

---

---

# CASE STUDY

---

---

## Resolution of Chronic Fibromyalgia and Improved Spinal Curves Following Correction of an Atlas Subluxation: A Case Report & Selective Review of the Literature

Nick Tedder DC,<sup>1</sup> Adam Tedder DC,<sup>1</sup> Stephen J. Gorshack DC<sup>2</sup>

---

---

### ABSTRACT

**Objective:** The objective of this study is to evaluate and discuss the effect of knee-chest upper cervical chiropractic care on a 32-year-old female patient with fibromyalgia syndrome and concurrent symptoms.

**Clinical Features:** The patient was 32-year old female who suffered with extreme fatigue, pain, and depression due to fibromyalgia syndrome. The patient experienced a rapid decline in health and vitality. The patient sought chiropractic care two years after the onset.

**Intervention & Outcomes:** After performing a case history, physical examination and chiropractic evaluation it was determined that the patient had a subluxation of the C1 (atlas) vertebra. The patient received knee-chest upper cervical chiropractic care for a period of six months, in which she was evaluated 41 times. She was checked for indicators of vertebral subluxation during every visit and was adjusted eight times over the course of care. The patient reported a complete resolution of her fibromyalgia symptoms.

**Conclusion:** The findings presented in this case study suggest that upper cervical chiropractic adjustments may benefit patients who suffer from fibromyalgia syndrome.

**Key Words:** *Chiropractic, upper cervical spine, upper cervical knee chest technique, atlas, vertebral subluxation, fibromyalgia*

---

---

### Introduction

Fibromyalgia is a chronic pain syndrome characterized by widespread, migrating, and frequently debilitating pain and fatigue. More commonly affecting women than men (9:1, respectively) and is present in all ethnic groups, climates, and cultures.<sup>1,2</sup> The American College of Rheumatology defines the following criteria as required for diagnosis: [Criterion 1]- Chronic, widespread pain in each of the four quadrants (above and below the waist, bilaterally, in the axial skeleton) that has been present for at least three months). [Criterion 2]- Pain elicited upon palpation of less than four kilograms of pressure

in at least 11 of 18 tender points, commonly referred to as allodynia (perception of pain to a non-painful stimulus).<sup>3,4</sup> It is important to note that these tender points fail to show any soft tissue inflammation or other abnormality and are differentiated from trigger points as their etiology is unknown.<sup>1,5,6</sup> Along with chronic pain, concurrent symptoms include stiffness, fatigue, numbness, migraine and tension headaches, irritable bowel syndrome, TMJ, swollen lymphatic tissue, Carpal Tunnel Syndrome, intolerance to cold weather, anxiety, depression, mental fogginess (“fibro fog”), sleep disorders, Raynaud phenomenon and exercise intolerance.<sup>1,5,7</sup>

- 
1. Private Practice of Chiropractic, Dacula, GA
  2. Private Practice of Chiropractic, San Luis Obispo, CA

Fibromyalgia is one of the most commonly diagnosed non-articular soft tissue conditions in all fields of musculoskeletal medicine.<sup>5</sup> Affecting approximately 2% to 7% of the United States population, it is the second most common disorder seen by rheumatologists, behind osteoarthritis, and is more than twice as common as rheumatoid arthritis.<sup>8,9</sup> Despite its prevalence, Fibromyalgia remains an elusive condition in which the etiology and pathology are still unknown. Without a known cure, most of the treatment has been directed at managing patient symptoms. Because of this, it is imperative to take an in-depth look at the pathophysiology of the syndrome.

Fibromyalgia is a complicated condition that likely has more than one single cause, although recent data tends to support the notion that the primary cause is a breakdown in the normal function of the central nervous system (CNS) and the abnormal pain amplification experienced by patients tend to occur at the level of the spine, not of the peripheral tissues.<sup>1,4</sup> This is important in considering its clinical application with chiropractic care. In regards to pain processing, perception of pain involves an ascending and descending neural pathway. Peripheral nerves send information to the brain via the spinal cord (ascending) for processing and the brain relays the appropriate response back down the spinal cord, out the peripheral nerves (descending). In patients with fibromyalgia, these two pathways have been shown to operate abnormally.<sup>1,6</sup>

