CASE STUDY

Improvement in Quality of Life, Sleep & Attention in a Patient with Attention Deficit Disorder Undergoing Upper Cervical Chiropractic Care to Reduce Vertebral Subluxation: A Case Report

Marshall Dickholtz Sr., D.C & Evan White, D.C.

ABSTRACT

Objective: To report an improvement in quality of life, sleep and attention following reduction of an upper cervical vertebral subluxation in a patient with Attention Deficit Disorder.

Clinical Features: A 19-year-old male presented for chiropractic care with complaints of Attention Deficit Disorder and chronic dorsal and lumbar pain.

Intervention and Outcomes: National Upper Cervical Chiropractic Association (NUCCA) technique was utilized to evaluate the appropriateness of chiropractic care. Several objective clinical findings were noted. The atlas misalignment was corrected with an upper cervical adjustment and immediate improvement was observed. Visual evoked responses revealed normalization of a previously abnormal steady-state visual evoked response. Outcome assessment tools showed significant improvements in overall health.

Conclusion: The reduction of the upper cervical vertebral subluxation was concomitant with improved quality of life, sleep and visual evoked responses.

Key Words: *Attention Deficit Disorder (ADD), Attention Deficit Hyperactivity Disorder (AD/HD), adjustment, subluxation, Magnetoencephalography (MEG), National Upper Cervical Chiropractic Association (NUCCA), Dysafferentation, Atlas*

Introduction

The Diagnostic and Statistical Manual of Mental Disorders defines three types of Attention Deficit Disorder (ADD): 1. Inattentive type; 2. Hyperactive-Impulsive type; and 3. Combined type (Inattentive and Hyperactive-Impulsive).[1] In order to be formally diagnosed an individual must display at least six symptoms specific to the first two types listed above. To be diagnosed as combined type an individual must display at least six symptoms from both the first and second type.

According to Barry et al, Attention Deficit Hyperactivity Disorder (AD/HD) "refers to a variable cluster of hyperactivity, impulsivity, and inattention symptoms which substantially affects the individual's normal cognitive and behavioral function."[2] AD/HD or something similar was first described by the ancient Greeks.[3] The first formal definition of the condition was established by Still in 1902.[3]

1. Private Practice of Chiropractic, Chicago, IL
2. Private Practice of Chiropractic, Lafayette, CO

Psychiatrists and researchers today find that AD/HD is a relative inability to regulate and organize behavior, which is equated to an impairment of the executive functions that are largely controlled by the frontal lobes of the brain.[3] AD/HD is one of the most common disorders treated by child and adolescent psychiatrists in America.[4] It accounts for as much as 50% of child psychiatric clinic populations.[5]

Prevalence ranges from 3 to 6%.[6] In clinical samples AD/HD is more common in males 9:1 and in epidemiological studies 4:1.[6] Community based studies show a ratio as low as 2:1.[7] Between 50 and 70% of children diagnosed with AD/HD will continue to suffer the symptoms related to the disorder as adults.[8] Adults tend to experience subtle impulsivity, restlessness, and inattention. AD/HD in adults is typically overlooked because most have learned to cope with these difficulties, making everyday life easier. Currently the children's diagnostic criteria is applied to adults. More research is needed to create a more sophisticated system for adult analysis.

This study will show the outcome following the reduction of vertebral subluxation and evaluation with magnetoencephalography (MEG) exam. Magnetoencephalography (MEG) is a noninvasive method of functional imaging performed by recording the magnetic flux on the head surface. It is associated with electrical currents in activated neurons, estimating the location of these neurons, and projecting their location in the brain onto a Magnetic Resonance Image (MRI). The MRI is used to identify and visualize the activated brain region.[9]

Parra et al. states that after electroencephalography (EEG), MEG is the only available neurophysiological technique able to trace neuronal activity with appropriate temporal resolution, i.e., in the millisecond range. This is in sharp contrast with other neuroimaging techniques widely used in neuroscience today such as PET, SPECT, and functional MRI, which measure neuronal activity indirectly and which have a rather poor temporal resolution ranging from seconds to several minutes.[10]

As mentioned above regarding AD/HD, impairment of the frontal lobes is present. The MEG allows an examiner to assess the impairment of frontal lobe function via magnetic flux. After the initial exam, successive exams can be performed to safely assess for positive or negative changes.

Case Report

History

A 19-year-old male presented to a private chiropractic practice with Attention Deficit Disorder (ADD) which his father reports he has had his whole life. His chief complaint was thoracic and lumbar pain. This had been going on for 5 years prior to the visit. His history revealed deficiencies in attention and organization.

