Case Study

Improvement in Post-Traumatic Stress Disorder Following Network Spinal Analysis Care: A Case Study & Review of Literature

Peter Fox, D.C.[1]
Shannon Martin, D.C.[2]

1. *Private Practice of Chiropractic, Davenport, IA*
2. *Private Practice of Chiropractic, Marietta, GA*

Abstract

Objective: This case study focuses on a 35-year-old male who presented to the office with complaints of post-deployment Post-Traumatic Stress Disorder (PTSD) symptoms that interfered with his ability to function on a daily basis. This study highlights the role of Network Spinal Analysis care in the improvement of PTSD symptoms in this individual.

Clinical Features: The patient presented to the office for assistance reducing his emotional stress due to post-deployment PTSD. He stated that he wished to become more resilient and gain the ability to cope with stress more effectively. His past health history included group and individual talk therapy with little improvement in PTSD symptoms.

Intervention and Outcomes: A self-rated health questionnaire was administered before and after care to measure self-reported outcomes in PTSD symptomatology. An initial examination and a post examination were performed to determine the levels of vertebral subluxation and adverse mechanical cord tension (AMCT). The patient received six weeks of Network Spinal Analysis care for a total of 12 visits. During each visit, an entrainment was performed in which light contacts to the cervical spine and sacrum were administered to address vertebral subluxations and AMCT.

Conclusions: This case demonstrates improvement in post-deployment PTSD symptoms over a 6-week period of Network Spinal Analysis care.

Key Words: *Chiropractic, Adjustment, Subluxation, Network Spinal Analysis, Post-Traumatic Stress Disorder, Reorganizational Healing, Anxiety, Stress, HPA-Axis, Dysafferentation, Neurodystrophic*

Introduction

Epidemiology of PTSD

Mental Illness is a very relevant topic in health care today. In 2013, approximately 1 in 5 adults over the age of 18 were diagnosed with a mental illness and approximately half of all Americans will experience a mental illness in their lifetime. In 2006 alone, the cost of treating the 31.6 million adult patients with mental illnesses in the United States totaled 48.6 billion dollars.[1] This paper will focus on one of these psychiatric disorders: Post-Traumatic Stress Disorder (PTSD). Specifically, we will focus on post-deployment PTSD associated with veterans, due to its increasing prevalence in the military population.

In the general population, the prevalence of PTSD is estimated to range between 8%-14%; however, the prevalence in the military population is much higher.[2] A 2010 study of the Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) military population showed prevalence rates of PTSD between 13.3%-19.8%.[3]. Other studies have shown

PTSD prevalence to be as high as 31%.[4] In addition to service members that are immediately diagnosed with PTSD post-deployment, as many as 2%-8% of service members are later diagnosed with new-onset PTSD within the first 3-years after their deployment ends.[5] Post-traumatic Stress Disorder is the second highest prevalent condition in the military population, second only to Depression.[1] Such high statistics in this population constitutes a close look at this disorder.

Economic Impact

Economic costs play a major role in determining policy when dealing with healthcare. Therefore, we must determine PTSD's cost to society; however, we must look at the secondary and tertiary effects of PTSD in addition to the direct effects. We must consider the medical costs of caring for today's veterans approximately 30-40 years post-service, when the cost for caring for war veterans peaks. Current veterans will hit this peak around 2035. If current trends continue, the data from the Congressional Budget Office predicts total lifetime medical costs for veterans over the next 40 years to be between $300 and $600 billion dollars. Although this number takes into account all medical costs and not just PTSD, PTSD has been shown to be a key factor in contributing to poor long-term health and is unlikely to be a disorder in isolation.[4] A veteran diagnosed with PTSD incurs approximately 60% higher medical costs throughout their lifetime than the average person.[6] Whether physically injured or not, many veterans develop PTSD; this translates into a lower quality of life and a greater number of medical problems than those who do not suffer from PTSD. Increased suicide rates, substance abuse, depression, anxiety, heart disease, obesity, diabetes, gastrointestinal disorders, musculoskeletal disorders, chronic fatigue, and increased dementia have all been shown to be secondary and tertiary effects of PTSD, which then lead to increased medical costs.[4]

In 2010, a study of United States Service members in Iraq estimated that the total societal cost of PTSD per person ranged from $5,900 to $25,800 over a two-year period. A follow-up study averaged this cost to be about $16,000 per person. Using this data, while allowing inflation and prevalence statistics to remain unchanged, this study determined an average cost of nearly $50,000 over two years per veteran with PTSD. When adding the total cost to treat just one veteran with PTSD for fifty years, the number is estimated to be $1,250,000 for PTSD and Depression, not including the concomitant conditions mentioned above.[4] If lost work productivity is factored into economic costs, then the total economic cost of PTSD after return from deployment is estimated to be as high as 6.2 billion dollars for the first two years after deployment ends.[3]

Due to social stigma associated with mental illness, many service men and women suffer in silence or fail to seek help for their condition; therefore, if these veterans seek professional help for their PTSD, the potential for an even larger financial need than outlined above exists. In 2007, it was documented that there were too few mental health providers in the Department of Defense (DoD) and Veterans Affairs (VA) health care systems to accompany the amount of veterans diagnosed with PTSD. If this trend continues, it is important to take measures to increase the availability of treatment for PTSD sufferers.[4]

History of PTSD

Historically, the first documented mention of symptoms concurrent with PTSD originates under Freud's contemporaries at the end of the nineteenth century. At the time, these symptoms were categorized under the broad term of "hysteria". These symptoms have gone through a multitude of different names: "shell shock" during World War I, "battle fatigue" during World War II, and then eventually coined as "Post-Traumatic Stress Disorder" during the Vietnam War.[7] There are four criteria that must be present for a person to be diagnosed with Post-Traumatic Stress Disorder. First, an event must occur that involves severe harm, threat to life, extreme feelings of fear, and/or helplessness.[3] Second, this event must be re-experienced in some way, whether through recurring dreams, disturbing recollections, or severe psychological distress at events that either resemble the traumatic event or trigger a memory of the traumatic event. Third, the individual must persistently avoid the stimuli associated with the trauma. Fourth, symptoms of increased arousal via the autonomic nervous system must persist, such as insomnia, irritability, poor concentration, hyper vigilance, and/or an exaggerated startle response.[7]

Standard of Care

The standard treatment for PTSD includes both a physiological and psychological component of care. The physiological component of care includes medications such as selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants, monoamine oxidase inhibitors (MAOIs), benzodiazepines, and/or anticonvulsants. Psychologically, eye movement desensitization and reprocessing (EMDR), exposure therapy, and/or cognitive-behavioral therapy (CBT) may be administered.[8] However, a survey conducted at the Veteran's Affair reported that a large proportion of VA patients have conditions that do not respond well to allopathic management.[9] Many of these treatments for the disorder are associated with high rates of dropout and nonresponse; this is perhaps due to difficulty dealing with an intervention that consists of heightened stress because their nervous system is already hyper-aroused.

Many PTSD-sufferers are turning towards Complementary and Alternative Medicine to treat their disorder; in fact, adult-use of CAM increased from 36% in 2002 to 38.8% in 2007.[9] The most utilized CAM techniques for PTSD include mind-body treatments such as relaxation, meditation, and exercise therapy. A person with PTSD has problems with the regulatory abilities of the autonomic nervous system, leading to symptoms of hyperarousal and anxiety. Mind-body treatments increase the autonomic nervous system's regulatory abilities, perhaps a reason as to why many PTSD patients are turning towards CAM techniques for treatment.[10] Similar to mindfulness CAM treatments, Network Spinal Analysis chiropractic care has been hypothesized to have these same autonomic nervous system regulatory effects via a reduction in Adverse Mechanical Cord Tension (AMCT) and structural vertebral subluxations (more on this discussed later).

As mentioned above, allopathic management of PTSD is

seeing only moderate results in treatment outcomes with high dropout rates, while CAM use is increasing, showing increased interest in new and improved ways to approach this disorder. In addition, the already-existent shortage of PTSD treatment providers raises the need for additional options for veterans suffering from PTSD. This paper will discuss improved quality of life outcomes and anxiety symptom reduction in a military veteran suffering from PTSD undergoing Network Spinal Analysis chiropractic care.

Case Report

History and Initial Examination

A 35-year-old male presented to a chiropractic office for symptomatology associated with Post-Traumatic Stress Disorder attributed to past military deployment. According to his initial intake form, his symptoms included an "overstimulated nervous system", along with an inability to function at a normal level due to stress levels that included an "intense, never-ending anxiety which has bled into all areas of [his] life – mental, physical, emotional, spiritual, and into relationships with others" (see Appendix). His symptoms of PTSD began in 2004, 11 years prior to beginning the care documented in this case study. The patient sought treatment for his PTSD via counseling, prescription drugs, and past chiropractic care, but saw "little to no lasting effect" on his PTSD symptomatology.

Upon initial consultation, the patient filled out a Comprehensive Health Profile, an initial intake form used for pre and post care data collection at the office in which he received care. The degree to which his PTSD affected aspects of his function and life, such as work, sleep, recreation, eating, exercise, love life, social life, sitting, and walking was rated as "Moderate" upon the initial examination. He noted that there is never a time throughout the day that he is not aware of his problem; however, it is more intense at night. When asked to rate the severity of inconvenience that his PTSD causes him, from "Not at all", "Slight", "Moderate", to "Extreme", he marked "Extreme" for both the present and the past symptoms. The patient wrote that he is "constantly searching for new things to help" and marked the box next to the pre-written statement: "I deserve more than what I have been experiencing and would like you to assist in my healing".

When asked to rate his stress levels on a scale of 0-3, with 0 being equal to "no stress at all", 1 being equal to "slightly stressful", 2 being equal to "moderately stressful", and 3 being equal to "drastically stressful", physical stress was rated as a 2 ("moderately stressful"), chemical stress was rated as a 2 ("moderately stressful"), and emotional/mental stress was rated as a 3 ("drastically stressful"). When asked to rate how he hopes to benefit from care in the office on a scale of 0 ("does not apply") to 3 ("very important to me"), the patient marked a 3 ("very important to me") for all of the following: improvement of physical symptoms, improvement of emotional/mental symptoms, more efficient ability to react or respond to stress, noticeable different in enjoyment of life, increased ability to make constructive choices, and overall improved quality of life.

The patient's past medical history included a motor vehicle accident in 2007 in which he was rear-ended and experienced neck pain. He received physical therapy for one month for neck pain with mild improvement. In 2005, a MRI was taken which showed osteophytes and disc herniations in his lumbar spine. From 2005-2010, the patient began emotional therapy via group and individual talk therapy sessions for symptoms related to his PTSD with "little change" noted for results. In terms of nutritional supplements, the patient disclosed that he takes magnesium regularly, but did not specify the reason. One of the last fill-in-the-blank questions on the questionnaire asks if there are any particular factors or elements about life that may impair the opportunity for full health. In response, the patient wrote: "Obligations to work and family sometimes make it hard to schedule time for myself".

Initial Examination

A Network Spinal Analysis examination utilizes Panjabi's three stabilizing systems of the spine as the focus for palpation findings. These stabilizing systems include the passive system (bones, ligaments, discs), the active system (musculature), and the neural control system (the nervous system which receives information, determines requirements for stability, and instructs the active subsystem to meet these demands). Under normal circumstances, these three spinal subsystems are highly coordinated; however, if dysfunction occurs in any one of these systems, the other two systems must compensate to try to increase stability, potentially leading to acute or chronic problems.[11] The initial physical examination revealed active tension rated as a 4/5 in the cervical, thoracic, and lumbar regions on a scale of 0-5 (0 = no tension, 5 =highest tension). Passive tension was rated as 4-5/5 on the same scale in the thoracic spine. Heel tension eversion stress was rated a 4/5 bilaterally and heel tension flexion/extension stress was also rated as a 4/5 bilaterally. Heel tension is thought to be associated with the presence of adverse mechanical cord tension (AMCT), which will be discussed later in this paper.[12]

Intervention

The patient began a care plan in which he received chiropractic adjustments, known as spinal entrainments in Network Spinal Analysis care, 2 times per week for 6 weeks for a total of 12 entrainments. These entrainments consisted of low-force contacts to the cervical spine and sacrum. Subluxations were noted and addressed at C1, C2, C5, along with a sacrotuberous ligament contact on several visits to correct an Anterior-Inferior sacrum subluxation. Five phases are used in NSA care to assess the levels of subluxation involvement and AMCT, along with an allowance for a sequential movement through care based on clinical outcomes and functional improvements.[13] Phases 2, 3, 4, and 5 were addressed in this case. The patient received Basic Level 1 Care for 10 out of 12 sessions; the 11th and 12th entrainment began Level 2 Intermediate Care. More will be discussed on the different levels of NSA care further in the paper.

Outcomes/Re-Examination

Upon his reexamination, the patient's heel tension eversion stress was reduced from a 4/5 to a 1/5 bilaterally, along with a reduction in heel tension flexion/extension stress from a 4/5 to a 2/5 bilaterally. A reduction in passive tension was noted in

the thoracic spine from a 4/5 to a 2/5. Active tension in the cervical, thoracic, and lumbar spine were all reduced from a 4/5 to a 0/5. The patient noted that he is more aware of his spine and the awareness is not due to greater discomfort or pain. He noted an increase in awareness of pleasant sensations in his spine, better posture, a better ability to take deeper breaths, and a greater ease in standing up straight. When asked about awareness of tension, the patient noted that he is now more aware of where he holds tension in his body and spine, is better aware of what releases tension from his body, and that he feels that his body is becoming more effective at releasing its tension since beginning care.

Within the first two weeks of care, the patient stated that he felt "less tension in his muscles at rest", a "small increase in overall well-being", slightly more ease in balance while standing, and felt "much more relaxed at rest" with an increased ability to "tolerate watching his kids". Within the first month of care, the patient noted an increased awareness of his breath and "improved digestion". During one visit, the patient noted that he felt "more tense than the past few visits", but "more resilient overall". By the ninth entrainment, the patient stated that he felt his breath "opening up into new areas" along with the ability to now "take a full breath".

When asked to evaluate his mental/emotional state on a scale of 1-5 post-care (1 = "never", 2 = "rarely", 3 = "occasionally", 4 = "regularly", 5 = "constantly"), the patient noted that the presence of negative feelings about himself, moodiness, angry outbursts, depression, lack of interest, restlessness, difficulty sitting still, and experience of recurring thoughts or dreams were all rated as a 2 ("rarely"). He noted that being overly worried about small things, difficulty thinking or concentrating, and experience of vague fears or anxiety were rated as 3 ("occasionally"), which is an improvement from his initial intake form in which he noted that he was unable to function prior to care due to constant stress. He also noted a 4 ("regularly") when asked how often he has positive feelings about himself and a 5 ("constantly") when asked how often he has an interest in maintaining a healthy lifestyle.

Review of Literature

A review of the literature conducted by Green, Johnson, Lisi, and Tucker, attempted to look at chiropractic utilization specific to military and veterans' health care. They found only 13 public, peer-reviewed papers on chiropractic and military populations; however, most of the cases were low-back pain or musculoskeletal-related. Two studies included PTSD as a concomitant condition; however, the focus of the studies were on resolution of low back pain; therefore, no outcome data was recorded in terms of PTSD.[14] In the first study by Dunn and Passmore, 16% of patients presenting for chiropractic care had a diagnosis of Post-Traumatic Stress Disorder, but 72% of the total patient base was seen for a lumbar complaint. In another study by Dunn et al., it was found that patients with PTSD experienced significantly lower levels of neck and low back pain score improvement than those without PTSD; however, no outcomes for the PTSD itself were recorded.[14] According to Dunn, the relationship between chronic pain and PTSD should "serve as a stimulus for chiropractic clinical research efforts".[15] Although included in this paper, these studies do not directly relate chiropractic care to PTSD treatment and therefore cannot be viewed as anything more than musculoskeletal cases.

Lisi conducted a retrospective review of cases in one Veterans Health Administration facility to assess outcomes of care for a group of OIF and OEF veterans over a six-month period in November 2007 – April 2008. Twenty-one out of thirty-one cases screened positive for PTSD prior to chiropractic consultation for musculoskeletal pain and another three veterans were screened positive by the chiropractic clinic, for a total of twenty-four out of thirty-one cases having a co-morbidity of PTSD. Although a majority of patients underwent a significant reduction in musculoskeletal pain, no data was collected on PTSD outcomes.[16]

Research conducted by the Foundation for Chiropractic Progress highlights the positive outcomes of chiropractic care and PTSD. According to lead author Frederick R. Carrick, treating PTSD as a physical brain injury rather than a psychiatric disorder showed positive outcomes in extreme PTSD sufferers. Primary treatment in this study included a novel brain and vestibular rehabilitation treatment (VRT), which included a mix of fast and slow eye movement exercises. However, this study does not mention any utilization of chiropractic adjustments and/or spinal manipulative therapy, so it is unclear as to whether VRT was the sole treatment or if a complication of VRT and chiropractic adjustments were utilized for these positive outcomes.[17]

A retrospective study of 2,818 patients undergoing Network Spinal Analysis care measured perceived changes in self-rated health and quality of life based on physical state, mental/emotional state, stress evaluation, and life enjoyment. The exact mechanisms behind the effects of this study are not known, but it is thought to be associated with changes in the levels of circulating factors released by the HPA-axis, which will be discussed later in that it plays an important role in recent understanding of PTSD pathophysiology.[18]

Discussion

Reorganizational Healing

Network Spinal Analysis is founded upon the premise of Reorganizational Healing (ROH), which is a paradigm in which the "intention is for the outcome to be dynamical change in the individual and the life system; to develop new resources so that the individual may use the experience consciously to bring his/her life to a greater level of understanding and appreciation; and to increase the individual's ability to thrive under most circumstances".[19] This is in contrast to Restorative Therapeutics (RET), under which most Western allopathic models are based, in which the goal is to restore the person to where he or she was before the problem began, not necessarily adding any health or add any additional benefit to his or her life. Reorganizational Healing approaches care with the central belief that change rarely comes from the area of the body that is in defense because that area is very guarded. Instead, change comes from the person becoming aware of the area that is in defense and acknowledging that this defense/pain/symptom exists for a reason. The person can then redirect the energy stored in that

bound area, whether in an area of fixation (structural vertebral subluxation), meningeal tension (facilitation), or muscular tension, to other areas of the body and it can be redirected into a new level of organization. Once this occurs, the area is no longer in a heightened state of defense; it is hypothesized that the body's physiology now allows the cerebral cortex, particularly the frontal lobes, and the vagal centers to become more available to assess what is occurring in the body.[19]

Network Spinal Analysis Care

The objective of Network Spinal Analysis is to correct two categories of vertebral subluxation using low-force adjustments of the spine and surrounding structures. These two categories of vertebral subluxation include structural subluxations and facilitated subluxations. Structural subluxations are what most chiropractors address when correcting a vertebral subluxation. These subluxations are thought to result from physical stress and trauma, causing a vertebral misalignment, which then leads to nerve interference secondary to the misalignment. A facilitated subluxation, on the other hand, is thought to result from adverse mechanical cord tension, or meningeal tension.[13] Adverse mechanical cord tension (AMCT) was first described by Breig in 1978.[20] Adverse mechanical cord tension, according to Network Spinal Analysis, results from facilitation, which occurs when numerous subthreshold stimuli layer upon each other to eventually lower the initial threshold of neural activation. This is known as central sensitization, which is discussed in further detail in the Dysafferentation Model of subluxation further in this paper.

With this type of subluxation, nerve irritation and interference is primary, which leads to AMCT, eventually leading to an osseous vertebral misalignment as an adaptive change. Therefore, in order to reduce the vertebral subluxation, NSA first addresses the increased facilitation in the spinal cord through what is classified as "Level 1 Basic Care". Level 1 care is introductory care for either new patients or patients who present with a recent trauma or high period of stress. The main goal of Level 1 Basic Care is reduction of spinal cord facilitation through light contacts along the spine where dural/meningeal attachments are most-concentrated (cervical spine and sacrum). Smooth, rhythmic muscular movements often accompany these contacts, along with deep respiration, which is thought to mechanically reduce this facilitation.

At the end of Level 1 Basic Care, this movement should move fully from sacrum to the cranium, one segment at a time. This is known as the "Respiratory Wave" in NSA care. This wave involves "undulation and specific rocking/oscillation of spinal segments and the development of what appears as a central pattern generation". It is possible that the oscillation of each individual vertebra allows for proper neurological input to the CNS, particularly increasing mechanoreceptor stimulation and reducing nociceptor stimulation (see more on Dysafferentation Model below). Since oscillation occurs at each vertebral level once a full respiratory wave has been achieved, neurological input is normalized along every level of the spine. This serves to reduce stress signals to the CNS and thus, a reduction in stress signals to the brain and body and by default, a reduction in stress hormones released as a response to these stress signals. The level of organization of these signals reflects the same level of organization in the nervous system. Therefore, as these signals become more predictable and organized, the nervous system becomes more organized. An increase in CNS organization has been shown to increase higher-level cognitive processes.[21]

Once this occurs and facilitation has been reduced, structural subluxations are easier to correct. At the end of Level 1 Basic Care, the patient should gain awareness of a deeper respiratory rhythm and improved natural movements of their spine. This reduction of facilitation and increased awareness has been associated with early signs of quality of life changes, such as a reduction in stress and an increase in energy. Next, the patient can move into "Level 2 Intermediate Care" and "Level 3 Advanced Care". For purposes of this paper, only Level 1 Basic Care is discussed due to the patient's involvement in Level 1 Care for the majority of the intervention recorded up to the point that this case was written.[13]

Dysafferentation Model, Neurodystrophic Model, and PTSD

In order to understand how NSA entrainments may have an effect on PTSD, we must first understand two models of vertebral subluxation: the Dysafferentation model and Neurodystrophic Model. According to Seaman, dysafferentation is defined as "an imbalance in afferent input such that there is an increase in nociceptor input and a reduction in mechanoreceptor input." Nociceptors, particularly "silent nociceptors", respond to chemical irritants, and are thought to be the main mediators in central sensitization. Under normal circumstances, nociceptors have high thresholds for stimulation; however, once central sensitization occurs, this threshold is drastically lowered and it takes less of a stimulus to cause these nociceptors to fire. It has been shown that norepinephrine released via synaptic terminals may also sensitize nociceptors, potentially through a release of prostaglandins.[22] Dysfunctional movement patterns, such as those present with AMCT or structural vertebral subluxations, result in dysfunctional afferent input through the Central Nervous System. In particular, an increase in abnormal nociceptive firing and an abnormal decrease in mechanoreceptor firing occur.

