and health status: From manual therapeutic art to objective measurement. American Academy of Osteopathy Annual Meeting March 2002.
27. Elster E. Sixty Patients With Chronic Vertigo Undergoing Upper Cervical Chiropractic Care to Correct Vertebral Subluxation: A Retrospective Analysis. *J Vert Sublux Res* Nov. 8, 2006;1-9.
28. Elster E. Eighty-One Patients with Multiple Sclerosis and Parkinson's Disease Undergoing Upper Cervical Chiropractic Care to Correct Vertebral Subluxation: A Retrospective Analysis *J Vert Sublux Res* August 2, 2004;1-9.
29. Elster E. Upper Cervical Chiropractic Care for a Patient with Chronic Migraine Headaches with an Appendix Summarizing an Additional 100 Headache Cases *J Vert Sublux Res* August 3, 2003;1-10.
30. Elster E. Upper Cervical Chiropractic Care For A Nine-Year-Old Male With Tourette Syndrome, Attention Deficit Hyperactivity Disorder, Depression, Asthma, Insomnia, and Headaches: A Case Report *J Vert Sublux Res* July 12, 2003;1-11.
31. Elster E. Upper Cervical Chiropractic Management of a Multiple Sclerosis Patient: A Case Report *J Vert Sublux Res* May 2001;4(2).
32. Elster E. Treatment of Bipolar, Seizure, and Sleep Disorders and Migraine Headaches Utilizing a Chiropractic Technique *J Manipulative Physiol Ther* March 2004;27(3).
33. Kessinger R, Boneva D. Vertigo, tinnitus, and hearing loss in the geriatric patient *J Manipulative Physiol Ther* June 2000;23(5):352-362.
34. Kessinger R, Boneva D. Case study: Acceleration/deceleration injury with angular kyphosis. *J Manipulative Physiol Ther* May 2000;23(4):279-287.
35. Kessinger R, Boneva D. Changes in Visual Acuity in Patients Receiving Upper Cervical Specific Chiropractic Care. *J Vert Sublux Res* 2(1):1-7.
36. Kessinger R. Changes in Pulmonary Function Associated with Upper Cervical Specific Chiropractic Care. *J Vert Sublux Res* 1(3):1-7
37. Kessinger R, Boneva D. Neurocognitive Function and the Upper Cervical Spine. *Chiropr Res J* 1999; 6(2): 88-89.
38. Kaminski T. Female Infertility and Chiropractic Wellness Care: A Case Study on the Autonomic Nervous System Response while Under Subluxation Based Chiropractic Care and Subsequent Fertility. *J Vert Sublux Res* November 2, 2003, pp. 1-10.
39. Lyons D. Response to Gonstead Chiropractic Care in a 27 year old Athletic Female with a 5 year history of Infertility *J Vert Sublux Res* November 9, 2003;1-3.

40. McCoy M, Malakhova E, Safronov Y, Kent C, Scire P. Improvement in paraspinal muscle tone, autonomic function and quality of life in four children with cerebral palsy undergoing subluxation based chiropractic care: Four retrospective case studies and review of the literature. *J Vert Sublux Res* June 21, 2006;1-15.
41. Pauli Y. Quality of Life Improvements and Spontaneous Lifestyle Changes in a Patient Undergoing Subluxation-Centered Chiropractic Care: A Case Study. *J. Vert Sublux Res* October 11, 2006;1-15.
42. Brand N, Gizoni C. Moire contourography and infrared thermography: Changes resulting from chiropractic adjustments. *J Manipulative Physiol Ther* Vol. 5 No. 3. September 1982.
43. Knutson G. Thermal asymmetry of the upper extremity in scalenus anticus syndrome, leg length inequality and response to chiropractic adjustment. *J Manipulative Physiol Ther* Vol. 20. No. 7. September 1997.
