

Improvement in behavior and attention in a 7-year-old girl with ADHD receiving chiropractic care: A case report and review of the literature

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ABSTRACT

Objectives: To present the case of a 7-year-old female previously diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD), and the improvement and management of symptoms under regular chiropractic care, including the integration of a retained asymmetrical tonic neck reflex (ATNR). **Methods:** Online review of the literature on motor development delay and chiropractic was performed using The Index to Chiropractic Literature, PubMed and Google Scholar. Search terms “ADHD”, “chiropractic” and “spinal manipulation” were used. **Clinical features:** A 7-year-old female previously diagnosed with ADHD presented with anxiety, sleep disturbances, learning difficulties and behavioral issues. Her mother reported sleep disturbances began at 22-months following a fall onto her forehead. Previous treatments for ADHD, including behavioral therapy, psychotherapy and dietary intervention, had marginal success. A retained ATNR and aberrant H-test (cranial nerves III, IV, and VI) was identified. Direct objective indicators of vertebral subluxation at C1, T2, T4, T9, and sacrum were identified on spinal examination. **Intervention and outcomes:** Modified Diversified using an Activator instrument as a force application was applied to correct vertebral subluxation. Within the 4 visits, the child's behavior, mood and sleep patterns had improved, and the retained ATNR had integrated. Cranial nerve findings had resolved. Direct objective indicators of vertebral subluxation had reduced. Ongoing care continued to improve and manage the presenting behavioral symptoms. **Conclusion:** Chiropractic care focused on the correction of vertebral subluxation, was associated with improvements in the child's presenting symptoms associated with ADHD.

Key words: Attention Deficit Hyperactivity Disorder; ADHD; Chiropractic; Pediatric; Vertebral Subluxation; Chiropractic Spinal Manipulation.

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a complex pattern of persistent inattention and/or hyperactivity and impulsiveness that can interfere normal functioning or development.¹⁻³ Within the criteria, an individual's academic and/or occupational activities are assessed relative to the expected developmental level of that individual's age.¹⁻³ The inattentive and/or hyperactive-impulsive symptoms must have a detrimental effect on the quality of social, academic or occupational functioning.³

ADHD is considered to be common behavioral disorders in children and adolescents.^{2,4,5} It has been estimated, through the Global Burden of Disease study, that 26 million children and adolescents have ADHD.³ Over the past two decades there has been a significant increase in the prescription of medications for children diagnosed with ADHD.⁶⁻⁸ Ritalin and Dexamphetamine are stimulants that have been used for over 40 years with short-term success in managing the symptoms of ADHD in 80-90% of children.⁶ The steady increase in diagnoses of ADHD in the past decade is only compounded by the concern that current best practice for treatment (pharmaceutical intervention) does not actually

treat the cause of ADHD, it only haphazardly manages the symptoms.⁹

Current non-pharmaceutical treatments for ADHD, including behavioral therapies,¹⁰ educational therapies,¹¹ family counselling,¹² and dietary or nutritional intervention,^{13,14} have exhibited varying degrees of success, though none stand out as significantly more effective than others. A common approach is to combine these methods to have a cumulative effect.¹⁵

Chiropractic care for the pediatric population has grown in acceptance.^{16,17} Parents regularly choose chiropractic care to help manage common childhood conditions.^{18,19} Chiropractic care aims to optimize health and wellbeing through the enhancement of the nervous system function by removing nerve interference caused by vertebral subluxation.²⁰ A vertebral subluxation represents an altered state of afferent input which can lead to maladaptive changes in central neural plasticity resulting in dysfunction.²⁰ The Australian Spinal Research Foundation developed a conceptual definition of vertebral subluxation that states, “A vertebral subluxation is a diminished state of being, comprising of a state of reduced

coherence, altered biomechanical function, altered neurological function and altered adaptability.”²¹ The correction of vertebral subluxations is achieved through chiropractic adjustments that are typically manually performed.²²⁻²⁴

Current literature regarding the chiropractic management of pediatric patients with ADHD is limited, and primarily of a low level of evidence.²⁵⁻²⁷ The evidence to date suggests that chiropractic care may be beneficial for this population.²⁷ The purpose of this study is to report the improvements in symptoms associated with ADHD in a 7-year-old female following chiropractic care.