The Dysafferentation model of vertebral subluxation provides a framework for how abnormal afferent input to the Central Nervous System via a vertebral subluxation or AMCT may occur. Next, the Neurodystrophic model takes this a step further and allows us to delve a little deeper into the potential consequences of this dysfunctional input. When dysfunctional afferent input occurs, a stress response is activated via the Central Nervous System in an attempt to adapt to the dysfunction. The sympathetic nervous system is activated when the brain perceives a stimulus as a threat to survival. The hypothalamic-pituitary-adrenal axis (HPA axis) responds to this threat by activating the secretion of stress hormones, such as cortisol, norepinephrine, and epinephrine, which enable the body to increase its chance of survival in the threatening situation.[23]

The HPA axis is of particular interest in this case report because of its purported involvement in PTSD. Sustaining a sympathetically dominant physiology can cause organ and tissue dysfunction by forcing the body to maintain an

inappropriately high level of sympathetic adaptation at all times. To continue a vicious cycle, a previously-activated nervous system response causes additional release of noradrenaline and adrenaline, which further activates the sympathetic nervous system, continuing a cascade of sympathetic dominance.[24] The HPA axis is a stress-responsive neuroendocrine system that allows for the adaptation to stress and the return to homeostasis after the stressful situation ends. A dysfunctional HPA axis is associated with numerous psychiatric disorders, including PTSD, due to the inability to regulate sympathetic arousal. This leads to symptoms of hypervigilance and hyperarousal associated with stress physiology. During a stressful event, whether physical or psychological, corticotropin-releasing factor (CRF) is produced in the hypothalamus. This results in the activation of the HPA axis and cortisol is released. It is hypothesized that high CRF levels at the time of a traumatic event may actually encode the traumatic memory, thus leading to CRF activation and anxiety effects each time the memory resurfaces, such as the case with PTSD.[2] This is thought to eventually lead to a burnout of the corticotropin releasing hormone system, resulting in a dominating sympathetic nervous system.[25]

Conclusion

In Reorganizational Healing and Network Spinal Analysis, patient care is administered via a subluxation-centered perspective. Therefore, in this case, rather than approaching the patient from a biomedical paradigm, in which a specific disease or symptom is treated, the patient was approached from a psycho-social paradigm, in which function and quality of life took precedence. This is why the Comprehensive Health Profile used in this case involved questioning to elicit psycho-social responses, rather than direct questions about symptomatology.[12]

Network Spinal Analysis care allows a person to shift away from sympathetic and stress physiology dominance towards a parasympathetic, relaxation physiology. This causes a reduction in release of stress hormones known to be associated with PTSD and other mental illnesses. In this particular case, the patient noticed significant changes in awareness of his spine, breath, and overall bodily tension patterns, along with a reduction in symptoms of anxiety. Due to the potential for practical implication of Network Spinal Analysis, larger studies need to be done to further investigate its potential benefits.

This case study has several limitations. First, this is a case study on one individual undergoing Network Spinal Analysis care and therefore, this research lacks the benefit of a large number of participants. Second, this study lacks objective measures, such as surface electromyography (sEMG), thermography, or other outcome measurement tools that would objectify a potential shift away from sympathetic and stress physiology. In addition, the symptoms described by the patient throughout the initial health questionnaire are somewhat vague. He stated that he was unable to function due to his symptoms; however, the exact ways in which his function was hindered was not mentioned, so it is difficult to measure the exact amount of improvement without an initial baseline to quantify. Lastly, this case was on-going at the time that this case study was written. The patient is continuing NSA care, so we cannot be sure of any improvements that may have occurred after this was written. Since NSA is closely tied in with ROH, in which limitations on maximal improvement are not placed, it is possible that the patient may have gained additional benefits with continued care after this study was written.

This case demonstrates the need for further research dealing with Network Spinal Analysis and mental illnesses; particularly Post-Traumatic Stress Disorder. Because so many service men and women return from deployment with PTSD regardless of physical injury, and the current, allopathic treatment for PTSD has proven largely unsuccessful, Network Spinal Analysis may be able to fill this void for many of these men and women. Through what we know from the Dysafferentation and Neurodystrophic Models of Vertebral Subluxation, spinal oscillation via the NSA Respiratory Wave may reduce stress physiology via effects on the HPA axis, thus potentially benefiting our service members with post-deployment PTSD.

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Case Study

Resolution of Panic Disorder and Improved Quality of Life in a Patient Receiving Network Spinal Analysis and Somato Respiratory Integration Care: A Case Report

Chris Lucks, BSc, BChiro[1]
Lisa Lucks, DC[1]

1. *Private Practice of Chiropractic, Auckland, NZ*

Abstract

Objective: To present the clinical outcomes of Network Spinal Analysis (NSA) chiropractic care and Somato Respiratory Integration (SRI) exercises in an adult female suffering from anxiety, panic attacks, and comorbid somatic complaints.

Clinical Features: A 49-year-old woman presented to a wellness based chiropractic clinic suffering from anxiety and panic attacks with associated chest pains for a period of eight months with no improvement. The presenting complaints began following a three-year period of prolonged stress. The patient's history revealed past episodes of extreme stress and trauma.

Interventions and Outcomes: A program of Network Spinal Analysis chiropractic care was employed to improve Spinal and Neural Integrity (SNI), including the reduction of Adverse Mechanical Cord Tension (AMCT) and vertebral subluxations. Somato Respiratory Integration exercises were utilized to enhance somatic awareness and provide greater internal safety. AMCT was assessed and measured using a Heel Tension Scale. Quality of life improvements were measured using a self-rated Health, Wellness, and Quality of Life (HWQL) survey. A steady reduction of anxiety and panic attacks was achieved during the first six weeks of care with significant quality of life improvements. Resolution of a panic disorder was achieved within fourteen weeks of care.

Conclusion: Network Spinal Analysis and Somato Respiratory Integration care was associated with the resolution of a panic disorder with significant quality of life improvements in this case. Further research is recommended to explore the role of chiropractic care combined with Somato Respiratory Integration exercises for the management of anxiety disorders and/or other stress related conditions that may be mediated through the spine.

Key Words: *Anxiety, panic disorder, stress, vertebral subluxation, chiropractic, Network Spinal Analysis, Somato Respiratory Integration*

Introduction

Anxiety disorders involve abnormal feelings of worry or fear that can interfere with daily activities such as job performance, school, work and relationships. There are several different types of anxiety disorders, including generalized anxiety disorder, panic disorder, post-traumatic stress disorder and social anxiety disorder. In the US, anxiety disorders are the most common mental disorder experienced by Americans, affecting over 18% of the adult population.[1] In New Zealand, anxiety and depressive disorders are the highest ranked conditions in terms of years lost to disability and the second leading cause of health loss overall behind only coronary heart disease.[2,3] For women they are the leading cause of health loss.[3]

Panic disorder is a type of chronic anxiety disorder that results in a significant reduction in quality of life. People with panic

disorder experience recurrent unexpected panic attacks with sudden periods of intense fear. Symptoms may include palpitations, pounding heart, or accelerated heart rate; sweating; trembling or shaking; shortness of breath, smothering or choking; and feeling of impending doom.[4] The majority of people with panic disorder present with one or more comorbid somatic complaints, including: cardiac symptoms (chest pain, tachycardia, irregular heart beat), gastrointestinal symptoms, and neurologic symptoms (headache, vertigo or paresthesias).[5]

Anxiety disorders are conventionally treated with medications, psychotherapy, or a combination of both.[6] Since the early 1990's pharmacological treatment for anxiety disorders has steadily increased with the introduction of serotonin selective reuptake inhibitors, a type of antidepressant medication.[7] Serotonin selective reuptake inhibitors are the most common drugs used for the treatment of panic disorders, while cognitive behavioural therapy is considered the psychosocial treatment of choice.[7,8] Antidepressant prescriptions increased in New Zealand by over 20% in the five years between 2008 and 2013.[3]

Complementary and alternative medicine (CAM) approaches which are commonly utilized by individuals with anxiety disorders include: homeopathy, natural medicines, acupuncture, chiropractic and various stress reduction and/or relaxation techniques such as yoga, massage and meditation.[9-11]

The purpose of this paper is to report on the improvements in a patient suffering from a panic disorder while receiving Network Spinal Analysis (NSA) and Somato Respiratory Integration (SRI) care. The authors propose a relationship between the patient's symptoms of anxiety, panic, and comorbid somatic complaints, and a chronic state of stress physiology mediated through the spine.

Case Report

Patient History

A 49-year-old woman presented to a chiropractic clinic with a chief complaint of anxiety and panic attacks associated with tight, gripping chest pains which began, according to the patient, following three years of financial, work, family and relationship stress. Secondary complaints included gastrointestinal pain and discomfort, mild paresthesia of the arms and hands, tachycardia and headaches. The presenting complaints began approximately eight months prior to presentation for chiropractic care with no improvement during this time.

The patient had previously tried herbal medications for symptom management, including: L-Tyrosine, Chromuim, Black Cohosh, and vitamins B6, B9 and B12. Six months prior to presenting for chiropractic care the patient was diagnosed with a panic disorder by her physician and prescribed Citalopram at a dose of 50mg/day. Citalopram is an antidepressant drug of the selective serotonin reuptake inhibitor class commonly used for the treatment of panic disorders. The patient began taking 25mg/day initially with the intention of gradually increasing the dosage to 50mg. After beginning pharmaceutical treatment the patient reported a reduction in chest pains but an increase in anxiety and panic attacks. She continued with 25mg/day of Citalopram but never increased the dosage.

The patient's history revealed a significant amount of past physical, psychological and emotional trauma. She was struck by a car as a pedestrian and suffered multiple fractures on the right side of her body, including fractures of the phalanges, metatarsals, tibia, fibula, ilium, pubis, ribs, scapula, clavicle, humerus, radius, ulna, carpals and skull. Multiple reconstructive surgeries were required and she had to re-learn to walk again. The patient was robbed at gunpoint on two different occasions and had a gun held to her head both times. During the second incident she was held as a hostage. She later immigrated to New Zealand with her family and experienced a three-year period of financial, work, family and relationship stress.

Examination

The Epstein Model of SNI is one of the models upon which NSA care is based. SNI, which is largely based on the theory of Monohar Panjabi, suggests that there are three spinal stability subsystems which regulate a dynamic state called spinal and neural integrity.[12] The spinal stability subsystems are the passive, active, and neural control subsystems. The passive subsystem is composed of the vertebrae, ligaments, and discs. The active system is composed of the spinal muscles and tendons. The neural control subsystem is composed of the spinal cord, nerve roots, and peripheral nerves, as well as the attachment of the meninges to the vertebral segments.[12,13] SNI is defined by Epstein as, "that state in which the physical components and physiological processes of the spine are unimpaired, including the body's ability to develop new strategies to maintain an appropriate flow of energy through its tissues."[14] In the Epstein Model of SNI, stress perceived by the body as a threat to survival accounts for a variety of observable somatic and/or visceral changes, including the facilitation of muscles and nerves, postural adaptations, bony fixations and vertebral subluxations.[14]

An initial chiropractic examination was performed to assess for SNI using observational and palpation findings for each of the spinal stability subsystems. High passive subsystem tension was noted in the upper cervical spine from Occiput - C2. High passive tension was also noted between C3 - C5, C7 – T1, and T2 - T5. High active subsystem tension was noted from Occiput - C1 bilaterally, and from C3 - C5 on the left. Medium high active subsystem tension was noted from C7 - T4 and T10 - L3 on the left. High neural control subsystem tension was noted bilaterally for both flexion/extension and lateral bending directions through evaluation of passive movement at the ankles, termed heel tension.

The concept of adverse mechanical cord tension (AMCT), originally developed by the work of neurosurgeon Alf Brieg in the 1970's, is associated with a lengthening of the spinal cord in both flexion-extension and lateral bending directions.[15] The NSA protocol characterizes five phases of AMCT associated with patterns of defensive physiology.[14] In NSA clinical assessments, AMCT is considered through heel tension

evaluation while performing leg check protocols involved with NSA care.[14]

The overall clinical impression of the patient was extreme stress physiology and hypervigilance with little functional evidence of SNI.

Interventions

The patient was placed on an initial program of NSA and SRI care at a frequency of three visits per week for six weeks, followed by an additional four weeks of care at three visits per week, and then four weeks of care at two visits per week. NSA care is applied through specific low force finger or thumb contacts along the spine. Contacts to the spine involve various graduations of light force in either a vertical or horizontal direction, influencing a flexion/extension or lateral bending response of the spinal structures.[16] NSA is applied through three increasing levels of care that are associated with new emerging properties within the spine and nervous system.[17] Levels one and two of NSA care were used exclusively in this case presentation.

SRI is a system of exercises which link enhanced somatic awareness with respiration and movement.[18,19] SRI exercises can help a person dissipate energy stored as tension, enhance structural flexibility, and increase the experience of safety within the body.[19] There are twelve SRI exercises associated with The Twelve Stages of Healing.[18] Exercises for stages one, two, and three were used exclusively in this case presentation. A description of how to perform SRI exercises can be found in the Somato Respiratory Integration Workbook, by Donald M. Epstein.[19]

The patient was evaluated for indicators contributing to the location and/or characterization of vertebral segments for the application of NSA care contacts according to the NSA protocol (Figure 1). Spinal levels most frequently addressed during the fourteen-week period of NSA care were: Occiput, C1, C2, C5, sacrum and coccyx. Spinal levels addressed less frequently were: C3, C4, C7 and T1.

The stage one SRI exercise was utilized on every visit during the first six weeks of care. The patient was instructed to perform this exercise at home between office visits and she reported doing the exercise daily. Stage two and three SRI exercises were utilized periodically over the course of the fourteen-week period of care in conjunction with NSA.

Outcomes

AMCT was measured in this case using a Heel Tension Scale and graded on a scale of 1 – 5. Heel Tension Scales have been shown through statistical analysis to provide strong intra-examiner reliability and moderate to strong inter-examiner reliability.[20] Heel tension measurements for both flexion-extension and lateral bending directions were recorded weekly during the first six weeks of care and then again at weeks 10 and 14. A gradual, steady reduction of AMCT was observed throughout the fourteen week period of care (Table 1).

The patient reported a reduction in anxiety and panic attacks within three weeks of beginning care. After six weeks of care she reported much less anxiety and a significant reduction in the intensity and frequency of panic attacks and chest pains. She also reported feeling more in control during episodes of panic attacks, and found that she was able to resolve them herself by using the stage one SRI exercise. She reduced her dose of Citalopram down to 12.5mg daily at this time.

After ten weeks of care the patient reported feeling better than ever with no anxiety or panic for two weeks. She reduced her medication to 12.5mg every second day at this time. By fourteen weeks of care she reported a complete resolution of anxiety and panic attacks and all comorbid somatic complaints. She stopped all medication at this time. Three months later the patient reported no further symptoms related to a panic disorder.

Quality of life changes were measured after six weeks of care and again after fourteen weeks of care using a retrospective self-rated Health, Wellness, and Quality of Life (HWQL) survey. The HWQL survey is designed to assess wellness changes through a patients' self-rating of different health domains and overall quality of life at two times points: presently and retrospectively before initiating care.[21] The HWQL survey has been shown through statistical evaluation to demonstrate a high level of internal reliability as a survey instrument, as well as stable reliability of the retrospective recall method of self-rated perceptions of change.[21] Significant improvements were found as an outcome of NSA and SRI care across all health domains, with overall quality of life representing the greatest degree of improvement (Table 2).

Discussion

Considerable evidence exists for the relationships between chronic stress, alterations in noradrenergic brain systems, and anxiety.[22] Periods of prolonged or chronic stress can cause disturbances of several physiological systems, and the basic survival or 'fight or flight' state can become the baseline function for the individual.[23,24] The Epstein model of SNI proposes that there is an anchoring of chronic stress physiology within the anatomical structures of the spine.[25,26] AMCT is believed to be associated with stress physiology and expressed by an individual as defense posture.[14] In NSA care, vertebral subluxations are seen as one of the consequences of this.

NSA contacts use low force in order to initiate the brain to temporarily shift away from defensive adaptations.[14] The application of NSA care results in a reduction in meningeal and/or spinal cord tension through spontaneous motor responses aimed at relieving or re-distributing tension within the spinal stability subsystems.[14] Most notable among these responses is a unique spinal wave phenomenon observed as an emergent property of NSA care which may release the anchors to stress from the spinal system and increase the organization and coherence of the central nervous system.[27-31]

SRI exercises may assist in reversing the process of stress physiology and defense posture while promoting greater internal peace or ease.[32] SRI can provide acute patients with a tool to help diffuse feelings of fear and encourage trust in their experience of their body.[32]

Social cognitive theory states that people who believe they cannot manage threatening events that might occur will experience high levels of anxiety arousal. This perceived coping inefficacy produces high levels of subjective distress, autonomic arousal, and catecholamine secretion.[33] Thus, SRI exercises can play a significant role in helping a patient suffering from anxiety by giving them a greater sense of efficacy over their symptoms while increasing the experience of safety in their body. When utilized in conjunction with NSA care, SRI has been shown to contribute to positive wellness outcomes in 11 patients at an early stage addiction recovery program, and in one patient with a functional movement disorder.[34,35]

A growing body of evidence exists to support the benefits of subluxation based chiropractic care for anxiety or depressive disorders, and for improved quality of life.[36-43] In a study of 2,818 patients receiving NSA care, 76% of participants reported statistically significant improvements across all four health domains measured (physical state, mental/emotional state, stress evaluation, life enjoyment), as well as overall quality of life.[21] Additional research has shown that NSA induces a sympathetic quieting effect.[44] NSA care has also been demonstrated to have a strong correlative effect (twice that of lifestyle modification) as a predictor of increased quality of life and wellness lifestyle choices.[45]

Previous life stress may sensitize individuals to the development of stress related psychopathology with exposure to subsequent stressors.[22] The patient in this case experienced previous episodes of extreme stress and trauma, followed by a three year period of chronic or prolonged stress. Overall, the improvement of SNI, including the reduction of AMCT and vertebral subluxations, coupled with greater internal safety and ease through the utilization of SRI, may account for the positive outcomes in this case.

Other contributing factors to the positive outcome in this case that should be considered are: the patient received care in an environment where she felt safe, trusted the clinicians, and had positive expectations of wellness based outcomes. The patient was also taking selective serotonin reuptake inhibitor medication while receiving NSA and SRI care; therefore a specific correlation between the positive outcomes in this case and NSA and SRI care cannot be made.

It is important to note that NSA and SRI care was not applied as treatment for a panic disorder in this case. NSA and SRI care was applied for the purpose of improving spinal and neural integrity, including the reduction of AMCT and vertebral subluxations, and to promote a shift in the patients' physiology toward greater internal safety and ease.

Conclusion

NSA and SRI care was found to have a significant positive effect on the quality of life of a patient suffering from a panic disorder, and was found to be of clinical benefit for the resolution of anxiety, panic attacks, and comorbid somatic complaints in this case. Subluxation based chiropractic care may provide a significant contribution to the management of patients with anxiety disorders by improving SNI, including the reduction of AMCT and vertebral subluxations. SRI may provide a significant contribution to the management of patients with anxiety disorders by giving them a greater sense of efficacy over their symptoms and increasing the experience of safety in their body. Further research is recommended to explore the role of subluxation based chiropractic care combined with SRI exercises in the management of anxiety disorders and other stress-related health conditions which may be mediated through the spine.

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Figure 1: NSA indicators contributing to the location and/or characterization of vertebral segments for entrainment

Certain musculoskeletal changes are considered to be indicators of the effects of AMCT. This is a list of these indicators and the spinal phenomena with which they are associated. These include both observational and palpation findings. For the significance and priority of the adjustment protocol, refer to The Theoretical Basis and Clinical Application of NSA Care (Epstein 2004).

Indicator	Segmental Level Assessed
Short Leg	Unilateral cord tension
Cervical Syndrome Test	Tension in cervical spinal cord
Leg Crossover	sacral or pelvic distortion
Ankle Eversion Stress	Lateral flexion cord tension
Flexion/Extension Heel Tension	Flexion/extension cord tension
Z-flick	C2, C3 lateral bending cord tension
Leg Adduction Stress	C2, C3 spinal cord tension
Leg Abduction Stress	C5, coccyx (F/E) spinal cord tension
Palpation (motion, static, muscular)	all vertebral segments
Sacrotuberous ligament tension	lateral bending sacrum
Postural analysis	all vertebral segments
Flexibility (Range of Motion)	all vertebral segments

**Positive indicators contributing to the location and/or characterization of vertebral segments for entrainment are assessed pre and post entrainment to determine efficacy of the force applied

Table 1 – Heel Tension Evaluation

Exam Dates	Initial Exam		week 1		week 2		week 3		week 4		week 5		week 6		week 10		week 14	
Achilles Tendon	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
Heel Tension (F/E)	5	5	5	5	5	4	4	4	4	4	4	4	3	3	3	3	3	2
Ankle Eversion Stress (L/B)	5	5	5	5	5	5	5	4	5	4	4	4	4	4	4	3	3	3

Heel Tension Scale: 1 – Low; 2 – Med-Low; 3 – Medium; 4 – Med-High; 5 – High

Table 2 –self-rated Health, Wellness, and Quality of Life Survey

HEALTH DOMAIN	Scale from lowest to highest rating	Before Care	6 weeks of care	14 weeks of care	Total change
Physical State (decreased rating = improvement)	50 - 0	25	20	21	-4
Mental/Emotional State (decreased rating = improvement)	50 - 0	30	21	23	-7
Stress Evaluation (decreased rating = improvement)	50 - 0	43	20	16	-27
Life Enjoyment (increased rating = improvement)	0 - 55	28	43	42	+14
Overall Quality of Life (increased rating = improvement)	0 - 98	56	80	86	+32

Case Study

Resolution of Post-Traumatic Anosmia Following Network Spinal Analysis Care: A Case Study

Carly Letzt Carney, D.C.[1]
Michelle MacCarthy, D.C.[1]
Christopher Girdis, D.C.[2]

1. *Private Practice of Chiropractic, Denver, CO*
2. *Private Practice of Chiropractic, Raleigh, NC*

Abstract

Objective: This case described the resolution of post-traumatic anosmia in a 58-year-old female under Network Spinal Analysis (NSA) care.

Clinical Features: The patient, a 58-year-old single woman, presented to a private practice for high blood pressure and symptoms occurring from a car accident a month prior to initial visit. Her symptoms included right shoulder, right scapular and mid-back pain. The patient also noted a loss in sense of smell nine years prior, after a previous auto accident.

Intervention & Outcome: The patient was under NSA care for 84 patient visits. There were improvements in anosmia after five months of continuous care.

Conclusion: This case describes the successful resolution of anosmia following Network Spinal Analysis care. Although this was the only form of healthcare the patient was receiving over the course of care, the relationship between Network Spinal Analysis chiropractic care and anosmia is unknown and requires further research.