Exam

Upon examination, supine leg length inequality and postural distortions were revealed. The supine leg length analysis showed a left contracted ilium of one inch. Anatometer analysis revealed a left ilium measuring 9 degrees lower than the right. The left shoulder measured 3 degrees lower than the right. A normal anatometer measurement should show no discrepancies between the right and left. It is used to empirically measure a patient's postural distortions. Figure 1 depicts the device and details its use. Anterior head translation of three inches, forward shoulder carriage of one and a half inches, and two inches of anteriority of the acetabulum were measured.

Figure 1. Anatometer posture analysis is performed by placing the patient's feet on the base of the device with the heels against the heel back. Two calibrated adjustable calipers are placed over the iliac crests and locked. A low-power laser pointer is used to locate upper body lean. Optical encoders ensure posture data is accurate to + or - 0.1 degree. Right and left weight measurements are taken by weight-sensitive transducers. The data is collected and displays the center of gravity shift including right weight, left weight, total weight, weight differential, and the percentage weight differential.

Intervention

Based upon the exam findings a subluxation of the atlas vertebra was suspected. Cervical spine radiographs were ordered to evaluate the atlas alignment. The National Upper Cervical Chiropractic Association (NUCCA) protocol and analysis requires lateral, nasium, and vertex radiographs.[11] Atlas misalignment was present. The atlas subluxation exhibited a laterality measuring 2.5 degrees left with 2 degrees of left anterior rotation. Rochester et al. and Jackson et al. show excellent reliability in upper cervical x-ray marking systems.[12-14]

Radiographs also revealed osseous degeneration of the cervical spine and calcium deposition within the cervical spine ligamentous structures. The first NUCCA adjustment was performed on the same day as the physical exam. The NUCCA adjustment was delivered to the patient in the side lying position. A static headpiece was utilized to support the mastoid of the head. The stance and line of drive to deliver the adjustment were determined by the radiograph analysis. The adjustment utilized a low force hand adjustment delivered to a depth ranging from 1/16 to 1/8 of an inch.[11]

Outcome

Immediately following the first adjustment the posture abnormalities improved. Anterior head translation was reduced to 1.5 inches. Anterior shoulder carriage was reduced to 0.5 inches. Anteriority of the acetabulum was reduced to 1 inch.

The patient was evaluated often to determine if a second adjustment was needed. The first corrective adjustment maintained proper alignment for 5 months. A second adjustment was delivered at that time. The patient was monitored for approximately two years. During this time only the two previous adjustments deemed necessary.

A Rand SF 36 outcome assessment tool was used to monitor the effect of care on the patient's physical functioning, bodily pain, general health, vitality, social functioning, and mental health as shown by Chart 1. The assessment was performed four times: at presentation, after one month of care, after two, and after ten months. Each assessment showed improvement when compared to the previous. The final assessment showed a perfect score in every category.

Chart 2 displays a Pittsburgh Sleep Quality Index outcome assessment tool used to monitor subjective sleep quality, latency, duration, efficiency, disturbance, sleep related medications, and daytime dysfunction. The sleep index is performed once per month for three months. Each monthly assessment showed improvement.

Magnetoencephalography examinations of spontaneous and evoked brain activity were performed 10 days before care and then two months following the first adjustment. On both the pre and post sessions mild slowing was seen in the delta and theta range with decreased parietal beta activity consistent with a diagnosis of ADD. Auditory evoked responses were within normal limits on pre and post sessions.

Visual evoked responses were also obtained prior to the first adjustment and demonstrated marginally abnormal findings of the steady state visual evoked response. There was normalization on the post adjustment scan.

The patient's mother reported that in general he was doing better and behaving better. He is more cooperative and is better able to follow through and complete tasks. These include chores at home, school work and music related activities. He began taking classes at college.

The patient reported resolution of his back, neck and head pain as well as improved sleep. He reported that he no longer feels "clumsy" and that he was able to start playing his musical instrument again.

Discussion

In this case an improvement in a patient with ADD was observed. Normalization of a previously abnormal visual evoked response followed an atlas subluxation correction. The patient and parents reported an improvement in physical functioning, bodily pain, general health, vitality, social functioning, emotion, and mental health measured by outcome assessment tools. Subjective sleep quality, latency, duration, efficiency, disturbances, medications, and dysfunction all improved as well.