Methods

To assess the relevance to chiropractic, an online review of the literature on ADHD and chiropractic was performed. The Index to Chiropractic Literature and PubMed were consulted using the search terms “ADHD,” “chiropractic” and “spinal manipulation.” Databases were searched from inception through July 2017, with peer-reviewed and complete systematic reviews, clinical trials, case series and case reports, all being included. Abstracts from research symposia were not included in the review.

Case Report

History

A 7-year old female with anxiety, sleep disturbances, learning difficulties and behavioral issues presented for chiropractic assessment. The presenting complaints were reported to be worsened by overstimulation and change of routine.

A review of the child’s health history revealed a birth requiring forceps and ventouse extraction. The child’s sleep disturbances are reported to have begun at 22-months of age, following a minor fall resulting in a laceration above her nose requiring medical management to suture the wound. Her sleep disturbance is reported as lacking the ability to fall asleep.

The child’s anxiety is reported to be associated with being bullied at school. Her learning difficulties and behavioral issues are reported as a greatly reduced attention span, and difficulty in following instructions at home and at school. She was medically diagnosed at age seven with ADHD by a general practitioner and pediatrician. It is unknown if the general practitioner or pediatrician used a formal instrument to assess ADHD. The pediatrician prescribed Ritalin, however the child’s parents were interested in seeking alternative solutions.

Previous treatments sought include cognitive behavioral therapy (CBT), psychotherapy and dietary changes. The

parents reported these to be ineffective in helping manage their daughter.

Examination

The child presented with an unsettled demeanor and short attention span, was distracted, hyperactive and had difficulty following instructions. Generally, the child’s gait and coordination were observed to be normal.

Postural analysis revealed a high left mastoid and shoulder with left scapular winging. Anterior tilt of the pelvis was also noted. No other postural abnormalities were reported. All global ranges of motion were within normal limits. Posture and ranges of motion were assessed via manual observation and palpation only.

Neurological examination presented with a retained bilateral asymmetrical tonic neck reflex (ATNR).²⁸ Assessment of cranial nerves III, IV, and VI revealed inability to track on H-test (by having the patient follow an object moved across their full range of horizontal and vertical eye movements by the chiropractor), especially the right eye, with saccadic pursuit at the lateral right of H-test.²⁹

Initial chiropractic examination for vertebral subluxation was performed using commonly used clinical indicators.³⁰⁻³⁵ Direct objective indicators of vertebral subluxation at C1, T2, T4, T9 and sacrum were identified through static and motion palpation, leg length inequality, Derifield assessment, sacral restriction test and cervical syndrome test.

Intervention

Informed consent was obtained from the child’s mother at the initial consultation for the child to begin chiropractic care. Full spine chiropractic care was administered over a period of 11-weeks at a frequency of one visit per week. Vertebral subluxations were routinely assessed using static and motion palpation, muscle testing, muscle palpation and leg length analyses including leg length inequality, Derifield, cervical syndrome and sacral restriction.³⁰⁻³⁵

Chiropractic adjustments were made using Diversified technique (Activator™ instrument assisted). Diversified is the most widely used chiropractic technique and system of adjusting that uses primarily motion and static palpation to locate levels of vertebral subluxation, and focuses on the restoration of proper biomechanics within the spine.³⁶ The most commonly adjusted levels of the child’s spine were C1, the left sacrum and T9, addressed 10, 9 and 8 out of the 11 visits respectively. For a detailed list of spinal levels addressed each visit see Table 1.

When the child began chiropractic care, she was seeing a counsellor weekly for CBT. She had undergone three visits

for CBT prior to commencing chiropractic care. Only two further visits were attended once starting chiropractic care as the child's change in behavior was rapid, and the mother did not believe CBT had been as effective.

Outcomes

Over the course of chiropractic care the child demonstrated reduction in symptoms associated with ADHD, was less anxious and had improved sleep patterns. Following the second visit the parents reported that the child's sleep patterns had improved markedly, and had noticed improvement in her behavior and anxiety levels. By the third visit the parents reported she was able to better concentrate. At the time of the fourth visit the child had had a successful sleepover for the first time, and clinical examination revealed resolution of ATNR.

Generally, the child's behavior was reported to have improved over the course of care and now remains under the chiropractor's care at a reduced visit frequency, every two to three weeks as recommended each visit, for regular wellness care. For a detailed list of reported and observed changes in the child's behavior and presenting complaints see Table 1. No adverse reactions were identified or reported during the course of chiropractic care.

Cranial Nerve examination (CN III, IV, and VI) revealed normalization of ocular tracking on H-test. Saccadic pursuit on lateral right H-gaze had resolved.