Keywords: *anosmia, post-traumatic anosmia, Network Spinal Analysis, chiropractic, vertebral subluxation, reorganizational healing*

Introduction

Anosmia is the loss of smell that can be complete or partial, however, complete loss of smell is quite rare in the general population.[1] Recent epidemiologic reports have shown that anosmia is most commonly seen in the elderly population. However, other pathophysiological processes are shown to have these indications including; head trauma, sinonasal diseases, pathology, toxic exposures, and very rare congenital anomalies. In reported head trauma injuries due to a coup/contracoup motion of the head, the mechanism of injury has been seen as a shearing type injury in which the olfactory nerves are sliced by the cribiform plate.[2] Alternatively, another mechanism of injury has shown hemorrhagic contusion of the inferior frontal lobes which causes a sequalae of gliosis of the olfactory bulbs, seen on T2 MRI. [3-5] Other mechanisms would include any fractures of the facial bones, which cause septal deviation, and sinonasal diseases, which may include polyps of the nasal cavity, rhinitis, and allergies.[2]

Medical conditions known to cause anosmia include: Alzheimer's disease, Multiple Sclerosis, Parkinson's disease, and depression. Local exposure to toxins such as ammonia, gasoline, and other strong chemicals such as hair dresser chemicals can cause permanent dysfunction to the olfactory bulbs.[6] A rare congenital anomaly that is associated with olfaction is Kallman syndrome, which deals with the mutation of specific proteins which has a direct effect on the olfactory neurons.[7]

The evaluation process of anosmia, and other possible smell disorders, has lagged throughout the years. This could be due to the lack of effective treatments that are available for this disorder. There are, however, validated tests that are used beyond neurological examination. The test that is used most often in the clinical setting is the University of Pennsylvania Smell Identification Test. This test consists of a 40 item "scratch & sniff" test in which the patient has to identify the smell of each odor and choose which smell it is from 4 different responses for each item.[2] MR imaging has been used in some case studies to show damage to small structures of the olfactory bulbs. MR imaging with surface-coil technology is ideally suited in the examination process of the olfactory bulb and tract especially in head trauma cases with loss of smell. It has been shown that MR imaging taken directly after a post-traumatic head injury, and in follow-up imaging, is important

because it will show the progression of anosmia and help with proper management of the patient.[3,4,5]

Patient management and treatment is dependent on the mechanism of injury, although the forms of treatment are very limited. Some cases have shown to have spontaneous improvement on their own. In cases of congenital anomalies, age related, and toxic exposure, there is very little that can be done to help improve these conditions. In post-traumatic anosmia, there is often use of systemic steroids which has shown to have very little effect on the recovery of smell. Spontaneous recovery has been seen in these patients however, it is usually seen within the first 6 months to a year and only occurs in a 1/3 of cases. In cases of chronic rhinosinusitis there has been shown to have some improvement when patients undergo endoscopic sinus surgery and polyp removal. Systemic steroid and corticosteroid inhalation into the nostrils has also been shown to be effective in the treatment of chronic rhinosinusitis.[8-9]

Several conservative modalities have been shown to help patients with anosmia to have partial to full recovery of smell. Chiropractic care has been utilized with anosmia due to a misalignment of the upper cervical spine. In one other case study the patient received one chiropractic adjustment in which there was improvement of symptoms. After three months of care she had regained full restoration of smell.[10] In another case report the patient was being managed conventionally for two years without any improvement, but with acupuncture she has shown improvement with anosmia, after just one acupuncture session she regained her sense of smell back.[11] Unfortunately, there is little research that shows a direct relationship between these modalities and the regaining of loss of smell.

Although the prevalence of anosmia is known in the medical community, there is very little public awareness regarding this problem. This could be due to the limited amount of resources for olfactory testing centers, which may interfere with patients trying to seek help. However, if these patients were to seek medical attention, there is very little that can be done to restore the loss of smell in an individual. With this lack of awareness people with anosmia have been shown to have a negative effect in their activities in daily living.

In a retrospective study of 420 patients with abnormal test scores for olfactory impairment, some of the major issues consisted of safety concerns such as: worrying about smoke, gas leaks, and inhaling toxic chemicals from cleaning products. The participants also showed a high response level to personal hygiene in which they worried about how their breath smelled, body odor, and even how their house smelled. Eating issues such as altered taste in food, less enjoyment from eating, and preferring spicier foods were indicated by the majority of the participants. Of all the patients of the study it showed that 25% of group indicated that they enjoyed life less than they used to.[12]

This case study focuses on the loss of olfaction via a coup/contracoup head motion from a car accident. Coup/contracoup head injuries usually occur from an impact to the frontal aspect of the skull resulting in an occipital blow. Another form of coup/contracoup injuries seen in anosmia cases are skull fractures; these have been shown to occur frequently in the frontal bone, occipital bone, midface, and at the skull base. Fractures, however, appear to only occur in very severe cases. These injuries are seen in minor accidents to the head, especially occurring in the frontal to occipital plane.[13] Previous results in literature have shown that approximately 30% of patients who have sustained a major closed head injury have acquired post-traumatic anosmia, a major closed head injury is defined as amnesia for more than 24 hours. Patients whose head injuries were not accompanied with amnesia or in which the amnesia occurred for less than one hour acquired anosmia 3-8% of the time.[3]

Case Report

The following is a case study of a middle-aged patient under Network Spinal Analysis care. The patient, a 58-year-old single woman, presented to a private practice for high blood pressure and symptoms occurring from a car accident a month prior to her initial visit.

The patient stated that she has been dealing with her high blood pressure for over 20 years which started with the pregnancy of her 3rd child, and was taking medication for the condition. She stated to have been experiencing some right shoulder, right scapular, and mid-back pain since her previous auto accident that occurred one month prior. Patient did not indicate any significant effect on activities of daily living. However, the patient stated that the pain has had some effect on enjoying time with friends and family. She also cited that in a previous auto accident 9 years prior she immediately lost her sense of smell. Patient stated that this was the only form of healthcare that she was receiving.

The patient was asked to cite the different stress factors that she experienced in her life. These stressors included physical, emotional, and work stress. For physical stress the patient had been through multiple car accidents, along with a biking accident in which the patient was struck by a car. She also experienced a surgical procedure of uterine scraping. For emotional stress, she had stated that she had been through a short-sale on her home along with going through a divorce which all happened around the same time period. The patient had stated that as a child she had an abusive father, along with a mother who wasn't supportive. Work stress included sitting for long periods of time, along with stressful deadlines and projects.

On the intake form the patient was asked about her current lifestyle, which included a current diet of no dairy, very little consumption of wheat or corn, and she cooked most of her meals from scratch. She stated she consumed 50 oz. of water per day and didn't consume any alcohol. The patient was a non-smoker. She stated that she worked out moderately (walking and bicycling) and she got 8-10 hours of sleep per day.

Radiology

A full spine series was taken with AP and lateral directions. The AP series was unremarkable. Lateral series revealed that there was an abnormal s-curve in the cervical spine, which measured 8.9 degrees in the lordotic curve of the lower

cervical spine and 7.4 degrees in the kyphotic curve of the upper cervical spine. The Lateral lumbar series revealed a normal lordotic curve of 48.1 degrees.

sEMG

Paraspinal surface EMG (sEMG) was taken using a MyoVision 4.0 unit, to record paraspinal activity. The MyoVision uses hand held electrodes that are placed on the skin in the paraspinal region scanning the 15 pair sites of the spine. This is utilized to measure asymmetrical contraction of the paraspinal muscles, dysponesis, and the response to chiropractic adjustments. If paraspinal dysfunction is seen from the scan, such as muscle asymmetry, it is generally accepted that this is an indicator for vertebral subluxation.[14]

At the initial exam, the patient demonstrated sEMG muscle tension measured as "High" at C2, C4, C5 on the right, C7, T1 on the left, T3, T4 on the right, T6 on the left, T7 on the right, T9 on the left, T10 on the right, T12 on the left, L1 on the right, L3, L4 on the left, and S1 on the left. The patient demonstrated sEMG muscle tension measured as "Moderately High" at C4, C5, T10, T12 on the left, L3 on the right, and S1 bilaterally.

Network Spinal Analysis Care

Network Spinal Analysis care is a technique utilized by chiropractors created by Donald Epstein, D.C. The technique has been published in multiple journals elaborating the technique and theory behind this approach to chiropractic and healthcare.[15] The term *spinal entrainment* is often used in Network Care, along side the universal chiropractic term of adjustment, also sometimes being referred to as a Network adjustment. During a spinal entrainment, a specific low force contact is made along the spine at areas termed as spinal gateways. A spinal gateway is a focal area of stored potential energy located on or near spinal segments which are directly or indirectly attached to the dura mater, most often at the sacrum and cervical spine.[16] Each level of NSA care elicits a unique sensory and motor responses to assist in the self-regulation of tension throughout the body. Epstein utilized the models of Brieg and Panjabi to hypothesize that tension (adverse mechanical cord tension) and energy is stored within three different subsystems: passive (vertebrae, discs and spinal ligaments), active (muscles and tendons surrounding spine), and neural (motion transducers).[17] Once the specific contact is made to the spinal gateway, it is believed to cause a global change throughout the body allowing for a higher level of reorganization in the system. This release of tension and reorganization can be seen through the development of two "waves" through the spine. The first wave, which is seen towards the end of Level 1 care is known as the *Respiratory Wave*. This is seen when there is a full respiration through the entire spine from sacrum through. The second wave, identified in Level 2 of care, is known as the *Somatopsychic Wave*. This is seen as a coordinated movement wave, which has been shown to reorganize the spine, and show elements of a central pattern generator.[18-19] In summary, NSA care is applied to the spine to increase spinal and neural integrity which leads to higher awareness of the external and internal environments along with heightened brain awareness of the body. Each level of care has its own specific objectives and outcomes derived from reorganization of the spine and the building of coherence throughout the nervous system.

The patient initially began care at 3 visits per week for 12 weeks. A reassessment was performed every 40 days, which consisted of sEMG scans, posture assessment with PosturePro, and a questionnaire. Questionnaires in NSA care are geared towards a self-rated perception of health, wellness, and overall quality of life, and specific to the level of care the patient is receiving.[20] The patient met all of her NSA goals and parameters after the first 12 weeks of care. The patient care plan was then changed to 2 visits per week for 24 weeks, continuing with the same reassessment schedule. After 84 visits, a post x-ray was taken looking for any structural changes in the patient.

Results

After the initial care plan (5 months of care), sEMG patterns had changed. The patient demonstrated sEMG muscle tension measured as "High" at C4, C7, T1, T3, T6, T9, T12, L3, and S2 on the left. Nine out of 15 levels demonstrated high muscle tension, compared to twelve at the initial visit. The patient demonstrated sEMG muscle tension measured "Moderately High" at C2 on the right, T1 on the left, T10 on the right, and L4 on the left. Four out of 15 levels demonstrated moderately high muscle tension, compared to six at the initial visit.

Radiographs showed improvement on the lateral cervical spine. Lateral series revealed that there was an increase in curvature in the lordotic curve of the lower cervical spine of 1 degree and a decrease in the abnormal kyphotic curve of the upper cervical spine of 3.3 degrees. On the lateral lumbar series, although within normal limits at initial exam, increased by 2.9 degrees which is still within normal limits.

After meeting the goals and objectives of Level 1 NSA care, the patient filled out a questionnaire where she reported: "I am more aware of my spine. This awareness is especially noticeable at rest."; "I have experienced a deeper awareness of knowing exactly what my body wants me to do. This has come in the area of exercise."; "I am more aware of my breathing in between adjustment sessions."; and, "In general, I feel my spine or areas of my spine to be more at peace."

After receiving 5 months of NSA care the patient reported that she had regained her sense of smell again. The patient also reported a significant decrease in pain from her original chief complaint of right shoulder, right scapular, and mid-back pain since her previous auto accident.

Discussion

The patient reported losing her sense of smell due a car accident that occurred 9 years prior. After being under NSA care for 5 months the patient reported regaining her sense of smell. Spontaneous healing of the olfactory nerve in patients with anosmia has been shown to be a very poor prognosis when dealing with traumatic accidents. When healing does occur it is usually seen within the first year and is only seen as a partial recovery.[8-9]

A possible mechanism of this injury occurred due to a coup-

contracoup movement of the brain relative to the anterior skull base causing shearing or stretching of the olfactory nerve as it passes through the cribifom plate. This is the most common mechanism of injury from a post-traumatic anosmic accident. A whiplash type injury, which is shown in this specific case, can cause a significant component of adverse tension. This adverse tension could be caused from possible connective tissue irritation and/or damaged olfactory axons. Once the adverse mechanical cord tension has occurred in the system, it causes both the nervous system and connective tissue system to become more vulnerable, in which after the car accident the patient experienced a sudden loss of smell.[17,21]

With NSA care, specific contacts at the spinal gateways are made in order to release and reorganize adverse mechanical cord tension through the three subsystems (passive, active, and neural) and improve spinal and neural integrity. Throughout care the patient is able to release adverse tension while potentially reducing the meningeal irritation and allowing for regeneration of the olfactory axons, allowing the patient to regain her sense of smell.[17,21]

The medical management for this condition has no standard of care. In fact at times it is overlooked because of the concern of more severe injuries in post-traumatic accidents. The current remedy utilized is the use of oral steroid treatment, however, information that has been published on this treatment has shown that the use of steroids is just as effective as spontaneous recovery.[8-9] Current research is being done for medical treatment of grafting olfactory epithelium to the olfactory bulb on lab mice. This publication showed a high success rate of the morphology of the graft which showed characteristics of normal olfactory epithelium. Although, the standard of treatment is limited, this type of research is giving hope for future developments.[22]

Limitations

There are several limitations to this study. Since this is a case study with only one patient, it cannot be generalized that all patients who are anosmic will regain their sense of smell after receiving NSA care. Due to the patient's chief complaint not being related to anosmia, a targeted evaluation was performed for the reason of care being sought. Follow-up tracking and neurologic assessment performed for the olfactory nerve on the patient to distinguish the severity of her anosmia would have added another dimension to the data collected. Although the patient reported that this was the only form of healthcare she was receiving there is a possibility that her condition had healed spontaneously.

Conclusion

This case described the successful resolution of anosmia following Network Spinal Analysis care. Although this was the only form of healthcare the patient was receiving over the course of her care, the relationship between adverse mechanical cord tension and anosmia is unknown and requires further research. In consideration of the potential dangers of the common use of the systemic steroids to patients with this condition, it suggested that there be a clinical trial of post-traumatic anosmia to evaluate the benefits of NSA care separate from other forms of treatment.

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Figures

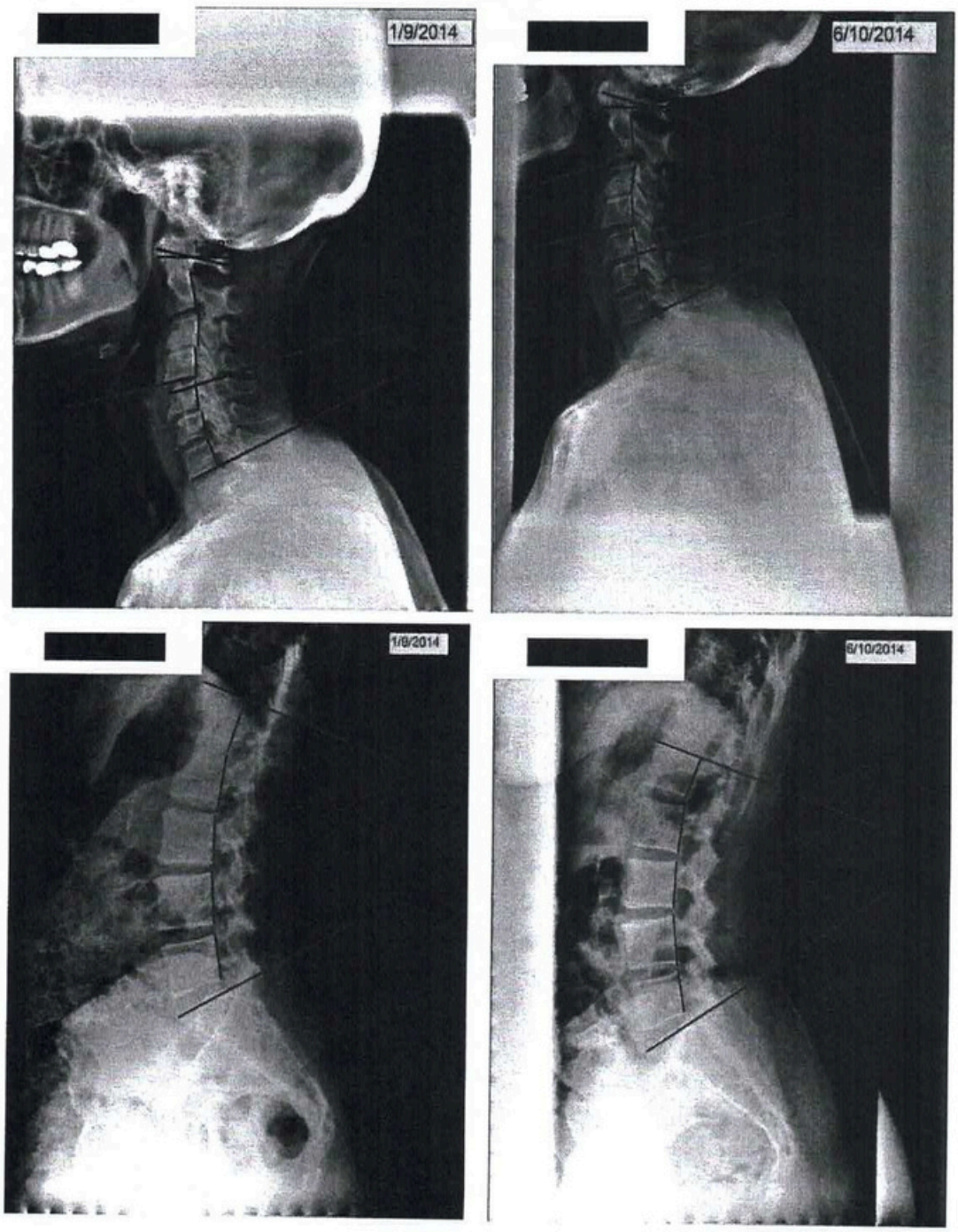

Figure 1: Pre and Post X-rays

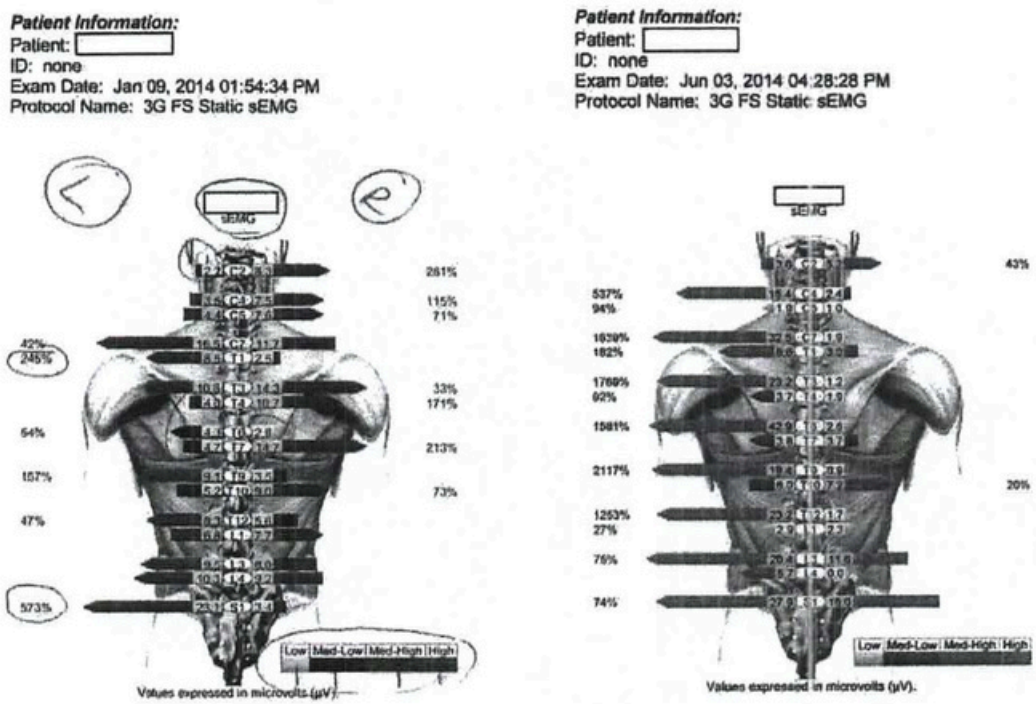

Figure 2: Pre & Post Scans

Case Study

Improvement in Post-Traumatic Stress Disorder Following Network Spinal Analysis Care: A Case Study & Review of Literature

Peter Fox, D.C.[1]
Shannon Martin, D.C.[2]

1. *Private Practice of Chiropractic, Davenport, IA*
2. *Private Practice of Chiropractic, Marietta, GA*

Abstract

Objective: This case study focuses on a 35-year-old male who presented to the office with complaints of post-deployment Post-Traumatic Stress Disorder (PTSD) symptoms that interfered with his ability to function on a daily basis. This study highlights the role of Network Spinal Analysis care in the improvement of PTSD symptoms in this individual.

Clinical Features: The patient presented to the office for assistance reducing his emotional stress due to post-deployment PTSD. He stated that he wished to become more resilient and gain the ability to cope with stress more effectively. His past health history included group and individual talk therapy with little improvement in PTSD symptoms.

Intervention and Outcomes: A self-rated health questionnaire was administered before and after care to measure self-reported outcomes in PTSD symptomatology. An initial examination and a post examination were performed to determine the levels of vertebral subluxation and adverse mechanical cord tension (AMCT). The patient received six weeks of Network Spinal Analysis care for a total of 12 visits. During each visit, an entrainment was performed in which light contacts to the cervical spine and sacrum were administered to address vertebral subluxations and AMCT.

Conclusions: This case demonstrates improvement in post-deployment PTSD symptoms over a 6-week period of Network Spinal Analysis care.

Key Words: *Chiropractic, Adjustment, Subluxation, Network Spinal Analysis, Post-Traumatic Stress Disorder, Reorganizational Healing, Anxiety, Stress, HPA-Axis, Dysafferentation, Neurodystrophic*

Introduction

Epidemiology of PTSD

Mental Illness is a very relevant topic in health care today. In 2013, approximately 1 in 5 adults over the age of 18 were diagnosed with a mental illness and approximately half of all Americans will experience a mental illness in their lifetime. In 2006 alone, the cost of treating the 31.6 million adult patients with mental illnesses in the United States totaled 48.6 billion dollars.[1] This paper will focus on one of these psychiatric disorders: Post-Traumatic Stress Disorder (PTSD). Specifically, we will focus on post-deployment PTSD associated with veterans, due to its increasing prevalence in the military population.