Central sensitization is defined as the increased excitability of nociceptive neurons, entailing spontaneous nerve activity, widely distributed receptive fields, and amplified stimulus responses within the spinal cord suggestive of both the allodynia and hyperalgesia (abnormally heightened sensitivity to pain) states of fibromyalgia.<sup>6,10</sup> Repeated painful stimulation creating abnormal temporal summation results in a phenomenon termed “wind up,” in which subsequent stimuli are perceived as progressively increasing central pain.<sup>6,9,10</sup>

The N-methyl-D-aspartate (NMDA) receptor, a primary excitatory synapse in the CNS, is thought to be responsible for this. Acting on this receptor and resulting in greater hyperalgesia and allodynia, is Glutamate; it is just one of the neurochemicals involved in the ascending facilitation pathway associated with nociceptive input to the brain. Studies have shown that the neurotransmitters involved in abnormal facilitation of nerve firing (substance P, nerve growth factor, and glutamate) are present in higher levels in the cerebrospinal fluid (CSF) of fibromyalgia patients versus the healthy population.<sup>6,9-14</sup> Substance P has been documented at an increase of two to three times the normal level in fibromyalgia patients.<sup>13,15</sup> Interestingly, there has been evidence to show that elevated CSF levels of substance P has been shown to cause disrupted sleep in rats, correlating to concurrent symptoms of fibromyalgia patients.<sup>10,13,15</sup>

In addition to increased facilitation of pain, fibromyalgia patients also experience a decrease in inhibition of the descending pathway. It is well documented in science that presence of a noxious stimulus activates an analgesic supraspinal effect; a process termed “counterirritation.”<sup>14</sup> The system of disrupted inhibition that occurs specifically in fibromyalgia patients is the ‘diffuse noxious inhibitory control’ (DNIC).<sup>14,16</sup>

DNIC is of particular importance because its inhibition causes the unique diffuse distribution of spontaneous pain often seen in these patients. Evidence of this is shown in the decreased CSF levels of serotonin, norepinephrine and dopamine metabolites. These neurotransmitters are of special interest, not only because of their role in the down regulation of pain, but also in their influence on mood, energy, and sleep. Dopamine plays an important role in memory and cognitive functioning as well as being released in response to a painful stimulus, and has been documented to be lower in patients with fibromyalgia.<sup>14,17</sup> Similarly, low levels of serotonin have been linked to insomnia and increased sensitivity to pain and evidence for low serum and CSF levels in these patients have been recorded.<sup>6,12,14</sup>

## Case Report

### *Patient History*

A 32-year-old female patient with a two-year history of fibromyalgia presented to the chiropractic practice. The patient reported a separated shoulder seven years prior before re-injuring the shoulder in May of 2010. At this time in 2010, the patient was prescribed a 10-day supply of pain medication and instructed to ice, heat, and rest by her general practitioner. After two weeks, the patient was referred to an orthopedic specialist where she was given a cortisone injection and sent to a physical therapist. The patient stated the pain worsened during those two months of physical therapy treatment.

In the months following the cessation of physical therapy, the patient experienced a massive decline in health and vitality. A bedridden state due to extreme fatigue, pain, and depression lead the patient led to seek alternative forms of care. Acupuncture, elimination diets, supplementation, tai chi, and meditation all yielded no results after a combined eight months of care. Following an extensive trial of medications, the patient experienced adverse effects such as visual, auditory, and tactile hallucinations, fits of rage, suicidal tendencies, and massive seizure-like myoclonic jerking episodes. She was admitted to the hospital for observation by a neurologist for three days.

While on a regimen of Tramadol (100mg 2x daily), Zanaflex (2mg in the morning, 2mg in the afternoon, 6mg in the evening), Volenine (50mg 3x daily), and Levoxyl (112mcg daily), the patient experienced some relief in two separate four hour blocks of time (one in the morning and one in the evening) of very limited function, but improved from normal.

On the intake form the patient reported the following concurrent conditions: possible rheumatoid arthritis (elevated factors on two separate occasions), hypothyroidism, polycystic ovarian syndrome, swollen ankles and feet, cold hands and feet, muscle weakness, numbness in the thigh, eczema, dry skin, blurred vision, excessive tearing, pressure over the eyes, indigestion, hemorrhoids, frequent urination and dribbling, painful and irregular menstruation, difficulty sleeping, irritability, fatigue, depression, and a general feeling of being run-down.