A possible mechanism of improvement can be hypothesized by the theory of dysafferentation, which is an imbalance of somatosensory input to the central nervous system.[15] Alterations in this somatosenory input into the central nervous system can be linked to many seemingly unrelated symptoms.[16]

Dysafferentation describes the neuropathophysiological effect of subluxation. Dysafferentation caused by subluxation affects the sensory or afferent system of the body. Subluxation specifically impacts the afferent mechanoreceptors and nociceptors within anatomical structures of joints.[16] This phenomenon causes a reduction in mechanoreception and an increase in nociception.

Due to subluxation's effects causing restricted joint mechanics, possible pain, and local inflammation, it is found to be capable of producing a chronic increased firing of nociceptors (A-delta and C-fibers) and a decrease in the firing of mechanoreceptors (A-beta fibers).[17] Bonica stated that reflexes from nociceptive input cause secretion of catecholamines and cortisol.[18] Seaman proposed that this response could play an active role in cardiovascular disease, cancer, diabetes, arthritis, and Alzheimer's disease.[16]

Schmahmann stated "increased somatomotor activity, as indicated by increased proprioceptive input into the cerebellar nuclei, may be relayed directly to the hypothalamus, alerting these cell groups to impending demands on the visceral motor system. Through its many afferent motor pathways, the hypothalamus elicits immediate motor responses." He goes on to state "the cerebellar contribution to these different subsystems permits the ultimate production of harmonious sensorimotor, cognitive, and affective/autonomic behaviors."[19]

Whittingham and Nilsson studied the effects of spinal manipulation on active range of motion. They determined that active range of motion in the cervical spine increased following a spinal manipulation.[20] When range of motion is increased an increase in mechanoreception must accompany the change. It can be proposed that a vertebral subluxation causing decreased mechanoreceptive and increased nociceptive afferent input to the central nervous system can causes symptoms associated with AD/HD via abnormal cerebellar input preventing harmonious cognitive and affective function. By restoring proper joint mechanics by a necessary chiropractic adjustment, afferent nociceptive input is reduced and mechanoreceptive input is restored resulting in harmonious cognitive and affective brain function.

Testimonies on the success of chiropractic care are large in number. Despite the testimonies, there is little literature substantiating the claim. However, a review of the available literature regarding AD/HD and chiropractic care shows that chiropractic care should be considered as a beneficial approach to the management of patients diagnosed with AD/HD.

Alcantara and Davis performed a retrospective study of

children with complaints associated with AD/HD presenting to chiropractic clinics. During one year of care parents and teachers documented scores evaluating hyperactive/impulsive and inattentive behavior as well as behavioral, social, and emotional difficulties. All scores steadily improved during care.[21]

Peet cited after three months of chiropractic care on an eight-year-old male, the parents discontinued all medications due to the boy's improvement in cognition, concentration and the ability to control emotion.[22]

Barnes studied an eleven-year-old male over the course of three years. He documented improvement in academics, attention span, and temper.[23] Giesen et al studied seven subjects of school age. Clinical findings of vertebral subluxation were documented. Following chiropractic care, improvements were observed as follows: 57% showed an improvement in radiographic findings, 71% showed a decrease in associated poor behavior; 57% showed improvement in level of autonomic activity, and 57% showed higher parental ratings of hyperactivity.[24]

Geoff et al studied the correlation between chiropractic care and attention span. Computerized continuous performance testing in forty-one patients supported the hypothesis that chiropractic care has positive effects on sustained attention.[25]

Hospers et al studied an eleven-year-old with AD/HD for 3 years. With only the application of upper cervical chiropractic adjustments, the patient reported improvements in attention, social, and affective communication skills.[26] Despite the evidence displaying the effectiveness of chiropractic care resulting in the decreased expression of AD/HD symptoms, more research is needed, especially in the area of adult AD/HD.

Conclusion

The results of this case study suggest that the reduction of vertebral subluxation by a specific chiropractic adjustment may improve quality of life and brain function. The authors suggest that an atlas subluxation may trigger aberrant somatosensory input to the central nervous system resulting in the symptoms associated with attention deficit disorder. Further studies should be performed to substantiate this hypothesis