In the general population, the prevalence of PTSD is estimated to range between 8%-14%; however, the prevalence in the military population is much higher.[2] A 2010 study of the Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) military population showed prevalence rates of PTSD between 13.3%-19.8%.[3]. Other studies have shown

PTSD prevalence to be as high as 31%.[4] In addition to service members that are immediately diagnosed with PTSD post-deployment, as many as 2%-8% of service members are later diagnosed with new-onset PTSD within the first 3-years after their deployment ends.[5] Post-traumatic Stress Disorder is the second highest prevalent condition in the military population, second only to Depression.[1] Such high statistics in this population constitutes a close look at this disorder.

Economic Impact

Economic costs play a major role in determining policy when dealing with healthcare. Therefore, we must determine PTSD's cost to society; however, we must look at the secondary and tertiary effects of PTSD in addition to the direct effects. We must consider the medical costs of caring for today's veterans approximately 30-40 years post-service, when the cost for caring for war veterans peaks. Current veterans will hit this peak around 2035. If current trends continue, the data from the Congressional Budget Office predicts total lifetime medical costs for veterans over the next 40 years to be between $300 and $600 billion dollars. Although this number takes into account all medical costs and not just PTSD, PTSD has been shown to be a key factor in contributing to poor long-term health and is unlikely to be a disorder in isolation.[4] A veteran diagnosed with PTSD incurs approximately 60% higher medical costs throughout their lifetime than the average person.[6] Whether physically injured or not, many veterans develop PTSD; this translates into a lower quality of life and a greater number of medical problems than those who do not suffer from PTSD. Increased suicide rates, substance abuse, depression, anxiety, heart disease, obesity, diabetes, gastrointestinal disorders, musculoskeletal disorders, chronic fatigue, and increased dementia have all been shown to be secondary and tertiary effects of PTSD, which then lead to increased medical costs.[4]

In 2010, a study of United States Service members in Iraq estimated that the total societal cost of PTSD per person ranged from $5,900 to $25,800 over a two-year period. A follow-up study averaged this cost to be about $16,000 per person. Using this data, while allowing inflation and prevalence statistics to remain unchanged, this study determined an average cost of nearly $50,000 over two years per veteran with PTSD. When adding the total cost to treat just one veteran with PTSD for fifty years, the number is estimated to be $1,250,000 for PTSD and Depression, not including the concomitant conditions mentioned above.[4] If lost work productivity is factored into economic costs, then the total economic cost of PTSD after return from deployment is estimated to be as high as 6.2 billion dollars for the first two years after deployment ends.[3]

Due to social stigma associated with mental illness, many service men and women suffer in silence or fail to seek help for their condition; therefore, if these veterans seek professional help for their PTSD, the potential for an even larger financial need than outlined above exists. In 2007, it was documented that there were too few mental health providers in the Department of Defense (DoD) and Veterans Affairs (VA) health care systems to accompany the amount of veterans diagnosed with PTSD. If this trend continues, it is important to take measures to increase the availability of treatment for PTSD sufferers.[4]

History of PTSD

Historically, the first documented mention of sympton concurrent with PTSD originates under Freud's contemporaries at the end of the nineteenth century. At the time, these symptoms were categorized under the broad term of "hysteria". These symptoms have gone through a multitude of different names: "shell shock" during World War I, "battle fatigue" during World War II, and then eventually coined as "Post-Traumatic Stress Disorder" during the Vietnam War.[7] There are four criteria that must be present for a person to be diagnosed with Post-Traumatic Stress Disorder. First, an event must occur that involves severe harm, threat to life, extreme feelings of fear, and/or helplessness.[3] Second, this event must be re-experienced in some way, whether through recurring dreams, disturbing recollections, or severe psychological distress at events that either resemble the traumatic event or trigger a memory of the traumatic event. Third, the individual must persistently avoid the stimuli associated with the trauma. Fourth, symptoms of increased arousal via the autonomic nervous system must persist, such as insomnia, irritability, poor concentration, hyper vigilance, and/or an exaggerated startle response.[7]

Standard of Care

The standard treatment for PTSD includes both a physiological and psychological component of care. The physiological component of care includes medications such a selective serotonin reuptake inhibitors (SSRIs), tricycl antidepressants, monoamine oxidase inhibitors (MAOIs), benzodiazepines, and/or anticonvulsants. Psychologically, eye movement desensitization and reprocessing (EMDR), exposure therapy, and/or cognitive-behavioral therapy (CBT) may be administered.[8] However, a survey conducted at the Veteran's Affair reported that a large proportion of VA patients have conditions that do not respond well to allopathic management.[9] Many of these treatments for the disorder are associated with high rates of dropout and nonresponse; this is perhaps due to difficulty dealing with an intervention that consists of heightened stress because their nervous system is already hyper-aroused.

Many PTSD-sufferers are turning towards Complementary and Alternative Medicine to treat their disorder; in fact, adult-use of CAM increased from 36% in 2002 to 38.8% in 2007.[9] The most utilized CAM techniques for PTSD include mind-body treatments such as relaxation, meditation, and exercise therapy. A person with PTSD has problems with the regulatory abilities of the autonomic nervous system, leading to symptoms of hyperarousal and anxiety. Mind-body treatments increase the autonomic nervous system's regulatory abilities, perhaps a reason as to why many PTSD patients are turning towards CAM techniques for treatment.[10] Similar to mindfulness CAM treatments, Network Spinal Analysis chiropractic care has been hypothesized to have these san autonomic nervous system regulatory effects via a reduction in Adverse Mechanical Cord Tension (AMCT) and structural vertebral subluxations (more on this discussed later).

As mentioned above, allopathic management of PTSD is

seeing only moderate results in treatment outcomes with high dropout rates, while CAM use is increasing, showing increased interest in new and improved ways to approach this disorder. In addition, the already-existent shortage of PTSD treatment providers raises the need for additional options for veterans suffering from PTSD. This paper will discuss improved quality of life outcomes and anxiety symptom reduction in a military veteran suffering from PTSD undergoing Network Spinal Analysis chiropractic care.

Case Report

History and Initial Examination

A 35-year-old male presented to a chiropractic office for symptomatology associated with Post-Traumatic Stress Disorder attributed to past military deployment. According to his initial intake form, his symptoms included an "overstimulated nervous system", along with an inability to function at a normal level due to stress levels that included an "intense, never-ending anxiety which has bled into all areas of [his] life – mental, physical, emotional, spiritual, and into relationships with others" (see Appendix). His symptoms of PTSD began in 2004, 11 years prior to beginning the care documented in this case study. The patient sought treatment for his PTSD via counseling, prescription drugs, and past chiropractic care, but saw "little to no lasting effect" on his PTSD symptomatology.

Upon initial consultation, the patient filled out a Comprehensive Health Profile, an initial intake form used for pre and post care data collection at the office in which he received care. The degree to which his PTSD affected aspects of his function and life, such as work, sleep, recreation, eating, exercise, love life, social life, sitting, and walking was rated as "Moderate" upon the initial examination. He noted that there is never a time throughout the day that he is not aware of his problem; however, it is more intense at night. When asked to rate the severity of inconvenience that his PTSD causes him, from "Not at all", "Slight", "Moderate", to "Extreme", he marked "Extreme" for both the present and the past symptoms. The patient wrote that he is "constantly searching for new things to help" and marked the box next to the pre-written statement: "I deserve more than what I have been experiencing and would like you to assist in my healing".

When asked to rate his stress levels on a scale of 0-3, with 0 being equal to "no stress at all", 1 being equal to "slightly stressful", 2 being equal to "moderately stressful", and 3 being equal to "drastically stressful", physical stress was rated as a 2 ("moderately stressful"), chemical stress was rated as a 2 ("moderately stressful"), and emotional/mental stress was rated as a 3 ("drastically stressful"). When asked to rate how he hopes to benefit from care in the office on a scale of 0 ("does not apply") to 3 ("very important to me"), the patient marked a 3 ("very important to me") for all of the following: improvement of physical symptoms, improvement of emotional/mental symptoms, more efficient ability to react or respond to stress, noticeable different in enjoyment of life, increased ability to make constructive choices, and overall improved quality of life.

The patient's past medical history included a motor vehicle accident in 2007 in which he was rear-ended and experienced neck pain. He received physical therapy for one month for neck pain with mild improvement. In 2005, a MRI was taken which showed osteophytes and disc herniations in his lumbar spine. From 2005-2010, the patient began emotional therapy via group and individual talk therapy sessions for symptoms related to his PTSD with "little change" noted for results. In terms of nutritional supplements, the patient disclosed that he takes magnesium regularly, but did not specify the reason. One of the last fill-in-the-blank questions on the questionnaire asks if there are any particular factors or elements about life that may impair the opportunity for full health. In response, the patient wrote: "Obligations to work and family sometimes make it hard to schedule time for myself".

Initial Examination

A Network Spinal Analysis examination utilizes Panjabi's three stabilizing systems of the spine as the focus for palpation findings. These stabilizing systems include the passive system (bones, ligaments, discs), the active system (musculature), and the neural control system (the nervous system which receives information, determines requirements for stability, and instructs the active subsystem to meet these demands). Under normal circumstances, these three spinal subsystems are highly coordinated; however, if dysfunction occurs in any one of these systems, the other two systems must compensate to try to increase stability, potentially leading to acute or chronic problems.[11] The initial physical examination revealed active tension rated as a 4/5 in the cervical, thoracic, and lumbar regions on a scale of 0-5 (0 = no tension, 5 =highest tension). Passive tension was rated as 4-5/5 on the same scale in the thoracic spine. Heel tension eversion stress was rated a 4/5 bilaterally and heel tension flexion/extension stress was also rated as a 4/5 bilaterally. Heel tension is thought to be associated with the presence of adverse mechanical cord tension (AMCT), which will be discussed later in this paper.[12]

Intervention

The patient began a care plan in which he received chiropractic adjustments, known as spinal entrainments in Network Spinal Analysis care, 2 times per week for 6 weeks for a total of 12 entrainments. These entrainments consisted of low-force contacts to the cervical spine and sacrum. Subluxations were noted and addressed at C1, C2, C5, along with a sacrotuberous ligament contact on several visits to correct an Anterior-Inferior sacrum subluxation. Five phases are used in NSA care to assess the levels of subluxation involvement and AMCT, along with an allowance for a sequential movement through care based on clinical outcomes and functional improvements.[13] Phases 2, 3, 4, and 5 were addressed in this case. The patient received Basic Level 1 Care for 10 out of 12 sessions; the 11th and 12th entrainment began Level 2 Intermediate Care. More will be discussed on the different levels of NSA care further in the paper.

Outcomes/Re-Examination

Upon his reexamination, the patient's heel tension eversion stress was reduced from a 4/5 to a 1/5 bilaterally, along with a reduction in heel tension flexion/extension stress from a 4/5 to a 2/5 bilaterally. A reduction in passive tension was noted in

the thoracic spine from a 4/5 to a 2/5. Active tension in the cervical, thoracic, and lumbar spine were all reduced from a 4/5 to a 0/5. The patient noted that he is more aware of his spine and the awareness is not due to greater discomfort or pain. He noted an increase in awareness of pleasant sensations in his spine, better posture, a better ability to take deeper breaths, and a greater ease in standing up straight. When asked about awareness of tension, the patient noted that he is now more aware of where he holds tension in his body and spine, is better aware of what releases tension from his body, and that he feels that his body is becoming more effective at releasing its tension since beginning care.

Within the first two weeks of care, the patient stated that he felt "less tension in his muscles at rest", a "small increase in overall well-being", slightly more ease in balance while standing, and felt "much more relaxed at rest" with an increased ability to "tolerate watching his kids". Within the first month of care, the patient noted an increased awareness of his breath and "improved digestion". During one visit, the patient noted that he felt "more tense than the past few visits", but "more resilient overall". By the ninth entrainment, the patient stated that he felt his breath "opening up into new areas" along with the ability to now "take a full breath".

When asked to evaluate his mental/emotional state on a scale of 1-5 post-care (1 = "never", 2 = "rarely", 3 = "occasionally", 4 = "regularly", 5 = "constantly"), the patient noted that the presence of negative feelings about himself, moodiness, angry outbursts, depression, lack of interest, restlessness, difficulty sitting still, and experience of recurring thoughts or dreams were all rated as a 2 ("rarely"). He noted that being overly worried about small things, difficulty thinking or concentrating, and experience of vague fears or anxiety were rated as 3 ("occasionally"), which is an improvement from his initial intake form in which he noted that he was unable to function prior to care due to constant stress. He also noted a 4 ("regularly") when asked how often he has positive feelings about himself and a 5 ("constantly") when asked how often he has an interest in maintaining a healthy lifestyle.

Review of Literature

A review of the literature conducted by Green, Johnson, Lisi, and Tucker, attempted to look at chiropractic utilization specific to military and veterans' health care. They found only 13 public, peer-reviewed papers on chiropractic and military populations; however, most of the cases were low-back pain or musculoskeletal-related. Two studies included PTSD as a concomitant condition; however, the focus of the studies were on resolution of low back pain; therefore, no outcome data was recorded in terms of PTSD.[14] In the first study by Dunn and Passmore, 16% of patients presenting for chiropractic care had a diagnosis of Post-Traumatic Stress Disorder, but 72% of the total patient base was seen for a lumbar complaint. In another study by Dunn et al., it was found that patients with PTSD experienced significantly lower levels of neck and low back pain score improvement than those without PTSD; however, no outcomes for the PTSD itself were recorded.[14] According to Dunn, the relationship between chronic pain and PTSD should "serve as a stimulus for chiropractic clinical research efforts".[15] Although included in this paper, these studies do not directly relate chiropractic care to PTSD treatment and therefore cannot be viewed as anything more than musculoskeletal cases.

Lisi conducted a retrospective review of cases in one Veterans Health Administration facility to assess outcomes of care for group of OIF and OEF veterans over a six-month period in November 2007 – April 2008. Twenty-one out of thirty-one cases screened positive for PTSD prior to chiropractic consultation for musculoskeletal pain and another three veterans were screened positive by the chiropractic clinic, for a total of twenty-four out of thirty-one cases having a co-morbidity of PTSD. Although a majority of patients underwent a significant reduction in musculoskeletal pain, no data was collected on PTSD outcomes.[16]

Research conducted by the Foundation for Chiropractic Progress highlights the positive outcomes of chiropractic care and PTSD. According to lead author Frederick R. Carrick, treating PTSD as a physical brain injury rather than a psychiatric disorder showed positive outcomes in extreme PTSD sufferers. Primary treatment in this study included a novel brain and vestibular rehabilitation treatment (VRT), which included a mix of fast and slow eye movement exercises. However, this study does not mention any utilization of chiropractic adjustments and/or spinal manipulative therapy, so it is unclear as to whether VRT was the sole treatment or if a complication of VRT and chiropractic adjustments were utilized for these positive outcomes.[17]

A retrospective study of 2,818 patients undergoing Networ Spinal Analysis care measured perceived changes in self-rat health and quality of life based on physical state, mental/ emotional state, stress evaluation, and life enjoyment. The exact mechanisms behind the effects of this study are not known, but it is thought to be associated with changes in the levels of circulating factors released by the HPA-axis, which will be discussed later in that it plays an important role in recent understanding of PTSD pathophysiology.[18]

Discussion

Reorganizational Healing

Network Spinal Analysis is founded upon the premise of Reorganizational Healing (ROH), which is a paradigm in which the "intention is for the outcome to be dynamical change in the individual and the life system; to develop new resources so that the individual may use the experience consciously to bring his/her life to a greater level of understanding and appreciation; and to increase the individual's ability to thrive under most circumstances".[19] This is in contrast to Restorative Therapeutics (RET), under which most Western allopathic models are based, in which the goal is to restore the person to where he or she was before the problem began, not necessarily adding any health or add any additional benefit to his or her life. Reorganizational Healing approaches care with the central belief that change rare comes from the area of the body that is in defense because tha area is very guarded. Instead, change comes from the person becoming aware of the area that is in defense and acknowledging that this defense/pain/symptom exists for a reason. The person can then redirect the energy stored in that

bound area, whether in an area of fixation (structural vertebral subluxation), meningeal tension (facilitation), or muscular tension, to other areas of the body and it can be redirected into a new level of organization. Once this occurs, the area is no longer in a heightened state of defense; it is hypothesized that the body's physiology now allows the cerebral cortex, particularly the frontal lobes, and the vagal centers to become more available to assess what is occurring in the body.[19]

Network Spinal Analysis Care

The objective of Network Spinal Analysis is to correct two categories of vertebral subluxation using low-force adjustments of the spine and surrounding structures. These two categories of vertebral subluxation include structural subluxations and facilitated subluxations. Structural subluxations are what most chiropractors address when correcting a vertebral subluxation. These subluxations are thought to result from physical stress and trauma, causing a vertebral misalignment, which then leads to nerve interference secondary to the misalignment. A facilitated subluxation, on the other hand, is thought to result from adverse mechanical cord tension, or meningeal tension.[13] Adverse mechanical cord tension (AMCT) was first described by Breig in 1978.[20] Adverse mechanical cord tension, according to Network Spinal Analysis, results from facilitation, which occurs when numerous subthreshold stimuli layer upon each other to eventually lower the initial threshold of neural activation. This is known as central sensitization, which is discussed in further detail in the Dysafferentation Model of subluxation further in this paper.

With this type of subluxation, nerve irritation and interference is primary, which leads to AMCT, eventually leading to an osseous vertebral misalignment as an adaptive change. Therefore, in order to reduce the vertebral subluxation, NSA first addresses the increased facilitation in the spinal cord through what is classified as "Level 1 Basic Care". Level 1 care is introductory care for either new patients or patients who present with a recent trauma or high period of stress. The main goal of Level 1 Basic Care is reduction of spinal cord facilitation through light contacts along the spine where dural/meningeal attachments are most-concentrated (cervical spine and sacrum). Smooth, rhythmic muscular movements often accompany these contacts, along with deep respiration, which is thought to mechanically reduce this facilitation.

At the end of Level 1 Basic Care, this movement should move fully from sacrum to the cranium, one segment at a time. This is known as the "Respiratory Wave" in NSA care. This wave involves "undulation and specific rocking/oscillation of spinal segments and the development of what appears as a central pattern generation". It is possible that the oscillation of each individual vertebra allows for proper neurological input to the CNS, particularly increasing mechanoreceptor stimulation and reducing nociceptor stimulation (see more on Dysafferentation Model below). Since oscillation occurs at each vertebral level once a full respiratory wave has been achieved, neurological input is normalized along every level of the spine. This serves to reduce stress signals to the CNS and thus, a reduction in stress signals to the brain and body and by default, a reduction in stress hormones released as a response to these stress signals. The level of organization of these signals reflects the same level of organization in the nervous system. Therefore, as these signals become more predictable and organized, the nervous system becomes more organized. An increase in CNS organization has been shown to increase higher-level cognitive processes.[21]

Once this occurs and facilitation has been reduced, structural subluxations are easier to correct. At the end of Level 1 Basic Care, the patient should gain awareness of a deeper respiratory rhythm and improved natural movements of their spine. This reduction of facilitation and increased awareness has been associated with early signs of quality of life changes, such as a reduction in stress and an increase in energy. Next, the patient can move into "Level 2 Intermediate Care" and "Level 3 Advanced Care". For purposes of this paper, only Level 1 Basic Care is discussed due to the patient's involvement in Level 1 Care for the majority of the intervention recorded up to the point that this case was written.[13]

Dysafferentation Model, Neurodystrophic Model, and PTSD

In order to understand how NSA entrainments may have an effect on PTSD, we must first understand two models of vertebral subluxation: the Dysafferentation model and Neurodystrophic Model. According to Seaman, dysafferentation is defined as "an imbalance in afferent input such that there is an increase in nociceptor input and a reduction in mechanoreceptor input." Nociceptors, particularly "silent nociceptors", respond to chemical irritants, and are thought to be the main mediators in central sensitization. Under normal circumstances, nociceptors have high thresholds for stimulation; however, once central sensitization occurs, this threshold is drastically lowered and it takes less of a stimulus to cause these nociceptors to fire. It has been shown that norepinephrine released via synaptic terminals may also sensitize nociceptors, potentially through a release of prostaglandins.[22] Dysfunctional movement patterns, such as those present with AMCT or structural vertebral subluxations, result in dysfunctional afferent input through the Central Nervous System. In particular, an increase in abnormal nociceptive firing and an abnormal decrease in mechanoreceptor firing occur.

The Dysafferentation model of vertebral subluxation provides a framework for how abnormal afferent input to the Central Nervous System via a vertebral subluxation or AMCT may occur. Next, the Neurodystrophic model takes this a step further and allows us to delve a little deeper into the potential consequences of this dysfunctional input. When dysfunctional afferent input occurs, a stress response is activated via the Central Nervous System in an attempt to adapt to the dysfunction. The sympathetic nervous system is activated when the brain perceives a stimulus as a threat to survival. The hypothalamic-pituitary-adrenal axis (HPA axis) responds to this threat by activating the secretion of stress hormones, such as cortisol, norepinephrine, and epinephrine, which enable the body to increase its chance of survival in the threatening situation.[23]

The HPA axis is of particular interest in this case report because of its purported involvement in PTSD. Sustaining a sympathetically dominant physiology can cause organ and tissue dysfunction by forcing the body to maintain an

inappropriately high level of sympathetic adaptation at all times. To continue a vicious cycle, a previously-activated nervous system response causes additional release of noradrenaline and adrenaline, which further activates the sympathetic nervous system, continuing a cascade of sympathetic dominance.[24] The HPA axis is a stress-responsive neuroendocrine system that allows for the adaptation to stress and the return to homeostasis after the stressful situation ends. A dysfunctional HPA axis is associated with numerous psychiatric disorders, including PTSD, due to the inability to regulate sympathetic arousal. This leads to symptoms of hypervigilance and hyperarousal associated with stress physiology. During a stressful event, whether physical or psychological, corticotropin-releasing factor (CRF) is produced in the hypothalamus. This results in the activation of the HPA axis and cortisol is released. It is hypothesized that high CRF levels at the time of a traumatic event may actually encode the traumatic memory, thus leading to CRF activation and anxiety effects each time the memory resurfaces, such as the case with PTSD.[2] This is thought to eventually lead to a burnout of the corticotropin releasing hormone system, resulting in a dominating sympathetic nervous system.[25]

Conclusion

In Reorganizational Healing and Network Spinal Analysis, patient care is administered via a subluxation-centered perspective. Therefore, in this case, rather than approaching the patient from a biomedical paradigm, in which a specific disease or symptom is treated, the patient was approached from a psycho-social paradigm, in which function and quality of life took precedence. This is why the Comprehensive Health Profile used in this case involved questioning to elicit psycho-social responses, rather than direct questions about symptomatology.[12]

Network Spinal Analysis care allows a person to shift away from sympathetic and stress physiology dominance towards a parasympathetic, relaxation physiology. This causes a reduction in release of stress hormones known to be associated with PTSD and other mental illnesses. In this particular case, the patient noticed significant changes in awareness of his spine, breath, and overall bodily tension patterns, along with a reduction in symptoms of anxiety. Due to the potential for practical implication of Network Spinal Analysis, larger studies need to be done to further investigate its potential benefits.