Additionally, the patient reported severe migraine headaches since age seven and ocular migraines since age 26. The patient

experienced popping sounds in the neck, pain over the kidneys, mid-back, lower back, shoulders, hands, fingers, hips, and knees, and muscle spasms throughout the entire body.

### *Chiropractic Examination*

The clinical purpose of the chiropractic examination was to determine the presence of vertebral subluxation, primarily of the C1 and C2 vertebrae, in the patient. The initial examination included weight distribution test on bilateral weight scales, palpation, range of motion and postural analysis. The analysis of posture revealed a high right ear and high right shoulder. Range of motion elicited pain in lumbar extension, otherwise unremarkable. Bilateral weight scales revealed a weight distribution of 119lbs on the left, and 115lbs on the right.

Additionally, the utilization of paraspinal thermographic imaging using the Tytron C-3000 instrument, which measures the infrared heat emitted along the spinal column, was used. This procedure gives valuable clinical information on the status of the nervous system as it relates to the neuromusculoskeletal conditions and is accurate to within 1.0° centigrade and sensitive to within .01° centigrade.<sup>18</sup> Static thermal asymmetry of 0.5°C or higher indicates neuropathophysiology originating from vertebral subluxation.<sup>19</sup>

The use of paraspinal thermography has been shown to have good to excellent reliability in the measurement of paraspinal temperature and has also been shown to have excellent inter-examiner and intra-examiner reproducibility.<sup>20,21</sup> Use of the Tytron C-3000 instrument has been shown to have very high intra-examiner and inter-examiner reliability.<sup>22</sup>

The chiropractor also observed a leg length inequality in the prone position. Analysis of leg length inequality is accepted as a useful tool by both chiropractors and the medical profession for assessing dysfunction within the spine.<sup>23</sup> It is a commonly-used criteria among chiropractors for the detection of vertebral subluxation, as the evidence suggests that an unloaded leg-length asymmetry is a different phenomenon than an anatomic leg-length inequality, rather indicating neurological interference to the suprapubic muscles.<sup>24,25</sup> The use of prone leg length analysis has been shown to have good inter-examiner reliability.<sup>26</sup> Leg length inequality was used as a secondary measure to pattern analysis established by the Tytron C-3000 instrument, as to whether there was neurological disturbances within the spine.

### *Radiographic Results*

Lateral cervical, anterior-to-posterior open mouth (APOM), base posterior, lateral lumbopelvic, and anterior-to-posterior (A-P) lumbopelvic x-rays were taken on the patient during the exam. The purpose of x-rays among upper cervical chiropractors is to determine the structural malposition of the subluxated vertebra, as studies show radiographic measurement to be the 'gold standard' since they most closely represent anatomical reality. No agreement has been shown between palpatory and radiographic findings for atlas laterality.<sup>27</sup>

The lateral cervical x-ray revealed a decreased cervical curve of 0° out of 45°, atlas intrusion of five millimeters (zero millimeters is normal), and an angle of 13° between the atlas vertebra plane line and the hard palate line (8-10° is normal). This finding suggested the atlas vertebra had subluxated in an anterior and superior malposition, with the anterior tubercle of atlas being the point of reference.

The APOM revealed five millimeters of lateral translation to the right of atlas (zero millimeters is normal). This measurement was taken according to the foramen magnum in relation to the junction of the posterior arch and lateral mass of atlas. This finding suggested the atlas vertebra had also subluxated to the right of center. The base posterior projection revealed a 2° rotation of atlas in relation to the center of the basilar process and the nasal septum (zero degrees is normal), giving a final atlas subluxation listing of ASRP (a common style of alphabetical representation of the misalignment among upper cervical practitioners).

The lateral lumbopelvic view revealed hypolordosis of the lumbar spine, mild degenerative joint disease (DJD) of L5/S1 vertebrae, and a break in George's line with a grade 1 anterolisthesis of S1 relative to L5 vertebra. The A-P lumbopelvic projection was unremarkable.

### *Chiropractic Intervention*

The initial examination with pattern analysis and x-rays revealed the presence of a vertebral subluxation at the level of C1. On each visit the patient was checked for vertebral subluxation in the following protocol: pattern analysis using the Tytron C3000 Paraspinal Thermography, leg length inequality, and palpation of the upper cervical spine. Once subluxation was determined to be present, a specific adjustment to the atlas vertebra was accomplished with the patient in the knee chest posture and a solid headpiece according to Knee Chest Upper Cervical Specific (KCUCS) protocol. With an atlas listing of ASR, the patient was placed with his knees on the floor at a perpendicular angle and midsternal notch at the front of the knee chest headpiece.