Chiropractic spinal examination revealed a right leg length inequality and negative Derifield (short leg remaining short on knee flexion to 90°), right Levator Scapula hypertonicity, right C5/6 edema, and decreased joint play and intersegmental motion of T3/4. These findings indicated a reduction of direct objective indicators of vertebral subluxation when compared to the initial presentation of the patient.

Discussion

Improvements in behavior associated with ADHD, sleep patterns and anxiety were reported in a 7-year-old female over the course of 11-weeks of chiropractic care. The child had a 5-year history of sleep disturbance, anxiety associated with school bullying, and ADHD medically diagnosed at age seven prior to commencing chiropractic care.

Most commonly a pharmaceutical approach is used in the treatment of ADHD, however there has been concern about this approach.⁶⁻⁹ Non-pharmacological approaches such as dietary change and counselling have shown some positive benefits, and more so when used in combination.¹⁰⁻¹⁵ Com-

Visit	Vertebral segment adjusted/Chiropractic listing	Parent's and chiropractor's observations
1	PL Sac, C1 ASR	
2	L5 BL, C5 BL, C1 ASR	Symptoms reduced significantly to last week; sleeping better, not as jittery, calmer. Parents have noticed big difference in behavior and anxiety levels.
3	T12 BR, T4 BR, C1 ASR	Moods improved, and able to concentrate better. Some anxiety with a child at school. Sleeping well
4	PL SAC, T9 BL, T4 BR, C1 ASR	Still doing well; marked improvement in behavior. Had a (successful) sleepover for the first time
5	PL SAC, T9 BL, T4 BR, C1 ASR	Still doing well with behavior and sleeping well at night.
6	PL SAC, T9 BL, T4 BR, C1 ASR	Behavior has been difficult to manage past 5 days.
7	PL Sac, T9 BL, T4 BR, C1 ASR	Behavior much improved over past week.
8	PL Sac, T9 BL, T4 BR, C1 ASR	Has been a little anxious and sleep is unsettled.
9	PL Sac, T9 BL, C1 ASR	Anxiety has improved. Sleep has been better though still unsettled. Behavior good.
10	PL Sac, T9 BL	Sleep improved after adj; attempted a sleepover again and managed to stay the night with minimal anxiety.
11	PL Sac, T9 BL, C1 ASR	Maintenance visit. Behavior good and sleeping well.

Table 1. Vertebral segments adjusted each visit and observations of both the parents and chiropractor.

plementary and alternative medicine (CAM) approaches are used by parents and healthcare providers, with ADHD being one of the most common reasons for seeking care.³⁷ Chiropractic care is one of the more common CAM modalities that parents choose for children, though still a very niche area.³⁷ Therefore, it is important to investigate the effect of chiropractic care on a child with ADHD.

While the chiropractic literature for this specific population is limited, a literature review revealed three systematic reviews of the literature,²⁵⁻²⁷ one clinical trial,¹⁵ one qualitative study,³⁸ four case series³⁹⁻⁴² and 18 case reports⁴³⁻⁶⁰ relevant to chiropractic management of people presenting with ADHD. All but one study described the care of pediatric patients. The clinical trial only described the proposed protocol for the study, results were to be published at a later date.¹⁵

The systematic reviews all report that the literature regarding the chiropractic management of pediatric patients with ADHD is not only limited, but primarily of a low level of evidence.²⁵⁻²⁷ The most recent systematic review however does suggest that chiropractic care may be beneficial for this population, though recognizes that higher level investigation is necessary.²⁷

Hermansen and Miller³⁸ conducted a qualitative study that adds weight to the inclusion of a biopsychosocial model in the clinical management of people with ADHD. In the study chiropractic care was well received by the patients reported by high levels of satisfaction, two-thirds of the subjects were using chiropractic solely with behavioural improvements reported by parents and teachers. The inclusion of Interactive Metronome treatment was found to be one of the major benefits of the course of care. The study suggests that parents felt the use of 'alternative' treatments was looked down on by other members of the public.

Alcantara and Davis³⁹ reported on four males, aged 7 to 11, who had been assessed using a 15-item Parent Teacher ADHD questionnaire. The children were managed with Diversified and Gonstead techniques for five months, with the inclusion of nutritional supplements. All children were found to have reduction in ADHD symptoms based on the questionnaire.