This case study has several limitations. First, this is a case study on one individual undergoing Network Spinal Analysis care and therefore, this research lacks the benefit of a large number of participants. Second, this study lacks objective measures, such as surface electromyography (sEMG), thermography, or other outcome measurement tools that would objectify a potential shift away from sympathetic and stress physiology. In addition, the symptoms described by the patient throughout the initial health questionnaire are somewhat vague. He stated that he was unable to function due to his symptoms; however, the exact ways in which his function was hindered was not mentioned, so it is difficult to measure the exact amount of improvement without an initial baseline to quantify. Lastly, this case was on-going at the time that this case study was written. The patient is continuing NSA care, so we cannot be sure of any improvements that may have occurred after this was written. Since NSA is closely tied in with ROH, in which limitations on maximal improvement are not placed, it is possible that the patient may have gained additional benefits with continued care after this study w written.

This case demonstrates the need for further research dealing with Network Spinal Analysis and mental illnesses; particularly Post-Traumatic Stress Disorder. Because so many service men and women return from deployment with PTSD regardless of physical injury, and the current, allopathic treatment for PTSD has proven largely unsuccessful, Network Spinal Analysis may be able to fill this void for many of these men and women. Through what we know from the Dysafferentation and Neurodystrophic Models of Vertebral Subluxation, spinal oscillation via the NSA Respiratory Wave may reduce stress physiology via effects on the HPA axis, thus potentially benefiting our service members with post-deployment PTSD.

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CASE STUDY

Chiropractic Care of a Battered Woman: A Case Study

Leslie Bedell, DC[†]

ABSTRACT

Objective: This case study documents the chiropractic care of a battered woman struggling with Intimate Partner Violence (IPV). Chiropractic offers battered women a unique service, it is the only profession trained and licensed to detect and correct vertebral subluxations. The relationship between the stresses of abuse and vertebral subluxation, as well as the subsequent changes during chiropractic care, are described.

Clinical Features: A Caucasian, 23-year old female presented with headaches, neck pain, and upper back pain. The initial complaint noted sharp, knife-like pains into the medial scapular borders, worse on the right side. Tingling extended into the right hand, most severe in the 2nd, 3rd, and 4th fingers.

Chiropractic care and outcome: Protocols of both Torque Release and Activator techniques were utilized to evaluate vertebral subluxations. Subjective quality of life issues were evaluated through a Network Spinal Analysis (NSA) Health Status Questionnaire. After commencing chiropractic care, this woman suffered a cervical spine hyper-extension/hyper-flexion type injury from an automobile accident. For the first 30 days after, adjustments were applied twice weekly. Acute exacerbations of symptoms unrelated to the original complaints were displayed and progress became irregular. During the next 60 days, there were various unexplained falls and severe flare-ups of painful symptoms, and she finally admitted to being battered by her husband. Referrals to counselors and programs dealing with domestic violence were provided. Once the physical battering stopped, consistent progress was noted in both clinical symptoms and quality of life issues.

Conclusion: As a battered woman must receive emotional and social support to improve her situation, it is important for chiropractors to recognize the "red flags" of IPV. Chiropractors re-evaluate regularly for changes in vertebral subluxation patterns and can recognize inconsistent responses. They may also be the first caregivers to offer a vitalistic approach; considering a woman's physical, chemical, and emotional quality of life; a perspective that offers significant connection and trust. This article serves as a foundation on the topic of IPV and chiropractic, for use in both communities.

Key words: *chiropractic, vertebral subluxation, adjustment, Activator technique, Torque Release Technique, Network Spinal Analysis (NSA), battered woman, Intimate Partner Violence*

Introduction

Intimate partner violence (IPV), previously termed "domestic violence," is defined by the Centers for Disease Control (CDC) as "intentional emotional and/or physical abuse by ex-spouse, boyfriend/girlfriend, ex-boyfriend/ex-girlfriend, or date."[1]

IPV is the most frequent type of violence committed against women,[2] affecting 2 million women each year in the U.S., and includes all races, ages, incomes, and religions.[3] Included in intimate partner violence is battering, where the abuser uses acts of violence and a series of behaviors, including intimidation, threats, psychological abuse and isolation to coerce and to control the other person. The violence may not happen often, but it remains as a hidden (and constant) terrorizing factor.[4] Battered women who are injured by ongoing partner abuse account for the highest percentage of U.S. emergency room visits, approximately 22-35%.[5] Cultural awareness of this social issue has increased since 1987, when the first Domestic Violence Awareness Month was observed that October, it is now an annual event. Also begun in 1987 was the first national toll-free hotline.[6]

Battered women suffer from symptoms such as depression, anxiety, a sense of being detached from their bodies and numb to the physical world, nightmares, and flashbacks of violent episodes. The syndrome characterized by these symptoms is 'post-traumatic stress disorder' (PTSD).[7] PTSD does not allow women to function well, think clearly, or prepare for their futures. Their bodies are constantly living in a state of "Fight or Flight", described by Hans Selye,[8] and many times the symp-

[†]Private Practice, P.O. Box 1219, North Bend WA 98045, agapechiro@msn.com

toms that a woman seeks help for are magnified by the extent of abuse in her life. Their symptomatic profile can include: chronic pain with taut and tender muscle fibers in the head, neck and upper back region, sleeping disorders, and digestive complaints. In addition to these symptoms, victims of intimate partner violence will often reveal 'red flags' that can alert health care practitioners to a battering situation. These indicators may also contribute to the inconsistent or stalled progress of subluxation correction that a battered woman may demonstrate. Eleven red flags, developed from clinical experience, are listed in Table 1.

Statistics indicate that a woman is more likely to discuss her abusive relationship with her doctor than other professionals.[9] As a trusting relationship is established between the chiropractor and the practice member, the battered woman may verbalize the truth about her life situation and be open to resources that are available to help her improve her situation.

Bruises and broken bones are not often a part of the clinical picture, however statistics report that verbal and emotional abuse can be just as damaging as physical abuse.[10] Research by noteworthy scientist Candace Pert, Ph.D indicates that emotional stresses are able to influence neurochemistry: "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."[11] The changes in neurochemistry triggered by emotional stresses may contribute to vertebral subluxations, and confirms the mind/body connection the developer of chiropractic, B.J. Palmer, termed the "mental impulse" many years ago. Accordingly, emotional issues such as a woman's feelings of insecurity, fears of danger to herself or her children, helplessness to change her situation, and loss of self-esteem are as essential for chiropractors to note, as are life-style issues such as diet, exercise and postural stresses.

The Case Report

A 23-year old Caucasian female presented with headaches, neck pain, and sharp, knife-like pains into her upper back region most pronounced along the medial scapular border on the right side. There was tingling into the right hand, most severe in the 2nd, 3rd, and 4th fingers. Torque Release technique was utilized as the primary approach for analysis and care, Activator technique was utilized secondarily for correlation and application of adjustments. The initial evaluation includes observation of prone leg length discrepancies, termed functional leg length inequality in Torque Release and Pelvic Deficiency in Activator technique. Unequal leg length is described as the expression of the body's fixated pattern that lacks adaptability and indicates lateral or posterior rotated subluxation.

Dr. Jay Holder, developer of the Torque Release Technique, describes the definition of a subluxation as: "A condition of one or more spinal segments that have lost their ability to move freely or completely throughout their range of motion and that physically interfere with the spinal cord and or spinal nerves and their function."

Holder's perspective recognizes that all vertebrates have a brain reward system utilizing opiate receptor sites, and the vertebral subluxation complex is the hallmark insult of the vertebrate's ability to express a state of well-being to its fullest potential. Therefore, Torque Release Technique views the subluxation as a "separation from wholeness." Holder describes the causes of subluxation as an:

"Imbalance between external incoming forces and internal resistive forces, often an exaggerated perception of stress causing an inappropriately excessive internal resistive response. The categories of one cause include 1) physical (trauma, thermal, electromagnetic, gravity), 2) chemical (nutritional, toxic, mood altering), 3) mental (perceived threats of stress, emotional), and 4) genetic."

The principles of the Torque Release Technique model are based on the original precepts and findings put forth in the two textbooks written by R.W. Stephenson, *The Chiropractic Textbook* and *The Art of Chiropractic*.[12]

Torque Release Technique Indicators[13]

In addition to functional leg length inequality, Torque Release technique utilizes the following findings as indicators to determine location of subluxations:

Palpation – The process of gathering information through touch. There are four types:

1. Scanning palpation
2. Tissue palpation
3. Intersegmental palpation
4. Motion palpation

The cranio-spinal meningeal functional unit is evaluated as a whole to observe energy imbalances including abnormal heat or cold. Vertebral segments are checked for rotational movement as well as anterior and posterior misalignments.

Abductor Tendency/Adductor Resistance:

A muscle which upon contraction draws apart and away from the median plane of the body, e.g. the action of the tensor fascia lata. The tendency of one or both legs to remain in abduction and resist being moved into adduction or together indicates C2 subluxation – usually on the side of greater resistance. The

Table 1. Bedell's Clinical Red Flags include:

1. hypersensitivity to touch including jumpiness and muscle twitching
2. vague descriptions of injuries related to acute exacerbations of symptoms
3. somato-emotional releases during chiropractic care including tears
4. financial concerns about treatment in spite of adequate family income
5. minimization of life stresses and their relationship to symptoms
6. obsessive need to find a physical answer that can be the cause of symptoms
7. over-concern about scheduling appointments and having to check in with her partner
8. irrational explanations of missed appointments
9. eye deviation/facial stress during questioning about injuries
10. changes subject frequently when asked about her relationship with her partner
11. over-emphasize positive character trait of partner

resistance in graded on a 0-5 scale with 0=no resistance and 5=maximum resistance to movement.

Foot Flare (Inversion/Eversion):

Toe-in or Toe-out – can be right, left or both observed in the prone position; indicates torsion/distortion/tension in the spinal cord and meninges. This is associated with anterior rotation of spinal segments with dural attachments.

Sphenoid, Occiput, C1,C2,C5, Sacrum (S2,3,4), and Coccyx anterior rotation is associated with traction of the meninges. Occiput has dural attachment around the entire foramen magnum.

Foot pronation/supination:

The foot resists against direction of supination and/or pronation and indicates a problem with the position of the trochanter. The resistance is rated on a 0-5 scale as above.

Heel tension (Achilles):

Indicates spinal cord torsion/distortion/tension and any subluxation, posteriority, superiority, or inferiority. Spinal cord tension at C2, C5, Sacrum, and coccyx is most likely. Resistance is rated on a 0-5 scale.

Abnormal breathing patterns:

Observation of patient's breathing pattern, looking for slow, rhythmic, and full movement occurring in a wave throughout the entire spine. Normal breathing is not compartmentalized. An observable decrease or incomplete movement accesses movement throughout the Cranio-Spinal meningeal functional unit.

Inappropriate Sustained Patterns of Paraspinal Contractions
Positive Jump sign, myoirritability, and EMG changes.

Congestive Tissue Tone:

Observation of abnormal fullness or congestion primarily in non-muscle tissue: over the subcutaneous tissue, over anterior neck muscles and the kidney area. Indicates trapped dominant patterns as a sequela to toxic chemicals, drugs, etc.

Postural faults (standing, sitting, prone):

Indicates stuck inappropriate pattern of spatial gravitational adaptation.

Cervical syndrome test:

A screening test for posterior rotation of C1 or C5, with or without laterality. A leg length inequality (short leg) is required prior to this test being performed. Evaluate in a prone position. The side that is down when head is turned and legs even is the side of posterior rotation. The legs must remain even to the exact millimeter and not lengthen or shorten again after a few seconds.

Bilateral Cervical Syndrome Test:

When the short leg changes back and forth to long and short as the head is turned from left to right and back again. In other words, the legs remain uneven. Repeat this action several times to verify that the legs are switching back and forth. A finger pressure test should be done first at coccyx, then occiput, C5, atlas, or T6. The posterior contact on the spinous process, the tubercle, or E.O.P. with a line of drive inferior to superior, and posterior to anterior will cause the legs to remain even, thus determining which segment to adjust with the instrument. Also pressure test for right or left torque.

Derifield Test:

The screening test for +D reveals the pubic subluxation, posterior-inferior ilium or opposite side AS ilium. The screening test for –D reveals an AI sacral base.

Abnormal heat/energy radiation from the body:

Utilizes heat-sensing instruments such as the Thermograph or neurocalometer. Testing documents sympathetic dysfunction.

Torque Release Technique is distinct from Activator technique in that it is described as "non-linear." The same segments are never adjusted in the same vector or in the same order any three visits in a row, and only 1,2, or 3 segments are adjusted on any one visit. Leg testing and pressure testing are utilized to determine the subluxation, the presence of torque, and the line of correction. The practice member is encouraged to allow time to process the changes in their body following the adjustment.

Indicators and Care Relevant to This Case

This woman's initial chiropractic examination, utilizing the previously described indicators, revealed postural distortions of a head tilt to the right with the right ear and shoulder lower than the left. The head was carried forward of the normal gravitational line by 1 ½ inches and a loss of normal kyphosis was evident in the upper dorsal region. Palpation revealed painful trigger points and taut and tender muscle fibers along both medial scapular borders from the levels of T4-sacrum with the right side demonstrating the most pain. Congestive tissue tone was evident over the right upper dorsal region as well as the left flank. A one-inch left leg discrepancy was displayed, which will be referred to as a "pelvic deficiency." Leg length became equal with her head rotated to the right side, indicating a positive cervical syndrome on the left side and subluxation of one of the cervical vertebrae. A gentle force with finger pressure was directed into the 1st and 2nd cervical vertebrae on the left side, alternating clockwise and counterclockwise rotational movements, to determine if leg length equality could be obtained. Following the clockwise force at the first cervical vertebra, the leg lengths became equal (balanced), indicating ease of tension in the dural attachments along the left side of the spinal column and correction of the vertebral subluxation.

An adjustment (specific force applied to a vertebra to release the flow of vital life force along the nerve pathway) was given utilizing the Integrator instrument. This instrument was developed by Dr. Holder for use with Torque Release Technique. It is a spring-loaded, hand-held instrument, which delivers a force utilizing torque and recoil at 1/10,000 sec., similar to a toggle-recoil manual adjustment.[14] The instrument is set with a preloaded tension so that when held lightly against the skin, the specific force is delivered in an exact line of drive to correct the misaligned vertebrae. In this case, the correction was made at the level of C1, from left to right, with a right torque. A similar

evaluation was performed along the medial sacral border on the left side. A noticeable evening of the legs was noted after applying a light finger pressure medially at the 1st sacral level, also indicating subluxation. The integrator instrument was pre-set and a specific force (adjustment) was applied medially, from left to right, at the 1st sacral level.

Levels of disability were self-rated in work and personal activities by completing Vernon-Mior (neck) and Oswestry (low back) scales. Visual Analogue assessment was also utilized as a means of monitoring the subjective symptoms. Findings are outlined in Table 2 and Table 3.

When questioned about personal stresses, the woman listed both work stress (working long hours at cleaning houses) and personal stress (live-in boyfriend). Her boyfriend worked for his father and the auto accident involved the father's vehicle, or both were stressful situations.A Health Status Questionnaire from Network Spinal Analysis was completed. The survey rates physical and mental/emotional stress evaluation, life enjoyment and overall quality of life on a 1-5 scale, with 5 indicating the highest rating.

A reduction in both objective and subjective findings occurred after the first month of care and the visit frequency was reduced to once weekly. A subluxation pattern continued to be evident, including acute exacerbations of painful symptomatology and taut, tender muscle fibers in the cervical, thoracic, and lumbosacral regions.

While planning a small wedding and marrying two months later, the woman missed several appointments during this time and stated, "I have the flu." Approximately one month after returning from her honeymoon, she returned to my office with increased painful symptoms in her neck and shoulder blade as well as paraesthesia into her right hand. Over the next 3 months, she was seen sporadically with several cancellations and vague excuses for her missed appointments. On one instance, she cited a "bad fall in the bathtub" and displayed a significant increase in her symptoms, including many tender muscle fibers during palpation. She was unable to make eye contact with me when I inquired about the details of her injury. One month later, she re-appeared in my office for treatment after another bout with "the flu" and stated, "My neck, mid-back and rib cage hurt so bad that I had to roll out of bed." Once again, she avoided eye contact when relating her symptoms.

It was at this point, that I felt she was being battered. The "Red Flags" were all evident (see Table 1).

Table 2 - Vernon-Mior and Oswestry Scales
(numbers show percentage of inability to perform everyday personal and work activities)

Date	Vernon-Mior	Oswestry
9-13-00	48	34
9-16-00	46	44
9-23-00	32	28
10-23-00	8	6
11-25-00	6	2
12-20-00	2	0
2-16-01	4	4
4-12-01	18	14
5-11-01	14	12
6-11-01	14	4
7-12-01	10	8
8-09-01	14	6
9-13-01	6	0
10-25-01	14	10
11-30-01	8	4

The Moment of Truth and Ultimate Trust

For a health care provider to successfully help battered women, they must be aware of the distinct communication patterns of this population. To document this appropriately, the following section is written in a more narrative style.

The moment of truth had arrived. The battered woman took an opportunity to trust me with her feelings - her emotional state as well as her physical state. While she lay prone on the adjusting table, I gently shared I could provide resources to help with whatever she was going through in her life that was causing her so much stress and pain, that was interrupting her full recovery. I related how much emotional stress affects our bodies and how much tension and stress I felt in her body. At that time she began sobbing and shared some of the suffering she was experiencing from her husband's abusive behaviors. I validated her by honoring her emotions while palpating her spine, and let her cry. I emphasized how valuable of a person she was, that she was deserving of respect, honor, and dignity, and provided her with the name of a counselor who helps women who are in abusive relationships. I told her she could call 9-1-1 if she was ever in danger. I was careful not to say negative things about her husband.

She began to keep her regular appointments of once weekly and established more eye contact with me. The symptoms remained consistent on both subjective and objective assessments. Two months passed until she appeared with a black eye and bruised face, falling into my arms in tears. I had built up enough trust in our relationship that she felt safe enough to let me see her bruises. I had not judged either her or her husband for all the past abuses. She admitted that she needed help and I advised her to contact the local law enforcement officers who deal with domestic violence. I gave her the name of an Advocate who could help her. I also told her about classes available for

Table 3 – Visual Analogue Scale
(numbers indicate level of total physical discomfort on scale of 1-100 with 100 being maximum pain and discomfort)

Date	Scale Reading
6-16-00	60
9-23-00	25
10-5-00	25
10-23-00	42
11-25-00	14
12-20-00	15
2-16-01	10
4-12-01	48
5-11-01	44
6-11-01	35
7-12-01	29
8-9-01	26
9-13-01	24
11-30-01	24

education and support to empower her. She was finally ready to risk the changes and followed through with my advice.

It had taken nearly a year for her to "come clean." Chiropractic care allowed her nervous system to reduce subluxations and included safety, gentleness, respect, and education. The empowerment associated with a clear spine and healthy nervous system was reflected in her life; old destructive behaviors were cleared and new constructive behaviors were chosen, allowing her to admit the painful truths of her life and build up courage to change the situation. I also encouraged her to begin a self-care program at home with scheduled hot baths, yoga and stretching, breathing exercises, and provided positive affirmation tapes to play when she was feeling stressed. Remarkably, it was only a couple months following this monumental office visit that her symptoms began to stabilize and she elected to continue with her wellness care.

A year after beginning chiropractic care, a follow-up NSA Health Status Questionnaire was completed, rating current quality of life. Nearly all of the areas of mental/emotional and physical stress factors that had previously rated as 4 or 5 (maximum) were reduced to 1 and 2 (minimal). Also, the areas of life enjoyment increased from 1 and 2 up to 3, 4 and 5, and overall quality of life also significantly increased. She is still attending classes, she is still with her husband who attends regular counseling sessions with her, and she is not allowing herself to be abused any longer.

Discussion

This case describes a subluxated battered woman who successfully broke the cycle of abuse in her life after the application of chiropractic care. Chiropractic offers battered women the benefits of: specific adjustments for vertebral subluxations, education on the chiropractic lifestyle, and resource support for changing destructive lifestyles and relationships that are robbing them of life. It should be noted that "low force" chiropractic techniques were utilized in this case. Clinical findings indicate that because of many battered women's life experiences, they can be more sensitive to physical "force" and do not relax during high-force osseous-type adjustments. Battered women also need more nurturing, as many of their questions and concerns involve their tremendous need for trust and safety. A chiropractor that has good listening skills can establish a tone of confidence and security.