In this knee chest position, the patient's head was rotated towards the right with his ear and neck maintaining solid contact with the headpiece. The doctor took a fencer stance and contacted the patient's right posterior arch with his right pisiform and performs a "set down" by rolling inward with the left hand grasping the right wrist in a perpendicular orientation. The adjustment comes by way of a body drop and a torquing motion of the arms in a high velocity, low force action.<sup>28</sup> The patient was then instructed to rest in the supine position for 20 minutes to allow the surrounding soft tissue structures to adapt to the correction. Following the rest period, a post-adjustment skin temperature differential was again performed to confirm neurological changes.<sup>29</sup> From the time of her first adjustment until the date of this publication, the patient had 41 office visits, totaling eight atlas adjustments.

### *Outcomes*

After the first adjustment, the patient reported a reduction in pain levels from 8/10 on the pain scale (10 being the worst) to

6/10. In the weeks following, the patient experienced more relief of symptoms. After six weeks under care, the patient elected on her own to begin reducing the frequency of medication, taking only as needed. By three months under care, the patient had elected to completely eliminate the use of medicine and experienced a 90% reduction in the fibromyalgia pain.

After four months of treatment, the patient reported 100% improvement in symptoms. The patient reported a full return to health and vitality. No longer bedridden, experiencing pain, fatigue or depression, the patient reported working with a personal trainer twice a week and exercising three to four days a week, fully able to return to daily activities.

The 90 day follow-up examination revealed the following: normal posture, normal range of motion, improvement in paraspinal thermography, and a bilateral weight scale distribution of 118lbs on the left and 117lbs on the right. Post films were taken 90 days later. The lateral cervical view demonstrated a normal atlas angle of eight degrees and an atlas intrusion of two millimeters (three millimeter improvement). The decreased cervical curve in the neck of 0° improved to a state of hypolordosis at 20° (45° is normal). The lateral lumbopelvic revealed a return to normal lordotic curve, no break in George's line at the L5/S1 vertebral level, and a correction of the anterolisthesis at S1. The mild DJD was still present on the A-P lumbopelvic projection.

## Discussion

The purpose of this case study was to document the relationship between upper cervical specific chiropractic care and the changes that occurred in a patient with fibromyalgia syndrome. The data shows a reduction of symptoms in fibromyalgia associated with specific upper cervical chiropractic through the correction of atlas misalignment and the neurological compromise related to it. The reduction in symptoms occurred over a six-month period without any other significant treatment or lifestyle changes.

Because of the unknown nature of the syndrome, there is a wide array of treatment options being employed to manage the symptoms of fibromyalgia with both pharmacological and non-pharmacological interventions. Of the pharmacological options, the most important come from guidelines set forth by the American Pain Society (APS) in 2005, in which tricyclics, selective serotonin reuptake inhibitors, anxiolytics, and pain medication for improving sleep, reducing anxiety/depression, and decreasing pain are recommended. The APS cautions against the use of opioids, corticosteroids, nonsteroidal anti-inflammatories, benzodiazepines, and tender or trigger point injections for the treatment of fibromyalgia due to a lack of evidence of efficiency.<sup>5</sup>

Although more than 90% of patients utilize at least one drug to manage their condition, many try several different medications over multiple years. Despite these numbers, more than 90% of patients also seek alternative therapies on their own accord and report a strong preference for non-pharmacological treatment options.<sup>10</sup>

Terhorst et al. reported an extensive literature review of the alternative therapies and concluded the following: eight out of 11 studies reviewed on water-based treatment found moderate evidence that spa therapy can improve pain levels. Four out of five studies showed no effect in the reduction of symptoms with massage therapy compared to control.