Cuthbert and Barras⁴⁰ reported on 157 children (86 male and 71 female) aged 6 to 13 diagnosed with developmental delay syndromes, including ADHD, via psychometric testing by a logopedist. Chiropractic care using Applied Kinesiology and Diversified techniques for 2 to 50 visits over a period of 5-days to 18-months. Parents reported behavioral improvements in all cases.

Hodgson and Vaden⁴¹ reported on four children aged eight to 12 who had been formally diagnosed with ADHD us-

ing the ADHD Symptom Regularity and Severity questionnaire, and had a history of medication for ADHD symptoms. Chiropractic care using Torque Release Technique over 5 to 10 months and all children showed improvements in ADHD symptoms indicated by the questionnaire.

Pauli⁴² reported on nine adults (four male and five female) presenting with ADHD assessed via the TOVA test. Chiropractic care using Network Spinal Analysis over a two month period resulting in all patients demonstrating significant improvements on the TOVA test.

The case reports suggest a generally positive benefit of chiropractic care with children and adolescents who present with ADHD.⁴³⁻⁶⁰ For a review of the case reports see Table 2.

Of the 23 peer-reviewed studies (qualitative study, and case series and reports) describing chiropractic management of patients presenting with ADHD, 15 (65.21%) specifically reported assessment and correction of vertebral subluxation,^{41-44,46,48-55,57,58} with 17 (73.91%) describing direct clinical indicators commonly used in the assessment of vertebral subluxation.^{41-44,46-55,57,58,60} The most commonly used approaches to address vertebral subluxation were Upper Cervical and Diversified techniques.^{39,40,43,45-49,52,54,55,59} Ten (43.47%) of the 23 studies reported additional intervention, such as auriculotherapy, soft tissue therapy and dietary supplementation in conjunction with chiropractic care.^{39,43-45,47,51,54,56,59}

Seventeen (73.91%) of the 23 studies describe formal/medical diagnosis of ADHD.^{38-45,47-50,53-55,57,59} One further case was assessed through the schooling system.⁵¹ Improvements in symptoms associated with ADHD were self-reported in the majority of cases, though there is little evidence of improvement following a course of chiropractic care being measured via a formal assessment instrument such as the TOVA test.^{39,41-45} In three cases a medical practitioner or therapist determined that the symptoms associated with ADHD had improved or resolved, though it is unclear if a formal assessment was used.^{50,57,59} In many cases the published literature indicates that reported improvements are either from parent and/or teacher observations, or self-reported.^{38,40,46-49,51-56,58,60}

Though limited, the current literature suggests that chiropractic care can improve symptoms related to ADHD.^{27,38-41,43-47,49-58} The findings from the current case study is congruent with previously reported studies investigating the effects of chiropractic care on the symptoms associated with ADHD. Of note is that the majority of studies report the assessment and correction of vertebral subluxation being associated with improvements, giving weight to research that investigates the vertebral subluxation in general.^{61,62} This study supports the use of chiropractic care for children and

young adults with ADHD.

Limitations

There are inherent limitations of a single case study. These include lack of a control group, and the inability to exclude spontaneous remission, accounting for cumulative effects of previous care, or a self-limiting clinical presentation. We caution the reader that generalizations to a larger population cannot be made. In this case the assessment of ADHD was made through a medical practitioner assessment but may not have been via an instrument such as a TOVA test. Reported improvements were through subjective observations made by the parents and chiropractor. Additionally, there were limited outcome measures used in the manage-

ment of this child.

A further limitation is the current lack of higher level investigation into the chiropractic care of this population. Further higher level investigation should be undertaken by the profession.

Conclusion

Chiropractic care, using instrument assisted Modified Diversified technique for the correction of vertebral subluxation, was associated with improvements in the child's presenting symptoms associated with ADHD. Higher level research is needed to investigate the role chiropractic may play in helping infants and children who present with ADHD.