When chiropractors create an environment where a battered woman feels safe enough to get in touch with her pain and non conscious beliefs, she can begin to trust herself to make healing changes, from her nervous system to her life. A battered woman has learned to survive in a constant state of stress. Her body is engaged in some degree of a "fight-or-flight" response at all times in preparation for the next verbal, emotional, or physical attack. The cortical releasing factor (CRF) secreted by the hypothalamus, stimulates production of ACTH that causes adrenalin to be released by the adrenal glands. This has been shown to happen whether the attack is real or perceived. This cycle can lead to adrenal exhaustion, as well as depression. Over time this highly reactive state takes a toll on the organs of the body. At the annual meeting of the American Psychosomatic Society in Monterey, California on March 13, 2001, it was reported that an unhappy marriage can break a woman's heart, figuratively, and literally.[15] Current work in the fields of psychoneuroimmunology and brain chemistry show the effects of emotional stress in decreasing wellness. *In Molecules of Emotion*, Candace Pert. Ph.D., explains that "CRF is the peptide of negative expectations, since it may have been stimulated by negative experiences in childhood," and "When emotions are expressed – which is to say that the biochemicals that are the substrate of emotion are flowing freely – all systems are united and made whole. When emotions are repressed, denied, not allowed to be whatever they may be, our network pathways get blocked, stopping the flow of the vital feel-good, unifying chemicals that run both our biology and our behavior."[16]

There is no record of previous literature in chiropractic research documenting the relationship between intimate partner violence and subluxation patterns. This article offers to establish a foundation and promote discourse. Research from the *International J. of Alternative and Complementary Medicine* includes a study that discusses chronic pelvic pain in women who have a history of sexual and/or physical abuse. The author emphasizes the importance of helping these individuals "learn all the necessary steps on how to achieve empowerment and to regain power and control over one's body."[17]

Chiropractic literature does include discussions on the relationship of stresses causing dis-ease. R.W. Stephenson states in *The Chiropractic Textbook* that "Dis-ease was a failure of organisms to adapt optimally to internal and external stressors because of loss of contact with the inherent organizing principle, or innate intelligence, found in every living organism."[18] And recent studies show the relationship of chiropractic care to the reduction of the effects of emotional stress.[19] Dr. Donald Epstein, the developer of Network Spinal Analysis, discusses an "emotional motor system" that has the ability to project from the prefrontal cortex and caudal brainstem into the spinal cord. It establishes sensory and motor levels in the caudal brain stem and spinal cord, influences the sympathetic and parasympathetic systems, results in independent movements of the extremities (axial and proximal body movements), establishes specific emotional behaviors, and triggers mechanisms of rhythmical and other spinal reflexes. In his book *The Twelve Stages of Healing*, he provides exercises that integrate breath, touch, and movement in order to provide a mirror to the bodymind and emotional/physical connections.[20]

Conclusion

Women in abusive relationships have attained what has been described as "learned helplessness." They have learned to survive but have little hope for improvement in their quality of life. The benefits associated with chiropractic care, including improvements in physical and emotional state, can help these women engage in constructive choices that break the cycle of abuse and make positive changes in their lives.

Intimate Partner Violence is a significant social problem. The chronic nature of abuse adds expenses to an overburdened health care system, as well as the economic impact of lost productivity and creativity of battered women.

The effectiveness of chiropractic care in helping IPV victims to successfully respond to stress and make improvements in

their life situations has never been formally studied. Additional factors to be evaluated are the decreases in medical expenses due to reduced emergency room visits, and the economic impact on business as these women become healthier and more productive. Funding is necessary to proceed with future studies that can evaluate chiropractic's cost effectiveness, safety, and benefits, as applied to the topic of Intimate Partner Violence, and support for funding will be pursued.

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CASE STUDY

Resolution of Night Terrors & Headaches in an Adolescent Female Undergoing Chiropractic Care

Danita Thomas Heagy DC[1] & Candice Warren BS[2]

Abstract

Objective: To report on improvement in headaches and sleep disturbances in an adolescent female undergoing chiropractic care to correct vertebral subluxations

Clinical Features: A female adolescent with recurring headaches and parasomnia (night terrors) presented for chiropractic care. The headaches and sleep disturbances had a negative affect on her academics, sports, and social life. Upon examination, she had abnormal postural findings indicating cervical, thoracic, and lumbar subluxations.

Intervention and Outcome: The patient was evaluated for postural abnormalities and palpatory muscle hypertonicity, segmental edema, and kinesiopathology during each visit. Postural abnormalities and associated vertebral subluxations were corrected using CBP® global adjustments and Gonstead inter-segmental adjustments for a period of approximately one month. There was a reduction in headache symptoms and complete resolution of parasomnia and night terrors following the initiation of treatment.

Conclusion: Sleep disturbances in children are common and often develop without explanation. To date there are few interventions that help alleviate the negative affects of interrupted sleep on the child's daily activities. Vertebral subluxation should be considered when a child is suffering from neuromusculoskeletal symptoms and sleep disturbances of otherwise unknown origin. More research is warranted to explore the benefits of chiropractic care in cases of parasomnia and sleep disturbances.

Keywords: *Parasomnia, sleep disturbances, headache, adolescent, vertebral subluxation, chiropractic*

Introduction

Parasomnia in children, explicitly disorders of arousal such as sleepwalking and night terrors, have been described as limited interruptions in the non-REM segment of the sleep-wake cycle.[1] A multifaceted blend of genetic predisposing issues, an increase in the amount of slow wave sleep, and other factors govern non-REM partial arousal occurrences.[2] Prior to onset, autonomic precursors such as tachypnea, tachycardia, and hyperhydrosis often demonstrate the complex development of parasomnia, specifically night terrors.[1]

1. Private Practice of Chiropractic, St. Augustine, FL, USA
2. Student Intern, Life University College of Chiropractic, Marietta, GA, USA

The vertebral subluxation occurs when the pain and sensory fibers located in all segments of the spine fail to function normally, therefore sending abnormal sensory input to the central nervous system and resulting in dysponesis.[3] It has been suggested that pain can lead to autonomic imbalance with increased firing within the sympathetic nervous system in comparison with the parasympathetic nervous system.

Previous studies concerning manual adjustments of the spine theorized that sensory information sent from paraspinal muscle spasms induce both pain and a reflexive reaction of the spinal cord, enhancing sympathetic nerve activity.[4] More

research is needed to provide evidence that alterations in this reflexive reaction occurs with chiropractic adjustments and that those alterations lead to a change in autonomic balance.[4] Supportive information includes the theory that the delivery of a manual chiropractic adjustment amplifies the firing of mechanoreceptors and that these mechanoreceptors could be responsible for decreasing sympathetic neuronal activity.[5]

Headaches in children are common and are often reason for referral by primary physicians to some type of neurological specialist for evaluation.[6] In a study by Zarowski et al[7], 300 children with headache symptoms and 284 children without headache symptoms were given a questionnaire regarding sleep. This study found a significant difference between activities of daily living between the two groups. There was a correlation between headache and sleep talking, bruxism, leg movement, nightmares, and breathing pauses. There was no significance between the types of headaches experienced.

In a case control study by Bruni et al,[8] a questionnaire was given to 283 parents of children with both migraine and tension headache diagnoses. Children with migraine headaches with aura were more likely to suffer from sleepwalking and nocturnal symptoms that included night sweating and nightmares.[8]

In another study by Miller et al,[9] parents completed the Children's Sleep Habits Questionnaire and a questionnaire about the characteristics of headaches. Results from this study showed a higher rate of parents reporting sleep disturbances in children with migraine headaches when compared to the norm. This study was unable to determine whether migraine headaches and abnormal sleep behavior should be considered a co-existing clinical presentation or if they were in fact separate occurrences.[9] The purpose of this paper is to describe successful chiropractic care in the case of a pre-teen female with headaches and parasomnia.

Case Report

Clinical Features

A ten year-old female presented for chiropractic care. Her chief complaint was daily headaches that began when she was two and a half years old. She has a past history of recurrent headaches, somnambulism (sleep walking), and parasomnia.

She was diagnosed with hyperopia and given a prescription for corrective lenses in hopes of resolving the headaches. She wore the corrective lenses until she was nine years old at which time the optometrist felt they were no longer necessary. The patient's pediatrician investigated the cause of headaches by ordering blood work and an encephalograph (EEG) to rule out seizures. The encephalograph and blood results were normal.

It was determined that the cause of the headaches was simply that the child was reading too much. These headaches were constant and triggered by reading, activity, and school related stress. She was never diagnosed with migraine headaches; however her mother treated them as such by having her lay down in a dark quiet room and use ice. Occasionally the patient's mother would give her Tylenol and/or Motrin, which seemed to help.

The patient's somnambulism and parasomnia began when she was seven years of age. Her mother reported that every night the patient would wake up several times screaming and would sit up in bed or be found walking or running through the house. Initially her mother woke her completely from these incidences, however her doctor advised to simply guide her back to bed instead. These incidences were socially debilitating for the child since she could not sleep anywhere other than home overnight out of fear that the sleepwalking and night terrors would occur in someone else's household.

Relevant past medical history was taken and revealed that the patient was a triplet. She was born at 32 weeks gestation and weighed approximately 4.2 pounds. There is information in the literature that multipart births often present with in-utero constraint that may contribute to developmental abnormalities.[10] She was breastfed for 4 months with the incorporation of formula feedings from birth until the child was 12 months of age. Cow's milk and solid foods were introduced when she was one year old.

She did not have any difficulty reaching developmental milestones concerning motor skills during the first year of life. High impact and/or contact sport related activity included participation in soccer. The patient had no history of previous surgery.

Intervention & Outcomes

The patient was given a posture examination at each visit. The exam included having the patient stand with her eyes closed in a neutral position followed by turning her head from side to side and up and down with the eyes closed. This evaluation was done before and after each chiropractic adjustment.

Following the chiropractic adjustment, postural abnormalities were no longer visualized or there was noticeable overcorrection of the postural anomaly by the musculoskeletal system that subsided within one day. Postural abnormalities upon initial evaluation included right cervical and global right torso rotation. Two weeks later cranial translation and a high left shoulder were observed. There were no postural irregularities noted following the adjustments given each visit.

Surface electromyography (sEMG), infrared thermal scans, and heart rate variability analysis was performed using the Insight Millennium Subluxation Station before the initiation of care and upon re-evaluation. Both, sEMG and thermal scans, have been proven to be valid and reliable outcome assessment tools.[11-16]

Surface electromyography measures nerve action potentials and muscle activity through the use of electrode placement on the skin surface of the paraspinal muscles in the body.[11] Muscle activity of the current patient was then compared with normative databases found within the Insight software and assigned a value measured in standard deviations from the norm.[8] Mild muscle hyperactivity has been defined as +1 standard deviations from the normative data, while moderate and severe findings indicated activity +2 and +3 standard

deviations from the norm, respectively.[11-16] Figure 1 shows the results of the pre-adjustment sEMG.

The initial sEMG scan demonstrated significant muscle hypertonicity in the upper cervical and upper thoracic regions. Moderate to severe values in muscle activity were recorded at C7, T1, and T2 spinal segments. Asymmetrical muscle activity was found in the upper cervical and upper thoracic paraspinal muscles. The scan illustrated moderate asymmetry in the upper cervical region, with muscle activity beyond the norm on the right paraspinal muscles. Mild deviation in muscle activity of the left upper cervical paraspinal muscles was also noted.

The Insight Millennium rolling thermography scan measures bilateral paraspinal skin temperature using a dual-probe infrared instrument.[16] Results given are based on findings of mild, moderate, and severe asymmetry between the left and right paraspinal skin temperature readings.[16] Figure 2 shows results from the pre-adjustment rolling thermal scan.

The initial rolling thermal scan, Figure 2, demonstrated asymmetrical paraspinal skin temperatures of the patient, indicating increased sympathetic nervous system activity in both the cervical and thoracic spine. An increase in paraspinal skin temperature was found at the following levels: C1, C6, T1, and T5-T8. The most severe finding is at C1 and illustrates asymmetry with hyperemia of the paraspinal skin temperature on the right side of the patient. All other temperature asymmetries were mild.

The Heart Rate Variability (HRV) analysis included in the Insight Millennium Subluxation Station, called the Pulse Wave Profiler, was performed before chiropractic care was initiated and following the resolution of the symptoms. The patient placed her index, middle, and ring finger into the pulse wave profiler for the analysis. The instrument creates a plethysmograph and monitors sweat gland activity. Plethysmographs give information concerning circulatory capacity and can detect ventricular tachycardia.[17]

Heart rate variability can be useful in clinical situations to measure the function and balance between the parasympathetic and sympathetic nervous system.[18] Heart rate variability testing calculates the gap between consecutive peaks of the QRS complex of the ECG wave.[18] Indicators of an overactive sympathetic nervous system include an increase in cardiac output, contractility, and heart rate.[19]

Figure 3 shows heart rate variability measurements prior to initiating treatment, the patient's Autonomic Activity Index was given a score of 70.55, indicating an autonomic activity on the lower end of normal. The patient's Autonomic Balance Index was given a score of 84.11(S), indicating a shift towards sympathetic nervous system being dominant.

The patient was adjusted using Clinical Biomechanics of Posture (CBP®) and Gonstead Technique during the visits. CBP focuses on correcting postural distortions while Gonstead technique adjusts a site-specific segment in the spine.[20-21] However, both include the application of a high velocity low amplitude osseous thrust to bring the joint slightly beyond passive range of motion to reduce vertebral subluxation.[20-21]

The CBP® Technique was performed with the application of mirror image adjusting® in order to correct postural distortions during the first 6 visits. The mirror image adjustments involved referencing postural findings and positioning the patient's body in the opposite orientation during the adjustment.[20]

During the first three adjustments, the patient's head and torso were rotated to the right, therefore the adjustment was delivered with the patient's head and torso rotated to the left. For both techniques mentioned, the patient was supine for cervical adjustments. When adjustments were delivered, the segmental contact point was the lamina-pedicle junction, using the lateral aspect of the doctor's index finger. The line of drive was posterior to anterior, inferior to superior, and lateral to medial.

In the thoracic spine, the patient was in a prone position, the segmental contact point was the transverse process of the involved segment and the stabilization hand was over the opposite transverse process. The contact point was the fleshy pisiform of the contact hand and the fleshy pisiform of the stabilization hand. The line of drive was posterior to anterior, inferior to superior, and lateral to medial.

On the 8th visit, a cervical stair step treatment was performed at C6 and C7. This maneuver involves the palpation of the cervical spine in a stair step manner, looking for decreased motion of a segment. Once the area of restriction is found, small motions resembling the figure 8 are performed in order to remobilize that segment.

Objective Results

Upon re-evaluation sEMG, rolling thermal scan, and heart rate variability were performed for outcome assessment purposes. Figure 4 demonstrates re-evaluation sEMG results. The sEMG results revealed normal muscle activity in the cervical and thoracic region. Significant muscle hyper tonicity was noted in the lumbar spine, with the most significant muscle activity occurring at the L4-L5 levels. Deviations from the norm were found in both the left and right regions of the lumbar spine. Observations included mild, moderate, and severe deviations toward the lumbar paraspinal muscles on the right as well as mild deviations toward the lumbar paraspinal musculature on the left.

Figure 5 shows results upon re-evaluation of the rolling thermal scan. Post treatment rolling thermal scan demonstrated paraspinal temperatures within normal limits in all regions of the spine, indicating that sympathetic nervous system activity in all levels of the spine were comparatively normal. Figure 6 shows post-treatment heart rate variability measurements taken at the patient's re-evaluation. After approximately two months of regular chiropractic adjustments, the patient's Autonomic Activity Index was 102.32 and her Autonomic Balance Index was 99.45(S). These scores indicated that there was an increase in autonomic activity as well as a decrease in the dominance of the sympathetic nervous system. This indicates balance was established between the two systems.

Subjective Results

The patient reported that headaches experienced following the initiation of chiropractic care were no longer severe and occurred very infrequently. In addition, the patient reported complete resolution of sleepwalking and night terrors.

During the first re-assessment a subjective intake form was given to evaluate the patient's progress. The patient reported that her primary objective when she began care was to help with headaches. She reported her level of progress a 9 on a scale of 0 to 10, with 0 representing no change and 10 indicating that the condition was resolved. She noted the ability to sleep better. She also reported drinking more water, an improvement in the ability to cope with/handle stress, increased perception of her own health, an increased sense of well-being, and satisfaction with her chiropractic care. At the time of re-assessment the patient reported having no major stress affecting her health.

Discussion

Sleep disturbances are often missed or go unreported because it is easier for the child to report other symptoms such as headache, daytime drowsiness, and fatigue.[22] In a study done by Isik et al, snoring, sleepiness, and parasomnia were more frequently found in children suffering from migraine headaches than those who had no headaches or those who had other types of headaches.[9] This supports the importance of screening pediatric patients carefully about their sleeping habits. Incorporating better documentation concerning sleep quality and sleep patterns of adolescent patients can provide more information about the relationship between headaches and sleep behavior. By asking questions related to sleep, chiropractors can better document the relationship sleep behavior and chiropractic adjustments.

In this case study, a reduction in headaches and sleep disturbances following chiropractic adjustments were found in relation to a decrease in the dysautonomia in the cervical and thoracic regions of the thermal scans, decreased hypertonicity on the sEMG scans, and an overall balancing of autonomic activity measured by heart rate variability. Temperature asymmetry has been documented in many health problems and suggests dysfunction of the sympathetic nervous system that controls the majority of cutaneous blood flow.[23]

The return to symmetrical paraspinal skin temperature suggests that a balance within the autonomic nervous system was achieved for the patient. The autonomic nervous system is composed of the parasympathetic and sympathetic nervous systems that influence our ability to adapt and react to our external environment.[24] Electromyography studies have indicated that local muscle aggravation results in abnormal sensory relay to the spinal cord and causes subsequent reflexive muscle contraction.[19]

Based on this information, decreases in muscle hypertonicity of paraspinal muscles following chiropractic adjustments may have been related to the ability of paraspinal muscles to relay proper sensory input to the central nervous system. This theory is supported by a study citing the scientific foundation related to chiropractic which mentions that nerve roots entering and exiting the spinal cord can be affected by deliberate tensile stress.[25] However, more research is needed to determine the effects the chiropractic adjustment has on muscle activity and sensory integration.

The improvement in the patient's heart rate variability scores also suggests that there was an improvement in autonomic function. The shift away from sympathetic dominance suggests balance between the two systems, therefore allowing one the ability to better adapt to the environment.

A study performed by Zemaityte and Varoneckas illustrated a normal decrease in autonomic activity during the non-REM stages of the sleep-wake cycle.[26] Other researchers have documented a close relationship between the sleep-wake cycle and the autonomic nervous system.[27-28] To date, there are several case studies that report improved sleep following chiropractic care.[29-33] More research needs to be done to determine the primary physiological properties that occur following a chiropractic adjustment and how those changes are related to sleep as well as its relationship to HRV.

Conclusion

Resolution of headaches and sleep disturbances presented in this case study suggest that chiropractic adjustments may be beneficial in adolescents who suffer from similar symptoms. Reduction of vertebral subluxations, in this case were effective in the reduction of headaches, sleep disturbances, and musculoskeletal abnormalities. More research is warranted to explore the effect of vertebral subluxation on the somatic and visceral systems of adolescents.

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Figure 1- Pre-adjustment sEMG showed hypertonicity and asymmetry of the cervical and thoracic regions.

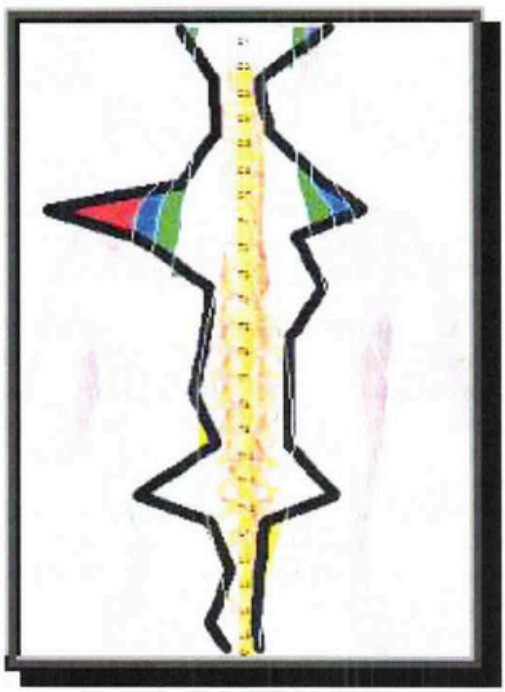


Figure 2 - Pre-adjustment rolling thermal showed asymmetrical paraspinal skin temperatures in the cervical and thoracic spine.

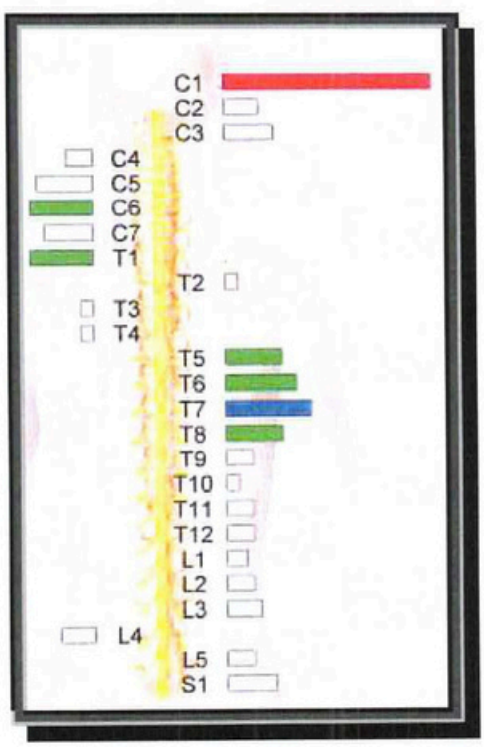


Figure 4- Post-adjustment sEMG showed resolution of previous cervical and thoracic hypertonicity and asymmetry. Hypertonicity and asymmetry was detected in the lumbar spine.

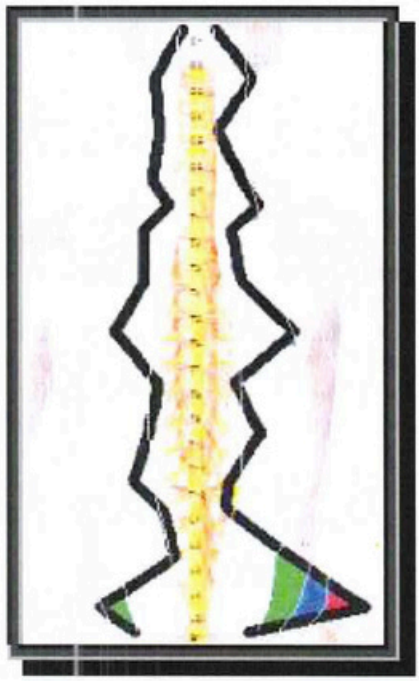
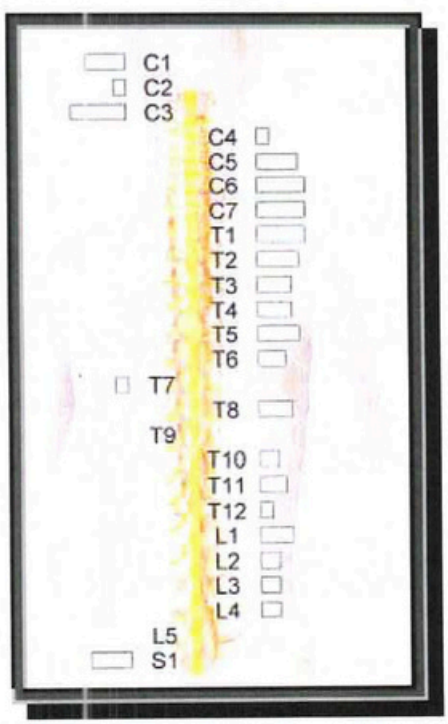


Figure 5 - Post-adjustment rolling thermal scan showed paraspinal skin temperatures within normal limits in all regions of the spine.