The use of magnetic sleep pads in two studies reviewed also showed no difference between the treatment and control groups. The six studies reviewed on homeopathic and nutritional interventions indicated no effect on symptoms. Mind-body techniques such as biofeedback, hypnosis, and meditation were found to be an effective means of treating pain in 10 studies reviewed. Studies on movement therapies such as quigong and tai chi were limited but suggested a positive effect on treatment groups. Acupuncture was noted to only be of modest effect in the seven studies reviewed; however it was noted that a previous meta-analysis reported no significant effect.<sup>8</sup>

Several studies support the evidence of upper cervical effectiveness in the relief of fibromyalgia symptoms.<sup>7,30-32</sup> In a study by Bennett and Tedder,<sup>30</sup> a 64-year-old woman diagnosed with fibromyalgia six years before entering care presented with pain, sleep apnea, loss of coordination, glaucoma, degenerative disc disease, and disruption in bowel habits. After three months of specific knee chest upper cervical care, symptoms were improved 80%, and a notable increase in energy levels was also reported.

In another study by Alibhoy, a 45-year-old woman presented with an 11-year history of fibromyalgia as well as concurrent symptoms of migraine headaches, chronic neck pain, upper and lower back pain, numbness in fingers, sciatica, right knee pain, depression, and duodenal ulcer. The outcome of the study showed within six months after the first knee chest upper cervical adjustment, the patient reported that the fibromyalgia had resolved and that she no longer needed wheelchair assistance. During this time, it is also important to note that the patient no longer needed any medication, and the only residual complaint was right hip pain.<sup>7</sup>

Hains and Hains documented in their study, although it was not based specifically on upper cervical care, that nine out of 15 patients responded positively (at least 50% reduction in pain) after 30 treatments of ischemic compression and spinal manipulation. Of the respondent category, an average of 77.2% lessening in pain intensity, an improvement of 63.5% in sleep quality, and a 74.8% improvement of fatigue level were recorded and maintained for one month following the study.<sup>31</sup>

Of the most intensive research on this subject may come from a study published by Amalu on 23 successful cases. Of the 23 patients (ranging from 11 to 76 years of age), 96% presented with a medical diagnosis of both fibromyalgia and chronic fatigue syndrome, for two to 35 years. With an average of 31 office visits over the course of 15 weeks, 92-100% improvement in symptoms was achieved in both syndromes. All 23 patients reported maintaining their improvement at the one to 1.5 year follow-up.<sup>32</sup>

Historically, chiropractic care has maintained a clinical focus

on the detection and correction of vertebral subluxation, thereby removing interference in the transmission of mental impulse between brain and body, and restoring proper physiology. *Stephenson's Chiropractic Textbook* describes the vertebral subluxation complex as a condition of malposition of a vertebra in relation to the one above, below, or both which, occluding a foramen, impinges a nerve and interferes with the transmission of mental impulse.<sup>33</sup> Palmer later expanded on this definition and limited the area of the spine in which subluxation occurs to within the occipito-atlanto-axial interrelationship.<sup>34</sup> This area of the spine allows for the mobility needed to move our head with full range of motion, and since the atlas vertebra relies entirely on soft tissue in order to maintain its proper alignment, it is more prone to displacement.<sup>35</sup> This displacement results in compromise of the brainstem's neural pathway.

It is evident from the above case studies and case reports that upper cervical chiropractic care may be beneficial for reducing symptoms associated with fibromyalgia syndrome. The mechanism by which correction of subluxation aids in the reduction of these symptoms is not well understood; however there have been numerous theories postulated that always involve a structural and neurological component.<sup>7</sup>

Grostick proposed that subluxation of the C1 vertebra places tensile stresses on the spinal cord via attachments of the dentate ligament. These abnormal stresses placed on the spinal cord may produce neurological irritation, separate from direct compression from atlas vertebra, itself.<sup>36</sup>

Later, Kent proposed the dysafferentation model of subluxation, which may be helpful in understanding the mechanisms through which subluxation correction helps to manage fibromyalgia symptomatology.<sup>37</sup> The dysafferentation model is based on the premise that a subluxated vertebra will alter the afferent stimuli being relayed to integrating centers of the brain. Being that the C1 (atlas) vertebra is richly innervated with mechanoreceptors, alteration of position and or motion of this vertebra can lead to abnormal signaling being relayed to the cerebral cortex.<sup>37</sup>

Distorted neuronal activity produced by subluxation may lead to widespread activation of the brainstem and cerebral cortex, which is recognized as a more commonly accepted theory of fibromyalgia etiology.<sup>1,3-6,9</sup> Therefore, by relieving mechanical pressure through correction of an atlas subluxation through chiropractic care, one can theoretically improve the state of well-being in fibromyalgia patients by removing neuronal irritation that is causing dysfunction of the processing pathways.