Authors	Patient presentation	General case management	Results reported
Bagnaro ⁴⁴	11-year-old male with noted behavioral and learning difficulties. ADHD formally assessed via behavioral Evaluation, TOVA	20 visits over 3 months, exercises and dietary advice given NUCCA technique	Reduced ADHD symptoms, improved TOVA assessment and academic performance
Hodgson and Fox ⁴⁵	21-year-old male with ADHD and migraine. ADHD assessed via Symptom Regularity and Severity Questionnaire	13 visits over 10 weeks, Auriculotherapy was also used Torque Release technique	Reduction in ADHD and migraine symptoms. Improved based on ADHD Symptom Regularity and Severity Questionnaire
Kuhn and Cambron ⁴⁶	15-year-old male with chronic headaches and 10-year history of behavioral issues. ADHD formally assessed via TOVA	42 visits over 19 weeks, home physical coordination activities prescribed Diversified technique	Improved based on patient reports and various validated methods, reduced medication
Manis and Rubenstein ⁴⁷	10 year old male with ADHD and involuntary motor tics	15 visits (8 adjustments) over a period of 10 months. Upper cervical technique	Parent reported changes in behavior
Muir ⁴⁸	5 year old male with medically diagnosed ADHD	21 visits over a 6-month period. Soft tissue therapy and myofascial release also used. Diversified technique	Parents reported improvement in behavior
Scroggin ⁴⁹	11-year-old male with upper back pain, and Autism and ADHD diagnosed by a pediatrician	8 visits (adjusted on 7) over 8 weeks. Grostic technique	Back pain resolved, No discussion of ADHD improvement
Wolfertz and Dahlberg ⁵⁰	16-year-old male medically diagnosed with bipolar disorder and ADHD	15 weeks, however the number of visits is unknown. Knee Chest Upper Cervical technique	Parent reported improvement in behavior
Zielinski and Mankal ⁵¹	8-year-old male diagnosed with inattentive type ADHD and learning disability. ADHD was diagnosed via private psycho-educational testing	27 visits, however the timeframe of care is unknown. Chiropractic Biophysics and Turner Cranial techniques	Pediatrician, teachers and parents reported improvement in presenting symptoms
Bedell ⁵²	7-year-old female identified through the school system as having behavioral concerns including aggression and inattention.	90 days (3 times per weekly) craniosacral therapy and nutritional supplementation (fish oils). Torque Release Technique	Parent reported improvement in behavior

Olafsson ⁵³	4 ½ year old male with suspected ADHD but not formally diagnosed	10 visits over 10 weeks, with dietary changes and exercises being prescribed. Diversified technique	Parent reported behavioral changes
Cassista ⁵⁴	4-year-old male with sleep disturbances and ADHD diagnosed by a pediatrician	3 visits per week for 2 ½ months, then reduced frequency to periodic care due to parents moving away. Pettibon technique	Parent reported behavior changes. The child's behavior reverted to pre care behavior and when assessed again after a 16 month hiatus from care the child demonstrated a marked increase in VS indicators similar to pre care
Stone-McCoy and Przybysz ⁵⁵	3 ½ year old male diagnosed with ADHD by a psychologist	3 visits weekly for 3 weeks, 1 visit weekly for 8 weeks, 1 visit every other week. Omegas and proprioceptive exercises were also introduced. Upper cervical technique	Parent and teacher reported improved behavior (attention and energy levels)
Elster ⁵⁶	9-year-old male with respiratory issues, ADHD, depression, insomnia and headaches. ADHD was diagnosed by a neurologist via the Attention Deficit profile worksheet	5 months Upper cervical technique	Parent, practitioner and self-reported improved behavior
Blum and Cuthbert ⁵⁷	2-year-old female with delayed developmental and emotional growth.	5 years Craniocervical therapy. (multi mineral supplement also given)	Parent reported changes in behavior. At 7 years of age is equal to her twin brother
Bastecki et al. ⁵⁸	5-year-old male with ADHD unsuccessfully treated with Ritalin. ADHD was medically diagnosed via the common ADHD checklist	35 visits over 8 weeks Chiropractic Biophysics technique	Medical doctor determined child no longer exhibited ADHD symptoms
Jaszewski and Sorbara ⁵⁹	7-year-old female with ADD, difficulty concentrating, vomiting and migraine. ADD was not formally diagnosed	1 visit weekly for 5 weeks Pierce Results System technique	Parent reported changes in behavior
Young ⁶⁰	4-year-old male with multiple behavioral conditions. ADHD was medically diagnosed	12 weeks (6 visits) with proprioceptive exercises, and dietary changes and supplements prescribed. Upper cervical technique	Parents, teachers and speech therapist reported positive behavior changes
Lovett and Blum ⁶¹	8-year-old male with behavioral symptoms associated with ADHD but not formally diagnosed	8 weeks (weekly visits) Sacro-Occipital Technique	Parents and teacher reported improvement in behavior

Table 2. ADHD case report summary.

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