CASE STUDY

Resolution of Post-traumatic Epilepsy, Headaches & Dizziness Following Upper Cervical Chiropractic Care in a 19-Year-Old Male: Case Study & Review of the Literature

Scott A. Null, D.C.[1] & Logan A. Null, D.C.[1]

ABSTRACT

Objective: To report on the positive health outcomes of a young adult with posttraumatic epilepsy undergoing chiropractic care and review the related literature.

Clinical Features: A 19-year-old male diagnosed with posttraumatic epilepsy following a traumatic brain injury six months prior presents to a chiropractor's office with signs of vertebral subluxation as well as episodes of headaches and dizziness.

Interventions and Outcomes: The vertebral subluxation was addressed using Grostic analysis and adjustments to reduce an Atlas subluxation. Post radiographs taken after the first adjustment revealed an average 53% reduction of the subluxation. The frequency of seizures began declining with the initiation of adjustments and completely resolved. His headaches and dizziness also improved. He remained seizures free in a 10 year follow-up.

Conclusion: Research on chiropractic care for posttraumatic epilepsy is not present in the literature; however, some studies on chiropractic and epilepsy have patients with head injuries that improved under care. Some literature reviews demonstrate the benefit of upper cervical chiropractic adjustments in managing patients with seizure type disorders. While this case demonstrated an optimal outcome with chiropractic care, more study is needed in this area.

Key Words: *Chiropractic, posttraumatic epilepsy, traumatic brain injury, Grostic, upper cervical, adjustment, subluxation*

Introduction

Posttraumatic epilepsy (PTE) is characterized by recurrent seizures occurring more than one week following an injury to the brain. These injuries could come from a traumatic brain injury (TBI) or a brain operation.[1,2] Definitions of TBI tend to vary widely among disciplines and is often synonymous with head injury, however, a consistent theme is an alteration or dysfunction of normal brain function.[3,4] PTE are distinguished from seizures occurring within 24 hours of injury (immediate seizures) and less than one week after injury (early seizures).[1,2]

The risk of PTE following a TBI has been reported as high as 86% but varies based on the severity of the injury.[2] Somesources report that the risk for immediate and early seizures after a TBI is 2%.[2] While the risk for seizures seems low immediately following an injury, the risk increases with time as one study found it was 13.8% two-years post TBI in the United States.[2] The risk drops after approximately five years and 80% of cases present within the first two years.[1,2] The incidence of PTE in the U.S. for patients hospitalized for mild, moderate, and severe TBI over a three-year period was reported as 4.4, 7.6, and 13.6 per 100 persons respectively.[5]

1. Private Practice of Chiropractic, Independence, KS

The incidence of PTE also occurs highest among young adults, as they are more likely to experience a traumatic injury.[1] In addition to young adults, children and the elderly are at an increased risk for TBI.[2] Males are 2.9 times more likely to experience a traumatic brain injury.[2] Roughly half of all PTE patients experience three or fewer seizures and then go into spontaneous remission.[1] Posttraumatic epilepsy is less than 10% of all epilepsy cases making it difficult to calculate the cost as an addition to the cost of TBI, which has been estimated to cost $37 billion US in the European Union.[2]

The literature shows a few case reports on the chiropractic management of posttraumatic epilepsy. There are a few literature reviews relating posttraumatic and other types of epilepsy and seizure and chiropractic care in addition to a variety of cases that follow chiropractic management of epileptic patients.

Case Report

A 19-year-old male patient, with multiple seizures occurring per day, presented six months after a head trauma. He was struck in the posterior of his crown when a fully loaded nail gun, weighing about 12 pounds, slid off a roof. The patient was rushed to the hospital bleeding, confused, and disoriented. CT scans and radiographs were negative for fracture or internal bleeding. Over the next six months, he received multiple magnetic resonance images (MRI), electroencephalograms (EEG), and neurologic exams all of which were negative. He was diagnosis with a mild traumatic brain injury about two months after the accident. He also developed progressive dizziness, headaches, and at times stuttering and mental fogginess. He was prescribed Meclizine, Ativan, and Benadryl. Around four months after the TBI he had his first tonic-clonic type seizure, which lasted 2.5 hours. The frequency of the seizures increased from 1-3 per day up to 7 at its worst. On average, they last about 20 to 25 minutes.

Physical examination revealed bilateral cervical extensor and trap muscle tightness. The Grostic upper cervical chiropractic technique protocols were used to manage this patient.[6] A neurocalometer, dual-probe thermometry, was used to assess skin temperature differences in the cervical region and has been shown to have a high degree of inter- and intraexaminer reliability in conducting the scans of the neck and interpreting the results.[6] This patient demonstrated a break, deviation laterally at an angle of approximately 45 degrees, to the left at the level of C1. A supine leg check was performed to assess spinal muscle tone. A misalignment of the C1 vertebrae can produce changes in the spinocerebellar tracts due to the attachments of the dentate ligaments.[7] The patient had a left short leg of ¼" while lying supine.

Radiographs, the main area of assessment in Grostic technique, are obtained when a patient presents with similar findings as described above. X-rays are taken on a precision aligned, tube to bucky X-ray machine. American X-Ray Corporation certifies precision tube to bucky alignment by testing points a certain distance from the central ray (Figure 1). Any small variation in alignment would produce a larger discrepancy due to divergent rays. A lateral cervical is taken to determine the appropriate angle of the central ray for a nasium view (Figure 2). The nasium is used to determine the laterality of the atlas misalignment relative to the center of the skull (atlas laterality), the angle of the lower spine relative to the atlas (lower angle), the plane of the atlas (plane line), the rotation of the axis vertebrae (C2 Spinous), and the occipital condyle curvature relative to the axis joint's surface curvature (C/A) (Figure 3). A vertex view is used to determine to the rotation of atlas relative to the skull (Figure 4). X-ray analysis demonstrates good to very good reliability and reduction of these measurements by at least 50% have better outcomes on average.[6] These measurements are used to calculate a precise line of correction (LOC) and patient placement on the table and head piece. The skull and atlas act as levers to address all components of the misalignment.

The patients first set of radiographs demonstrated a left acute angle of the skull relative to the atlas of 1.5 degrees, an angle of 6.25 degrees to the right of the atlas relative to the lower cervical spine, and an anterior rotation of 5.25 degrees on the left (Figure 3 & Figure 4). These measurements, combined with the C/A, plane line, and C2 spinous, yielded a type 1 opposite lower angle listing. The patient is placed on a low, more level headpiece with a LOC 3 inches superior and 5.25 inches anterior to the left atlas transverse process. This placement utilizes the atlas as a second-class lever and the skull as a first-class lever to correct the large lower angle as well as atlas laterality. The adjustment is given using a side lying posture on a Grostic table with a pisiform reinforced contact and a triceps pull.

The patient was assessed 133 times over a two-year period. He received 44 adjustments during this time. After initiating care, his seizure frequency and duration began to reduce. The patient only experienced four seizures in the first month of care compared to an average of 2-3 per day before. His post adjustment x-rays revealed reductions in atlas laterality (83%), lower angle (48%), C2 spinous (83%), and atlas rotation (43%) (Figure 5, Figure 6, Table 1). The plane line was 0 in both pre and post films. After 11 months, he had no further episodes (Table 2). He continued care consistently for another 13 months for occasional headache and dizziness. After the two-year period, the patient was seen infrequently in the office for unrelated conditions and reported no seizures 10 years post treatment.

Discussion

Literature on chiropractic care for epilepsy is limited but growing. Several case reports and literature reviews demonstrate improvement in patients with epilepsy under chiropractic care, specifically of the upper cervical type. Pistolese's review of chiropractic care in children with epilepsy revealed 15 cases that improved with upper cervical chiropractic care, 14 of which were uncontrolled with medication.[8] Approximately 30 to 40% of seizures are uncontrolled by medication.[9] Another literature review that covered the broader topic of neurodevelopmental disorders and chiropractic demonstrated a benefit of chiropractic care in several epilepsy cases.[10] A trend among the case reports was upper cervical chiropractic care being beneficial for patients with epilepsy. Of the 11 cases cited in this report, seven of them used a specific upper cervical technique.[11-17] The other four cases, multiple regions of the spine were adjusted, but they all had subluxations adjusted in the cervical region.[18-21]

Less is available for chiropractic care and posttraumatic epilepsy. Nothing was found in the literature directly citing PTE and chiropractic, however, four cases were found that had head trauma prior to the onset of seizures.[11-13,18] Directly comparable to this case were two cases with patients of a similar age that had accidents. In one, a patient landed on their head after falling 10 feet while pole vaulting.[12] The other involved a patient whose onset of seizures coincided with a fall from a bed and striking the head on a desk.[13] In both cases, the patients benefited from upper cervical adjustments and experienced a resolution of their seizures.[12,13]

The current treatment model for epilepsy is elimination of the cause or avoidance of dangerous situations if possible. If this is not an option, pharmaceuticals are the main choice of managing seizures. Which drug will control the seizure varies from patient to patient and may require more than one.[9] The general approach is to try one drug at a time, if this fails, patients may receive a combination of drugs to bring the seizures under control.[9] If they are still uncontrolled after multiple drugs have been tried, surgery may be considered but is not always an option.[9]

Reported rates of complementary and alternative medicine (CAM) in epilepsy patients range from 24 to 44%.[22] One study found that prayer or spirituality was the most popular at 46% of those who used CAM for epilepsy.[23] The same study also found that vitamins, chiropractic care, and stress management were the next choices coming in at 25%, 24%, and 16% respectively.[23] These options are not extensively supported by the literature but some evidence suggests they may be effective. Multiple randomized controlled trials of yoga, meditation, relation training, and biofeedback showed reductions in seizures from 29-86%.[22] These therapies fall under a title of mind-body therapies and work to develop mindful ability over the body's function.[22] Nutritional and herbal supplements are another popular form CAM. A few randomized controlled trails of omega-3 fatty acids and ketogenic diets showed improvement in epileptic patients, but one omega-3 trial showed a 6% increase.[22] Acupuncture, Reiki, and Homeopathy are also utilized by some patients, however, only acupuncture has a randomized controlled trail but its results were nonsignificant.[22] Much like chiropractic's evidence for effectiveness with epilepsy, Acupuncture, Reiki, and Homeopathy have case reports and anecdotal evidence.

According to the dentate ligament, cord distortion hypothesis, a misalignment of the atlas causes altered signals in the spinocerebellar tract.[7] The blow to the head from the nail gun falling from the roof could have cause sprained ligaments in the upper neck creating the atlas subluxation. The dentate ligaments attach firmly to the atlas and the spinal cord and distort the cord when its subluxated.[7] Distorted signals to the cerebellum could result in the altered output resulting in the seizures experienced by the patient.

This study is limited by the nature of a case report. It is not appropriate to apply this treatment approach to all PTE patients. The outcome measures did not include any OATs that would have globally assessed the patient's quality of life or the impact of the seizures on the patient's life. While he reported improvement in subsequent visits, there is no objective measurement of this aside from a reported reduction and eventual elimination in the number of seizures.

Conclusion

A 19-year-old male patient with posttraumatic epilepsy experienced resolution of seizures after 11 months of upper cervical chiropractic adjustments. Post x-rays demonstrated an average reduction of 53%. More research is needed into chiropractic care and epilepsy, but specifically upper cervical chiropractic and posttraumatic epilepsy as the relationship between an atlas misalignment and PTE is unknown. Future clinical trials are needed to investigate the role of upper cervical chiropractic care in the treatment of epilepsy.

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Appendix

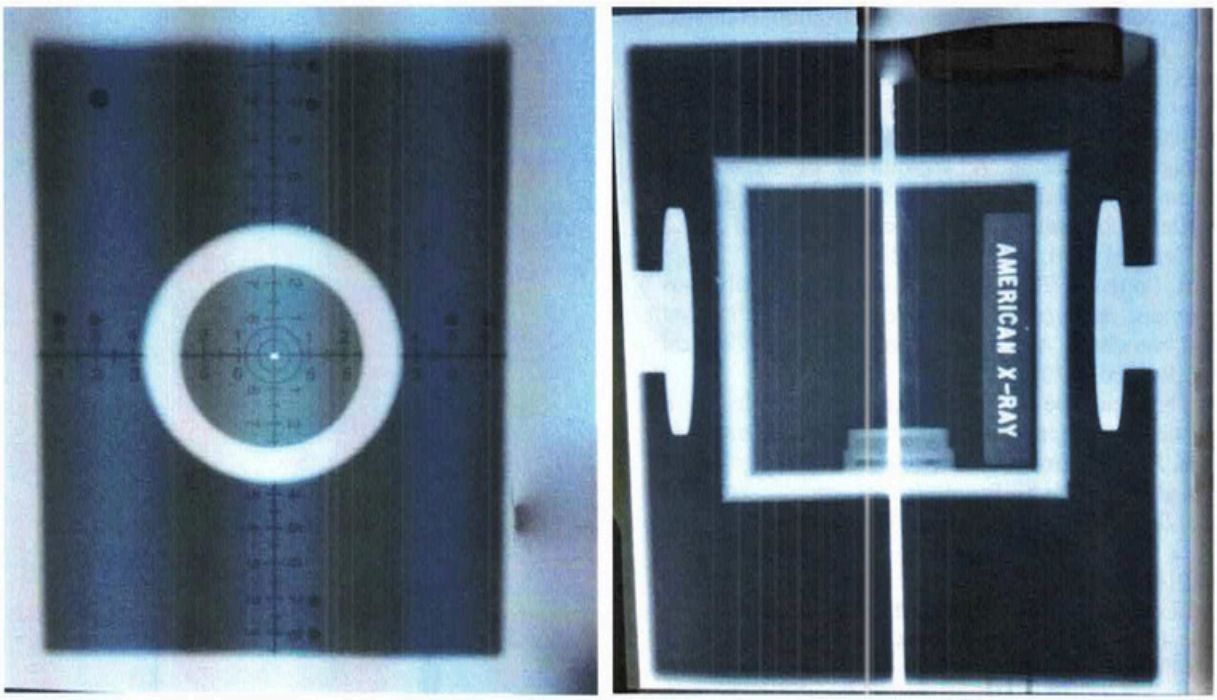

Figure 1: American X-Ray Corporation certifies precision tube to bucky alignment by testing points a certain distance from the central ray. Any small variation in alignment would produce a larger discrepancy due to divergent rays.

Figure 2: Patient's pre lateral cervical x-ray. It is taken to determine the appropriate angle of the central ray for a nasium view.

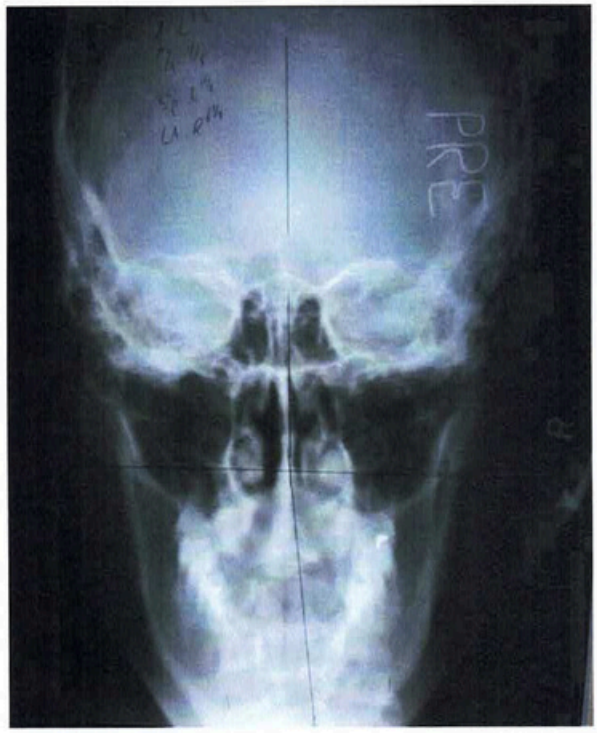

Figure 3: The patient's pre nasium is used to determine the laterality of the atlas misalignment relative to the center of the skull (atlas laterality), the angle of the lower spine relative to the atlas (lower angle), the plane of the atlas (plane line), the rotation of the axis vertebrae (C2 Spinous), and the occipital condyle curvature relative to the axis joint's surface curvature (C/A)

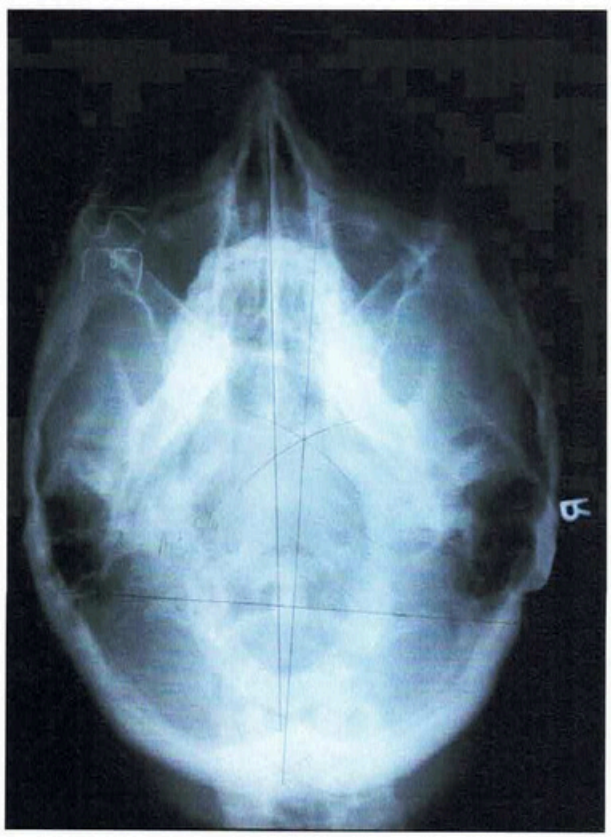

Figure 4: The patient's pre vertex is used to determine to the rotation of atlas relative to the skull.

Figure 5: The patient's post nasium revealed reductions in atlas laterality (83%), lower angle (48%), and C2 spinous (83%).

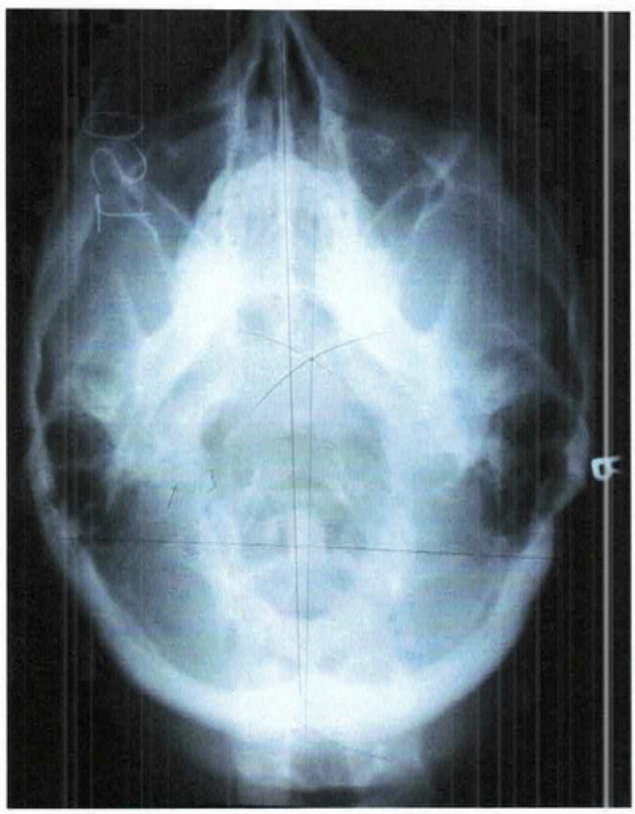

Figure 6: The patient's post vertex revealed reduction in atlas rotation (43%).

Case Study

Resolution of Anxiety & Hypertension in a 60-Year-Old Male Following Subluxation Based Chiropractic Care: A Case Study & Review of the Literature

Sarah Prater-Manor, DC [1]
Erin Clifton, DC[1]
Allison York, DC[2]

1. *Private Practice of Chiropractic, Stockbridge, MI*
2. *Private Practice of Chiropractic, Las Vegas, NV*

Abstract

Objective: To present the chiropractic care of a 60-year-old male presenting with anxiety and hypertension receiving specific chiropractic adjustments.

Clinical Features: The patient is a 60-year-old male with medically diagnosed anxiety and hypertension. A thorough history and exam were performed. Subluxations were determined through static and motion palpation, bilateral weight scales and posture analysis.

Interventions and Outcomes: The management plan of the patient utilized the Thompson Technique protocol to deliver specific adjustments to the areas of vertebral subluxations. After six months of care the patient is no longer taking prescription medications to control his anxiety and hypertension and his blood pressure remains stable.

Conclusion: This study evaluates resolution of anxiety and hypertension in a 60-year-old male receiving chiropractic care. More research with larger sample sizes is recommended to further explore the use of chiropractic care for resolution of anxiety disorders and hypertension.

Key Words: *Anxiety, hypertension, blood pressure, chiropractic, subluxation, adjustment, spinal manipulation, Thompson Technique*

Introduction

Anxiety disorders affect approximately 40 million Americans 18 years or older, or 18% of population.[1] Anxiety leaves them with the feeling of fear and worry. General fears, such as public speaking, subside with time; however, anxiety disorders can last up to six months and will lead to worsening fears if left untreated. The disorder can begin at any point during life with genetics have been linked to playing a role.[2] Symptoms that can arise from anxiety disorders include, but are not limited to, muscle tension, fatigue, restlessness, irritability and difficulty concentrating.

The treatment consists of pharmacological drugs, such as Selective Serotonin Reuptake Inhibitors (SSRIs), Serotonin norepinephrine reuptake inhibitors, selective norepinephrine reuptake inhibitors and tricyclic tetracyclic inhibitors.[2] These drugs could cause side effects and worsen symptoms.[1] Research shows that individuals with anxiety disorders have a higher prevalence of suffering from hypertension or other cardiovascular conditions.[3] Hypertension (HTN) or high blood pressure can be defined as increased force of blood through arterial walls having a systolic pressure of higher than 140 mmHg (millimeters of mercury) or diastolic pressure of higher than 90 mmHg.[4] The diagnosis is concluded from two or more readings taken at two or more office visits following an initial screening. Today, one in three Americans, approximately 67 million people, have high blood pressure.[5] It is normal for blood pressure to rise and fall; however, if blood pressure continues to stay at a high level for a long period this could lead to worsening conditions.