## Conclusion

The study of fibromyalgia syndrome presents a unique and complex set of challenges, from diagnosis, to etiology, to treatment of the illness. Although recent evidence suggests that fibromyalgia results from a central nervous system derangement rather than a dysfunction at the level of peripheral tissue, only one thing is certain; patients with fibromyalgia experience pain vastly different than the general population, in the absence of disease.<sup>6,9</sup>

With the success seen in this individual case study involving one chiropractic patient, it should be noted that more research is needed in the area of upper cervical chiropractic and a reduction in fibromyalgia symptomatology. This case report demonstrates the imperative need to further understand the chiropractic approach to resolving fibromyalgia syndrome.

## References

1. Grodman I, Buskila D, Arnson Y, Altaman A, Amital D, Amital H. Understanding fibromyalgia and its resultant disability. *IMAJ*. 2011; 13: 769-772.
2. Malin K, Littlejohn GO. Neuroticism in young women with fibromyalgia links key clinical features. *Pain Res Treat*. 2012; 730741: 1-7.
3. Schnieder MJ, Brady DM. Fibromyalgia syndrome: A new paradigm for differential diagnosis and treatment. *J Manipulative Physiol Ther*. 2011 Oct; 24 (8) 529-541.
4. Schnieder MJ, Brady DM, Perle SM. Commentary: Differential diagnosis of fibromyalgia syndrome: Proposal of a model and algorithm for patients presenting with the primary symptom of chronic widespread pain. *J Manipulative Physiol Ther*. 2006; 29:493-501.
5. Schneider M, Vernon H, Gordon K, Lawson G, Perera J. Chiropractic management of fibromyalgia syndrome: A systematic review of the literature. *J Manipulative Physiol Ther*. 2009 Jan; 32 (1): 25-40.
6. Abeles A, Pillinger M, Solitar B, Abeles M. Narrative review: The pathophysiology of fibromyalgia. *Ann Intern Med*. 2007; 146:726-734.
7. Alibhoy N. Resolution of fibromyalgia following upper cervical chiropractic care: A case study. *J Upper Cervical Chiropr Res*. 2011 Jun; 39-44.
8. Terhorst L, Schneider MJ, Kim K, Gozdich L, Stilley CS. Complementary and alternative medicine in the treatment of pain and fibromyalgia: A systematic review of randomized controlled trials. *J Manipulative Physiol Ther*. 2011 Sept; 34 (7) 483-496.
9. Clauw DJ, Arnold L, McCarberg BH. The science of fibromyalgia. *Mayo Clin Proc*. 2011 Sept; 86(9)907-911.
10. Forbes D, Chalmers A. Fibromyalgia: Revisiting the literature. *J Can Chiropr Assoc*. 2004; 48(2):119-131.
11. Baraniuk J, Whalen G, Cunningham J, Clauw D. Cerebrospinal fluid levels of opioid peptides in fibromyalgia and chronic low back pain. *BMC Musculoskelet Disord*. 2004 Dec; 5:48
12. Legangneux E, Mora J, Spreux-Varoquaux O, Thorin I, Herrou M, Alvado G, Gomeni C. Cerebrospinal fluid biogenic amine metabolites, plasma rich platelet serotonin and [<sup>3</sup>M]imipramine reuptake in the primary fibromyalgia syndrome. *Rheumatology*. 2001; 40:290-296.
13. Russell J. Neurochemical pathogenesis of fibromyalgia syndrome. *J. Musculoskeletal Pain*. 1996; 4(1/2):61-92.
14. Ceko M, Bushnell MC, Gracely RH. Neurobiology underlying fibromyalgia symptoms. *Pain Res Treat*. 2012; 585419:1-8.