References

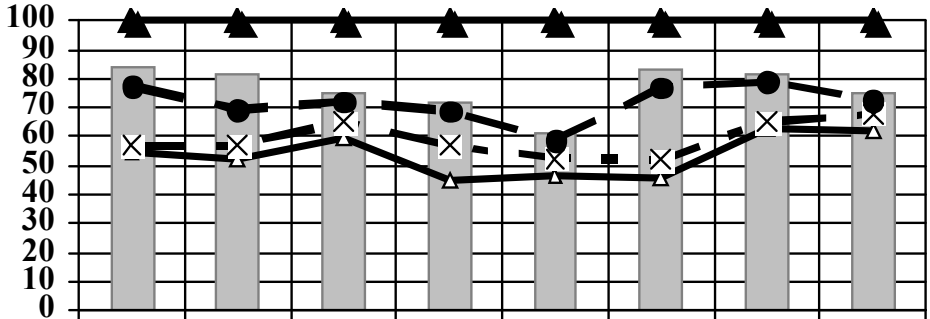
1. American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders. (4th ed.). Washington DC: American Psychiatric Association.
2. Barry R, Johnstone S, Clarke A. A review of electrophysiology in attention-deficit/hyperactivity disorder: II. Event-related potentials. Clinical Neurophysiology 2003; 114(2):184-198.
3. Brassett-Harknett A, Butler N. Attention-deficit/hyperactivity disorder: An overview of the etiology and a review of the literature relating to the correlates and lifecourse outcomes for men and women. Clin Psychol Rev 2007; 27(2):188-2010.
4. Barry R, Clarke A, Johnstone S. A review of electrophysiology in attention-deficit/hyperactivity disorder: I. Qualitative and quantitative electroencephalography. Clinical Neurophysiology 2003; 114(2):171-183.
5. Cantwell D. Attention deficit disorder: a review of the past 10 years. J Am Acad Child Adolesc Psychiatry 1996; 35:978-987.
6. Pelham W, Gnagy E, Greenslade K, Milich R. Teacher ratings of DSM-III-R symptoms for the disruptive behaviour disorders. J Am Acad Child Adolesc Psychiatry 1992; 31:210–218.
7. Szatmari P. The epidemiology of attention-deficit hyperactivity disorder. Child Adolesc Psychiatr Clin N Am 1992; 1:361–371.
8. Mannuzza S, Gittelman-Klein R, Bonagura N, Malloy P, Giampino T, Addalli K. Hyperactive boys almost grown up: V. Replication of psychiatric status. Arch Gen Psychiatry 1991; 48:77–83.
9. Wheless J, Venkataraman V, Kim H, et al. Assessing normal brain function with magnetoencephalography. International Congress Series 2002; 1232:519-534.
10. Parra J, Kalitzin S, Lopes da Silva F. Magnetoencephalography: an investigational tool or a routine clinical technique? Epilepsy & Behavior 2004; 5(3): 277-285.
11. Thomas MD 1st editor. NUCCA Protocols and Perspectives: A Textbook for the National Upper Cervical Chiropractic Association. 1st ed. Monroe: National Upper Cervical Chiropractic Research Association; 2002.
12. Rochester RP. Inter and intra-examiner reliability of the upper cervical x-ray marking system: a third and expanded look. Chiropr Res J 1994; 3(1): 23-31.
13. Jackson BL, Barker W, Bentz J, Gambale AG. Inter and intra-examiner reliability of the upper cervical x-ray marking system: a second look. JMPT 1987; 10(4): 157-163.
14. Jackson BL, Barker WF, Gambale AG. Reliability of the upper cervical x-ray marking system: a replication study. J Clin Invest Res 1988; 1(1): 10-13.
15. Seaman D. Joint complex dysfunction, a novel term to replace subluxation/subluxation complex: Etiological and treatment considerations. JMPT 1997; 20:634-44.
16. Seaman DR, Winterstein JF. Dysafferentation: a novel term to describe the neuropathophysiological effects of joint complex dysfunction. A look at the likely mechanisms of symptom generation. JMPT 1998: 21:267-280.
17. Peterson D, Bergmann T. Joint assessment principles and procedures. In: Bergmann T, Peterson D, Lawerence D, editors. Chiropractic Technique. New York: Churchill Livingstone; 1993. P. 51-121.
18. Bonica J. Clinical importance of hyperalgesia. In: Willis W, editor. Hyperalgesia and Allodynia. New York: Raven Press; 1992. p. 17-43.
19. Schmahmann JD, Pandyat DN. The Cerebrocerebellar System. Int Rev Neuro 1997; 41: p. 31-38, 38a, 39-60.
20. Whittingham W, Nilsson N. Active range of motion in the cervical spine increases after spinal manipulation (Toggle Recoil). JMPT 2001; 24(9): 552-555.
21. Alcantara J, Davis J. The chiropractic care of children With Attention-Deficit/Hyperactivity Disorder: A Retrospective Case Series. Explore 2010; 6(3): 173-182.