The medical management for hypertension consists of treatments with various medications such as, diuretics, angiotensin II receptor blockers, alpha-blockers and beta-blockers.[4] Research has shown that at least 66% of patients

will need two or more antihypertensive agents to stabilize their blood pressure, as they will not achieve their blood pressure goals with only one agent.[4,6]

A correlation between hypertension with stress and anxiety has been documented.[7] Stress is arbitrated by the autonomic nervous system. Therefore it is reasoned that anxiety can be affected by chiropractic adjustments. Research has shown that vertebral subluxations, spinal manipulative therapy and cranial adjusting have an effect on autonomic functions, such as heart rate, blood pressure, pupillary diameter and skin temperature.[8]

In this case, the patient was analyzed utilizing the Thompson Technique protocol to detect and correct areas of subluxation. Care was provided based on this definition of subluxation and its role on the body.

Case Report

Patient History

The patient is a 60-year-old retired male who presented into a chiropractic office for anxiety, high blood pressure and neck pain. The patient stated that his neck pain was an achy, dull pain that is a 6/10 on the pain scale, where 0 is no pain and 10 is unbearable pain. For this paper, his anxiety and hypertension will be the primary focus.

The patient stated when standing up from a seated position, his equilibrium was not stable. The patient described when his equilibrium was unstable; he felt disoriented and had to re-evaluate his location at the time of the experience. The frequency and duration of the episodes had not increased over time; however, the intensity had been getting worse since the first occurrence. A medical doctor evaluated the patient 15 years prior to entering the chiropractic office and stated the sensations were due to his blood pressure. The medical doctor determined the patient's blood pressure to be 170/110 mm Hg. The patient was prescribed 20mg of Lisinopril and 10mg of Hydrochlorothiazide per day to help equalize blood pressure.

The patient was diagnosed with anxiety by his medical doctor and was prescribed medications which included 150mg of Wellbutrin and 10mg of Lexapro per day. At the time that the patient had presented to the chiropractic office he had been on anxiety reducing medications for over 20 years. Since being on the medications patient had been getting more sleep than he had previously. The patient had previously self-medicated with alcohol and drugs, but had ceased five years ago.

The patient's history includes a motorcycle accident 10 years ago, which he described as traumatic. The patient spun around while on motorcycle and hit his head on the ground. The patient stated he received previous chiropractic care following the accident for a few months. No hospitalizations or surgeries were noted.

The patient was delivered via cesarean section and vaccinated as a child. The patient stated he consumes fried foods, soda, dairy and caffeine on a regular basis. The patient also noted he is overstressed, but rates his personal fulfillment as a 7/10 with 0 being no fulfillment and 10 being the most fulfillment one could feel. The patient exercises two times per day, which includes walking for one hour each time.

Chiropractic Examination

Once the chiropractor reviewed the patient's history, a physical examination was performed. The patient had postural findings of a high left shoulder and high left hip of greater than .5cm and 1cm respectively. An anterior head carriage of greater than 3cm, forward protruded shoulders and knees by 1.8cm and 3cm respectively and posterior positioned hips by 4.5cm was also noted. These findings were all determined from observation of that patient standing in a neutral position, and by comparing side-to-side analysis.

Upon motion palpation of the patient, several subluxations were noted. These subluxations were located at: C1 on the right, C4 and C5 on the left, C6 on the right and T2, T4, T12, L3 and sacrum on the left. These findings agreed with the patient's cervical spine having pain on left lateral flexion at 14 degrees, lumbar spine having pain on extension at 15 degrees and bilateral weight scale that was 37lbs heavier on the left. Motion palpation has shown to have high quality evidence in regards to its use with some limitations.[9]

A prone leg check was utilized to assess the patient's leg length. The patient presented with a right short leg and a subluxation going posterior and inferior in relation to the right sacroiliac joint. According to a study done by Schwartzbaurer and Hart, there have been numerous studies indicating good reliability for prone and prone-knees-flexed leg length analysis.[10]

The patient's blood pressure was taken and monitored by his medical doctor. Prior to entering the chiropractic office, his blood pressure was 170/110 mmHg. In the chiropractic office, cervical, thoracic, lumbar, pelvis and sacral subluxations were diagnosed.

Interventions

The patient's care plan was designed with his visits occurring twice per week. Every visit consisted of chiropractic analysis and chiropractic adjustments utilizing Thompson Technique protocol with correction of the vertebral subluxations detected.

In the Thompson Technique protocol, leg checks are used with the patient lying prone to determine primary subluxations within the spine and pelvis.[11] These checks are first done with the legs in extension. If the patient presents with a short leg in this position, then they are instructed to turn their head to one side and then the other. If the legs become balanced while the head is rotated in either direction, then a cervical syndrome (CS) on the side of head rotation is indicated.[11]

In the Thompson Technique protocol, once the CS has been cleared, the leg length should be equal.[12] The legs must be assessed with the legs in extension and in flexion. This position test allows the chiropractor to determined informatio. regarding the level and nature of vertebral subluxation of the spine, pelvic torsion and the kind of correction that should be performed.[12]

Thompson Technique utilizes a drop table to aid in the adjustments of primary subluxations. A leg check was performed with the patient prone and a right short leg was determined. Upon both right and left head rotation his legs balanced. Palpation of the left side of the neck revealed a tender nodule at C2 and palpation of the right side of the neck revealed a tender nodule at C6. A cervical drop was used to aid in the adjustment.

After the CS was cleared, his legs balanced in extension. Leg length was assessed with the knees flexed and his leg lengthened which correlated with his decreased motion within the right sacroiliac joint. With the patient lying prone, the drop table was used with contacting the right PSIS while stabilizing the opposite ischial tubercle three times. With the patient lying in the same position, the chiropractor proceeded to use the drop table to adjust L5 by contacting the right mammillary process of L5 with a posterior to anterior line of correction.

The chiropractor used the drop table to adjust L3 by contacting the left mammillary process of L3 with a posterior to anterior line of correction. The chiropractor used the drop table to adjust T10 by contacting the posterior aspect of the T10 spinous process with a posterior to anterior line of correction. Finally, the chiropractor used the drop table to adjust T2 by contacting the left transverse process of T2 with a posterior to anterior line of correction. After the adjustment was made, the legs balanced in both flexion and extension. For the remainder of the patient's care, Thompson protocol was used to detect and correct subluxations.

The patient was assessed following the Thompson Technique protocol for the next six months until a re-evaluation was given, which included assessment of the patient's posture, range of motion, bilateral weight scale, palpation and re-assessment questionnaire.

Outcomes

After six months under chiropractic care, a re-evaluation was performed. The findings of the initial exam versus the re-evaluation exam are noted in Table 1, Table 2 and Table 3 (Appendix). Prior to chiropractic care his blood pressure was 170/110 mmHg. Following these six months of care, the patient's blood pressure had stabilized to 128/80 mmHg. He also started seeking out other methods for dealing with his anxiety, such as stress management skills and counseling. During the six-month re-evaluation, the patient stated his medical doctor took him off all prescription medications for both anxiety and hypertension. The patient also noted his energy level and ability to function had improved. His neck pain had reduced in frequency and severity from a 6/10 to a 3/10 on the pain scale, where 0 is no pain and 10 is unbearable pain. Pain on left cervical lateral flexion and extension of the lumbar spine resolved.

Discussion

Etiology of Anxiety Disorders & Hypertension

The "Brain Reward Cascade" model explains an individual's ability to express a state of well-being.[13] These feelings are mediated in the limbic system and are conveyed through the reward cascade of neurotransmitters. If these neurotransmitters are not working properly, then the feelings of anxiety, anger and depression can supersede a positive thought process. This results in negative emotions leading to Reward Deficiency Syndrome (RDS). Individuals are predisposed to RDS through anomalies of Dopamine D_2 Receptor genes, Dopamine Transporter genes and Beta Hydroxylase genes, resulting in the inability to cope with stress and could cause cravings.

The Reward Deficiency Syndrome shows how chiropractic care could impact mental health and addiction.[14,15] Holder and Blum revealed that only vertebrates have an opiate receptor "brain reward cascade" mechanism. However, invertebrates are the ones who have opioid peptides, but only vertebrates can express a well-being state. The common factor between the two is the spine and spinal cord. They stated that having misaligned spinal vertebrae could affect the mesolimbic dopaminergic pathway, which is responsible for reward and pleasure. These misalignments can cause vulnerability in the spine leading to mood disorders and addictive behaviors. Therefore, addressing these spinal misalignments through chiropractic adjustments can address both mood disorders and addictive behaviors.[14,15]

The central nervous system has been linked as an etiology for hypertension.[4] The rostral ventrolateral medulla known as the cardiovascular control center of the brain has been known to play a role in sympathetic outflow to the heart, vessels and kidneys. Recent research has shown the relationship between pulsatile arterial compression of the rostral ventrolateral medulla and the presence of high blood pressure.[4] Aoki et al conducted a study on 32 patients whom had essential hypertension.[16] Results concluded that 90% of them showed neurovascular compression of the left ventrolateral medulla.

Many other mechanisms have been proposed to explain the etiologies of hypertension. Magnum et al concluded that increased sympathetic activity, a long-term diet that is high in sodium, poor potassium and calcium intake and/or an increased production of aldosterone could lead to hypertension.[17] Plaugher also discussed several mechanisms that included aldosterone levels and the autonomic nervous systems role in hypertension.[18]

Medical Intervention

The medical model views anxiety disorders as a chronic condition with an unknown cause.[1] The most common form of treatment is through psychotherapeutic and pharmacological interventions, which includes Selective Serotonin Reuptake Inhibitors (SSRIs), Serotonin norepinephrine reuptake inhibitors, selective norepinephrine reuptake inhibitors and tricyclic tetracyclic inhibitors.[2] Side effects of these drugs not only decrease safety to the individual, but also could increase symptomatology.[1]

Cognitive Behavioral Therapy (CBT) has been shown highly effective in treating anxiety disorders.[3] CBT is a process that exposes the factors that cause and maintain the patient's anxiety symptoms. This can be delivered individually or in a

group setting and is not limited to the addition of self-help books, internet/computer based programs and exposure therapy. With the disabling affects of anxiety, this means that an individual may fail to respond to the first-line of treatment leading to the use of a combination therapy.[19]

Over the past 70 years, the form of treatment has not drastically changed for hypertension. However, the amount of prescription drugs prescribed has increased.[20] Medication is the most common form of treatment for hypertension, which includes single or combined treatments of diuretics, receptor blockers, alpha-blockers, beta-blockers and calcium antagonists.[4]

Chiropractic Intervention

DD Palmer founded Chiropractic in 1895 on the foundation of the removal of vertebral subluxation. Vertebral subluxation, as reviewed by Kent, is "pressure on the nerves, abnormal functions creating a lesion in some portion of the body, either in its action, or makeup."[21] Kent reviews vertebral subluxation according to Stephenson's 1927 reference. According to the Stephenson's text, a vertebral subluxation occurs when there is:

1. Loss of juxtaposition of a vertebra with the one above, the one below, or both
2. Occlusion of an opening
3. Nerve impingement
4. Inference with the transmission of mental impulses

The chiropractic profession has several models of subluxations. According to the neurodystrophic model, "neural dysfunction is stressful to body tissues and that 'lowered tissue resistance' can modulate specific and nonspecific immune responses and may alter the trophic function of the involved nerves."[21] This model is based on increased sympathetic output negatively affecting organ and tissue responses to hormones, infectious agents, and blood components, which can easily be related to this case. This increased activity would keep the central nervous system from responding to stimuli appropriately.

The neurodystrophic model shows the affects on organs and tissues.[21] Through the neurodystrophic model we can show how a removing a spinal subluxation can lead to decreasing hypertension. The kidneys are responsible for controlling the renin-angiotensin system. Renin is a protein enzyme that is released by the kidneys when the arterial pressure falls too low, thus causing an increase in renin.[22]

When the arterial pressure falls, the cells within the kidney release renin. Most of the renin is released through the kidneys and into the bloodstream; however, some is left within the kidney. Renin breaks down angiotensinogen, which is secreted from the liver, into angiotensin I. Angiotensin I is further converted into angiotensin II, an extremely powerful vasoconstrictor. Angiotensin II acts on the musculature of arteries causing peripheral resistance leading to elevated blood pressure. Angiotensin II stimulates the adrenal glands and raises aldosterone, which causes an effect on the kidneys leading to increased sodium retention and leads to increased blood volume.

A study done by Plaugher et al concluded these effects of the renin-angiotensin-aldosterone system on blood volume and pressure.[18]

The kidneys are located between the spinal levels of T12-L1. The parasympathetic spinal nerves are from levels T12-L1. Nerve interference at these levels would inhibit the parasympathetic output, therefore causing the sympathetics to take over. Thus, the patient's hypertension may have resolved through normalization of the parasympathetic- sympathetic innervation to the levels of T12-L3. The spinal segments were adjusted sending proper neurological input to the kidney. Proper innervation throughout the body and especially nerves supplying the kidney, allows hormone levels to normalize which resumes blood pressure levels to a normal rate. Through the removal of spinal misalignments and restoring proper parasympathetic innervation, proper functioning within the body is restored.

Review of Literature

A review of literature was performed using published peer-reviewed studies on chiropractic in relation to anxiety and hypertension.

Behrendt and Olsen studied the impact of subluxation correction on a 19-year-old female with a mental health disorder.[1] The patient had a history of physical, mental and emotional abuse, which included multiple motor vehicle accidents, childhood emotional abuse from an alcoholic father and smoking since the age of 17. An examination revealed multiple subluxations within the spine and decreased curvatures in the cervical and thoracic regions. The Diversified Technique was utilized and after the first adjustment a 50% reduction in anxiety, 30% reduction in headaches and increased motion within the cervical spine were noted. After four months of care, medications were discontinued and there was 80% reduction in anxiety, 30% reduction in headaches and increased quality of life.

Desaulniers studied the effects of chiropractic care on quality of life in a 46-year-old patient with major depression.[23] Along the depression, the patient was experiencing neck and low back pain, anxiety, fatigue and low appetite. Treatment consisted of specific chiropractic adjustments utilizing the Diversified Full Spine and Palmer Toggle Recoil techniques. Throughout the course of care, the patient noted a significant increase in quality of life.

Kennamer used Thompson Technique protocol to study the effects of spinal manipulative therapy on a 52-year-old male with depression, bipolar disorder and hemichorea.[11] He was also advised about the benefits of omega-3 fatty acids. After only four adjustments, the hemichorea associated with his anxiety attacks had subsided, along with improvement of his depressed state.

A prospective case series was conducted by Roth and studi the benefits of upper cervical chiropractic care for depressio and anxiety.[15] Five of the six participants completed the 12 recommended chiropractic visits and of those, four stated they had a positive outcome. They also reported a decrease in muscle tension with an increase in mental clarity and energy.

Teytelbaum studied the effects of anxiety, depression and pain in a 58-year-old male undergoing subluxation based chiropractic care.[2] The patient had a score of 46 on the Beck Depression Inventory-II, which indicated severe depression. The patient was seen three times per week for three months using Diversified Technique to address vertebral subluxation. Teytelbaum concluded that the chiropractic adjustments along with the ancillary procedures improved overall function, reduced pain and decreased symptoms of depression and anxiety.

A case study presented by Whedon reported the results of a 25-year-old female who was medically diagnosed with hypertension.[5] Initial exam revealed blood pressure to be 138/98 mmHg. Knee Chest Upper Cervical Technique was utilized over twelve weeks and the patient experienced a significant decrease in blood pressure to 114/80 mmHg.

Yates conducted a study on the effects of chiropractic adjustments to the thoracic region (T1-T5) on blood pressure and anxiety.[7] Twenty-one participants were randomly assigned to three groups; treatment, placebo or control. Activator Methods Chiropractic Technique was utilized to deliver a low force, high velocity adjustment to the thoracic region. Yates found a significant decrease in blood pressure and anxiety following the chiropractic adjustment.

Bakris et al studied the effects of atlas realignment on blood pressure.[24] A randomized, double blinded placebo controlled trial utilized NUCCA (The National Upper Cervical Chiropractic Association) for eight weeks on 50 participants whom were divided into treatment and control groups. The study concluded that reduction in blood pressure was shown after correction of atlas misalignment.

Chung et al wrote a case report on a 57-year-old male with hypertension.[20] The patient was on Lisinopril and Simvastatin while receiving chiropractic treatment. The patient was treated using NUCCA (The National Upper Cervical Chiropractic Association) and after 16 adjustments, the patient was no longer taking medications for hypertension and his blood pressure remained stable.

Connelly studied the effects of cranial adjusting on hypertension on three individuals.[25] Sacro-Occpitial Technique (SOT) was used, specifically the cranial ranges of motion and cranial technique. All three cases had responded favorably. This study proved the impressive effect that the autonomic nervous system has on the regulation of blood pressure through chiropractic adjustments.

Dimmick et al studied the effects of manipulation on blood pressure in normotensive patients. Individuals whom received manipulation had lower systolic blood pressure in both arms.[26] The study concluded that the subjects under treatment had vertebral subluxation that could have been responsible for different systolic values presented in the right and left arms.

A case study presented by Kessinger reported the results of a 55-year-old male with a 20-25 year history of hypertension.[4] One upper cervical adjustment was performed following the KCUCS (Knee Chest Upper Cervical Specific) protocol. Over a seven-month period and the patient receiving one cervical adjustment, the blood pressure significantly lowered.

Knuston performed a controlled clinical with two different studies.[27] First, he compared 40 individuals with upper cervical subluxations to 40 individuals without subluxation. Then he had 30 more individuals with signs and symptomatology of upper cervical subluxations. Knuston found that palpation and vectored upper cervical adjustments significantly lowered systolic blood pressure compared to the control groups. He also noted that removal of these upper cervical dysfunctions could help organ and hormone physiology.

Magnum et al found that only two studies had a low bias and they did not show a clinically relevant decrease in blood pressure when compared to other ancillary procedures.[17] There needs to be more research that shows the use of spinal manipulative therapy in treating hypertension.

A randomized controlled-comparison clinical trial was conducted on 23 participants by Plaugher to see what effect chiropractic and massage would have on individuals with essential hypertension.[18] The participants were divided into three groups; chiropractic, massage and control. The results of the study concluded that the benefits of chiropractic care for patients with hypertension are reduced costs and side effects from drugs, increased quality of life and better operating healthcare system.

A cohort study was conducted by Torns to study the effects of arterial blood pressure reduction following an atlas adjustment.[28] Forty two participants were divided into three separate groups depending on their blood pressure. Atlas Orthogonal technique was utilized and results concluded that blood pressure was regulated.

Zhang et al studied the effects of Hans electrical stimulation of acupuncture points on blood pressure.[29] Twenty seven participants were recruited from the local chiropractic college and were randomly assigned to the experimental or control groups. The experimental group received Hans electrical stimulation on two acupuncture points for 30 minutes each session, twice per week for five weeks. The study showed a reduction in only systolic blood pressure in both groups.

A crossover study performed by Guirro et al studied the immediate effects of electrical stimulation, diathermy and physical exercise on lower limb arterial blood flow in diabetic women with peripheral arterial disease.[30] One session of each therapeutic resource was utilized on 15 women, with a rest period of seven days between sessions. Blood flow was measured prior to each session and right after, 20, 40 and 60 minutes after administration. The study concluded that proximal blood circulation in the lower limb was increased with only one session of electrical stimulation and physical exercise, while distal circulation was increased only with physical exercise.

Ward studied the immediate effects of anterior upper thoracic adjustments on cardiovascular response in normotensive subjects.[31] Thirty six Chiropractic college students were divided into three groups; anterior thoracic adjustments of T1-4 using Activator Methods Chiropractic Technique, Activator-

based placebo adjustments or control. Electrocardiogram, bilateral pulse oximetry and bilateral blood pressure were measured at baseline, one minute after intervention, 10 minutes after intervention and 24 hours after intervention. The study concluded there was no significant difference between groups.

A repeated-measures design by Holey et al studied the effects of connective tissue massage (CTM) on the autonomic nervous system.[32] Thermography and physiological measurements were included. Eight individuals had skin temperature at the location of massage, blood pressure, heart rate and dorsal foot temperature taken prior to intervention, immediately after and at 15-minute intervals for an hour. The study concluded that CTM on skin temperature was effective on autonomic function.

McMasters et al conducted a preliminary study to determine if chiropractic care would change blood pressure measurements in African American patients.[33] Twenty four African American participants who had a diagnosis of pre-hypertensive (120-139/80-89 mmHg) or hypertensive stage I (140-159/90-99 mmHg) received chiropractic care in a teaching clinic for 23 visits. Reductions in both systolic and diastolic blood pressure were not significant; however, when four of the participants with higher body mass index (BMI) values were excluded, a significant decrease in diastolic blood pressure was concluded.

Agyemang et al used data from the HELIUS study, to assess the current prevalence with hypertension and its management among multi-ethnic populations.[34] The study included 12,974 participants aged 18-70 years. Participants included 1,871 Ghanaian, 2,184 African Surinamese, 2,278 South-Asian Surinamese, 2,277 Turkish, 2222 Moroccan and 2,142 Dutch. The ethnic minority groups had a higher level of hypertension awareness and treatment options for lowering blood pressure compared to the Dutch. However, the study concluded that the ethnic minority groups had poor blood pressure control despite their treatment options.

Limitations

Limitations of this study include a small sample size, since this is based on a case study. The patient was on anxiety and hypertensive medications while receiving chiropractic treatment; therefore the specific factor leading to the positive reduction of conditions cannot be definitively identified.

Conclusion

This case report demonstrates resolution and successful chiropractic treatment of an anxiety disorder and hypertension in a 60-year-old male. The review of literature shows positive effects of chiropractic care for the treatment of an anxiety disorder and hypertension, and provides supporting evidence for the use of chiropractic for these conditions using the Thompson Technique.

There is a growing amount of literature regarding the effects of chiropractic care on both anxiety disorders and blood pressure. More research with larger sample sizes is recommended to further explore the use of chiropractic care for resolution of anxiety disorders and hypertension.

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Table 1. Neutral posture analysis on the initial exam versus the re-evaluation

	Initial Exam	Re-Evaluation
High Shoulder	Left >.5cm	Right .3cm
Ribcage Shifted to the Left	1cm	.5cm
High Hip	Left >1cm	Right .4cm

Table 2. Side-to-side posture analysis on the initial exam versus the re-evaluation

	Initial Exam	Re-Evaluation
Anterior Head Carriage	>3cm	<3cm
Shoulders Shifted	Forward 1.8cm	Backwards .3cm
Hips Shifted	Backwards 4.5cm	Forwards <1cm
Knees Shifted Forward	3cm	4cm

Table 3. Bilateral weight scale analysis on the initial visit versus the re-evaluation

Initial Exam	Re-Evaluation
+37 lbs Left	+10 lbs Right