15. Russell IJ, Orr MD, Littman B, Vipraio GA, Alboukrek D, Michalek JE, Lopez Y, MacKillip F. Elevated cerebrospinal fluid levels of substance p in patients with the fibromyalgia syndrome. *Arthritis Rheum.* 1994 Nov;37(11):1593-601.
16. Gracely RH, Ambrose KR. Neuroimaging of fibromyalgia. *Best Pract Res CL RH.* 2011;25:271-284.
17. Wood PB, Schweinhardt P, Jaeger E, Dagher A, Hakyemez H, Rabiner EA, Bushnell MC, Chizh BA. Fibromyalgia patients show an abnormal dopamine response to pain. *Eur J Neurosci.* 2007 Jun;25(12):3576-82.
18. Brown M, Coe A, DeBoard TD. Mastoid fossa temperature imbalances in the presence of interference patterns: a retrospective analysis of 253 cases. *J Vert Sublux Res.* 2010;July(15):1-13.
19. Uematsu S, Edwin DH, Jankel WR, Kozikowski J, Tranner M. Quantification of thermal asymmetry. *J Neurosurg* 1988; 69:552-555.
20. McCoy M, Paraspinal Thermography in the Analysis and Management of Vertebral Subluxation: A Review of Literature. *A. Vertebral Subluxation Res.* 2011; July:57-66.
21. McCoy M, Campbell I, Stone P, Fedorchuk C, Wijayawardana S, Easley K. Intra-examiner and inter-examiner reproducibility of paraspinal thermography. *PLoS One.* 2011;6(2): e16535. doi:10.1371/journal.pone.0016535.
22. Hart JF, Owens EF Jr, Donofrio JJ, Haralambous J, Mierzejewski E. Paraspinal skin temperature patterns: and interexaminer and intraexaminer reliability study. *J Manipulative Physiol Ther.* 2004 Mar-Apr;27(3):155-159.
23. Seeman DC. Bilateral weight differential and functional short leg: An analysis of pre and post data after reduction of an atlas subluxation. *Chiropr Res J.* 1993;2(3):33-38.
24. Knutson G. Anatomic and functional leg-length inequality: A review and recommendation for clinical decision-making. Part II, the functional or unloaded leg-length asymmetry. *Chiropr & Osteopat.* 2005;13:12. doi:10.1186/1746-1340-13-12.
25. Walker B, Buchbinder R. Most commonly used methods of detecting spinal subluxation and the preferred term for its description: A survey of chiropractors in Victoria, Australia. *J Manipulative Physiol Ther.* 1997 Nov-Dec;20(9):593-589.
26. Holt KR, Russell DG, Hoffman NJ, Bruce BI, Bushell PM, Taylor HH. Interexaminer reliability of a leg length analysis procedure among novice and experienced practitioners. *J Manipulative Physiol Ther.* 2009 Mar-Apr;32(3):216-222.
27. Jende A, Peterson CK. Validity of static palpation as an indicator of atlas transverse process asymmetry. *Eur J Chiropr,* 1997; 45:35-42.
28. Kessinger RC, Boneva DV. A new approach to the upper cervical specific, knee-chest adjusting procedure: Part I. *Chiropr Res J.* 2000;3(1):14-32.
29. Kessinger RC, Boneva DV. Vertigo, tinnitus, and hearing loss in the geriatric patient. *J Manipulative Physiol Ther.* 2000; 23(5):352-362.
30. Tedder N, Bennett C. Improvement in a patient with fibromyalgia following knee chest upper cervical specific care: A case report. *J Upper Cervical Chiropr Res.* 2012 Mar; 27-30.
31. Hains G, Hains FH. Combined ischemic compression and spinal manipulation in the treatment of fibromyalgia: A preliminary estimate of dose and efficacy. *J Manipulative Physiol Ther.* 2000; 23(4):225-230.
32. Amalu WC. Upper cervical management of primary fibromyalgia and chronic fatigue syndrome cases. *Today's Chiropr.* 2000;29(3)76-86.
33. Stephenson RW. *Chiropractic Textbook.* Davenport: Palmer School of Chiropractic; 1927.
34. Palmer BJ. *The subluxation specific the adjustment specific.* Davenport, IA: Palmer School of Chiropractic, 1934.
35. Panjabi M, Dvorak J, Duranceau J, Yamamoto I, Gerber M, Rauschnig W et al. Three-dimensional movements of the upper cervical spine. *Spine* 1988; 13(7):726-730.
36. Grostic JD. Dentate ligament-cord distortion hypothesis. *Chiropr Res J* 1988; 1(1):47-55.
37. Kent C, *Models of Vertebral Subluxation: A Review.* *J of Vertebral Subluxation Res.* 1996;1(1):1-7.