22. Peet J. Adjusting the Hyperactive / A.D.D. pediatric patient. Chiropractic Pediatrics 1997; 2(4):12-13, 16.
23. Barnes T. A multi-faceted chiropractic approach to ADHD: A Case Report. Intl Rev Chiro 1995; 51:41-44.
24. Giesen JM, Center DB, Leach RA: An evaluation of chiropractic manipulation as a treatment for hyperactivity in children. JMPT 1989;12(5):353-363.
25. Goff P, Sheader W, Thornton M, Sheader D. Using a computerized performance test to assess the effects of chiropractic adjustment on attention apan: A pilot study. Chiropr J Aust 2000; 30(2): 48-54.
26. Hospers L, Zezula L, Sweat M. Life upper cervical adjustment in a hyperactive teenager; Today's Chiropractic, 1987, 15(16):73-75.
27. Ware J, Gandek B. Overview of the SF-36 health survey and the International Quality of Life Assessment (IQOLA) Project. J Clin Epidemiol 1998; 51(11):903-912.
28. Buysse D, Reynolds III C, Monk T, et al. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Res 1989; 28(2): 193-213.

Charts 1 & 2. Outcome assessment tool results -- Chart 1 portrays a Rand SF 36 study. The SF 36 is a generic, short-form, thirty-six question survey that yields a summary of physical and mental measures.[27] Chart 2 portrays a Pittsburgh Sleep Quality Index. This outcome assessment was developed to discriminate between "good and bad" sleepers in a valid and reliable manner.[28] A maximum score of three indicates the worst quality of sleep. A score closer to zero indicates a superior sleep outcome. This index is performed monthly. After the first month scores were poor. Quality of sleep improved moving closer to zero each of the first three months following the onset of subluxation based chiropractic care.

Chart 1.

SF-36 v. 1 Scores ADD Case Study (over 10 months)

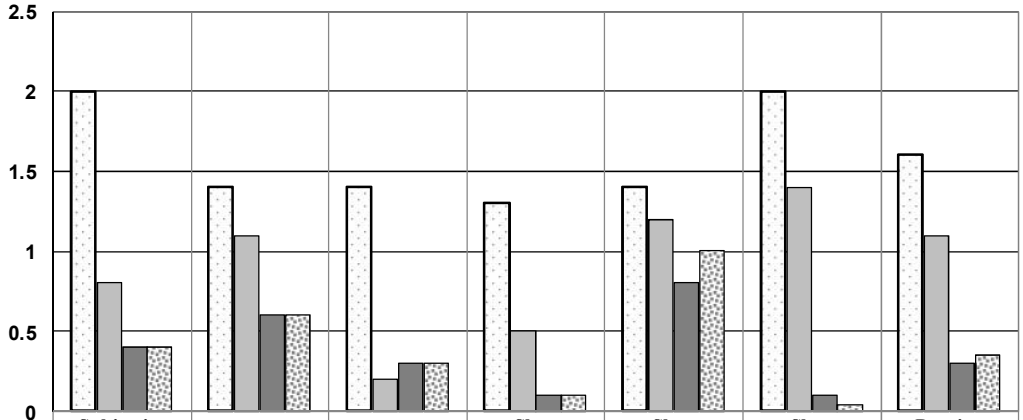


	PF	RP	BP	GH	VT	SF	RE	MH
US Average	84.2	81	75.2	72	60.9	83.3	81.3	74.7
12/17/2007	54.5	52.4	59.7	44.6	46.3	45.8	62.9	62.1
1/25/2008	56.8	56.8	64.9	56.7	52.4	51.8	65.1	67.8
2/15/2008	77.3	69.1	72.1	68.8	58.9	76.8	78.8	72.3
10/20/2008	100	100	100	100	100	100	100	100

PF=Physical Functioning, RP=Role Physical, BP=Bodily Pain, GH=General Health, VT=Vitality, SF=Social functioning, RE=Role Emotional, MH=Mental Health

Chart 2.

Pittsburgh Sleep Quality Index (PSQI) Component Scores ADD Case Study (over 3 months)



	Subjective Sleep Quality	Sleep Latency	Sleep Duration	Sleep Efficiency	Sleep Disturbance	Sleep Medications	Daytime Dysfunction
12/17/2007	2	1.4	1.4	1.3	1.4	2	1.6
1/25/2008	0.8	1.1	0.2	0.5	1.2	1.4	1.1
2/15/2008	0.4	0.6	0.3	0.1	0.8	0.1	0.3
U.S. Avg (n = 52)	0.4	0.6	0.3	0.1	1	0.04	0.35