44. Cooperstein R, Gleberzon B. *Applied Kinesiology in Technique Systems in Chiropractic 2004* Churchill Livingstone.
45. Cuthbert S, Goodheart G. On the reliability and validity of manual muscle testing: a literature review. *Chiropr Osteopat* 2007;15(4)
46. Friel PN. EEG biofeedback in the treatment of attention deficit hyperactivity disorder. *Altern Med Rev* 2007;12(2):146-51
47. Geisen J, Center D, Leach R. An evaluation of chiropractic manipulation as a treatment of hyperactivity in children. *J Manipulative Physiol Ther* Vol. 12, No. 5. October 1989.
48. Biedermann H. Kinematic imbalances due to suboccipital strain in newborns. *J. Manual Med* 1992. 6:151-156
49. Gutmann G. Blocked atlantal nerve syndrome in infants and small children. *J. Manual Med* 1987.
50. Barnes T. A multifaceted approach to Attention deficit Hyperactivity Disorder: A Case report. *The International Review of Chiropractic*. January/February 1995.
51. Phillips C. The effect of utilizing spinal manipulation and craniosacral therapy as the treatment approach for attention deficit hyperactivity disorder. *Northwestern College of Chiropractic*.
52. Elster E. Upper cervical chiropractic care for a nine year old male with Tourette Syndrome, Attention Deficit Hyperactivity Disorder, depression, asthma, insomnia and headaches: A Case Report. *J. Vert Sublux Res*. July 13, 2003.
53. Young A. Chiropractic Management of a Child with ADD/ADHD. *J Vert Sublux Res*. Sept 6, 2007
54. Lovett L, Blum C. Behavioral and Learning Changes Secondary to Chiropractic Care to Reduce Subluxations in a Child with Attention Deficit Hyperactivity Disorder: A Case Study. *J Vert Sublux Res*. Oct. 4, 2006
55. Yannick P. Improvement in attention in patients undergoing Network Spinal Analysis: a case series using objective measures of attention. *J Vert Sublux Res*. August 22, 2007
56. Bastecki A, Harrison D, Haas J. Cervical kyphosis is a possible link to attention-deficit/hyperactivity disorder. *J Manipulative Physiol Ther* 2004;27(8):e14
57. Hoppers L. EEG and CEEG studies before and after upper cervical or SOT category II adjustment in children after head trauma, in epilepsy and in "hyperactivity". *Proceedings of the National Conference on Chiropr Pediatr* 1992:84-138
58. Blum K, Braverman E, Holder J, Lubar J, Monastra V, Miller D, et al. Reward Deficiency Syndrome (RDS): A Biogenetic Model for the Diagnosis and Treatment of Impulsive, Addictive and Compulsive Behaviors. Vol 32 Supplement. November 2000. Haight Ashbury Publications. *Journal of Psychoactive Drugs*.
59. Pert C, Dienstfrey H. The Neuropeptide Network. *Annals of the New York Academy of Sciences* 1988 Vol 521 pp 189-194.
60. Holder J, Duncan Robert C, Gissen M, Miller M, Blum K. Increasing retention rates among the chemically dependent in residential treatment: Auriculotherapy and subluxation-based chiropractic care. *J Molecular Psych* Vol 6, Supplement No. 1. March 2001.
61. Richardson A, Montgomery P. The Oxford-Durham study: a randomized, controlled trial of dietary supplementation with fatty acids in children with developmental coordination disorder. *Pediatr* 2005;115(5):1360-6
62. Julvez J, Ribas-Fitó N, Fornis M, Garcia-Esteban R, Torrent M, Sunyer J. Attention behaviour and hyperactivity at age 4 and duration of breast-feeding. *Acta Paediatr* 2007;96(6):842-7
63. Braun J, Kahn R, Froehlich T, Auinger P, Lanphear BP. Exposures to environmental toxicants and attention deficit hyperactivity disorder in U.S. children. *Environ Health Perspect* 2006;114(12):1904-9
64. Marcus S, Wan G, Zhang H, Olfson M. Injury Among Stimulant-Treated Youth With ADHD. *J Atten Disord* 2007;12 [Epub ahead of print]
65. Klassen A, Miller A, Fine S. Health-related quality of life in children and adolescents who have a diagnosis of attention-deficit/hyperactivity disorder. *Pediatr* 2004;114(5)