

Case Study

Restoration of the Cervical Curve and Improvement in Neurological Function in a Patient Following Network Spinal Analysis

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Abstract

Objective: To describe the restoration of a cervical curve following Network Spinal Analysis™ (NSA) chiropractic care in a patient with neck pain.

Clinical Features: The patient presented with a chief complaint of neck pain. Radiographs were taken and demonstrated an Atlas Plane Angle measurement of 12° and a cervical Absolute Rotation Angle (ARA) of 10°, representing a cervical kyphosis.

Intervention and Outcomes: The patient received NSA care that consisted of Network adjustments entailing light contact to specific regions of the patient's spine. Follow up radiographs were taken after one year of care. The radiographs demonstrated significant sagittal curve improvement with an Atlas plane line measurement of 32° and an Absolute Rotational Angle (ARA) of -27°.

Conclusion: Successful chiropractic care was described in this case by improved measurements in the cervical curve. The Atlas plane line improved by 18° and the Absolute Rotation Angle improved by 37°. More research is warranted in this area.

Key words: *cervical curve, kyphosis, lordosis, Network Spinal Analysis, chiropractic, entrainment, tensegrity, subluxation, surface electromyography, thermography*

Introduction

In the last few decades, research has illustrated the importance of the natural contours of the spinal column with regards to one's symptoms, pain, and overall health.² The cervical curve develops as an anterior curve (lordosis) in infancy when the infant learns to hold his head upright.³ When the normal lordotic curve of the cervical spine is compromised, the proper biomechanical function of the spine becomes disrupted, altering the body's ability to transmit forces through the body to decrease the chance of injury to a localized area.²

Symptoms associated with an abnormal cervical curve may include cervical-brachial neuralgia, numbness, vertigo, nausea, paresthesia, occipital neuralgia, suboccipital pain, vascular headaches, migraine headaches, and muscle spasm with limited cervical range of motion.⁴

With this in mind, some chiropractic techniques have been developed in an effort to address the biomechanical integrity of the cervical spine by focusing on the characteristics of the

cervical curve. Most commonly, CBP, Pettibon and Pierce have focused on the restoration and correction of the cervical curve via spinal adjustments, mirror-image adjusting, cervical extension-traction, 3-point bending, cervical compression traction with a posterior –anterior transverse load at mid-neck, and a headweight device.^{2,5}

At the heart of the chiropractic philosophy is the premise that the body has the innate ability to heal and self correct. However, the efficacious correction of the cervical curve has always been thought to require manual or mechanical

manipulation, stretching, neuromuscular re-education and high velocity thrusts.² There has been very limited research on the correction of the cervical curve in the absence of force, and the purpose of this paper is to report on the body's ability to self-correct and restore the proper spinal curvatures through Network Spinal Analysis care™.

Case Report

This paper is a retrospective study on a Network Spinal Analysis patient. The patient is a 23 year old female massage therapist who presented for Network care with complaints of neck pain rated as an 8-9/10 on the pain scale, as well as shoulder and sacroiliac pain. Her past history reveals a roll-over car accident two years prior, E coli infection, and fractures unrelated to the motor vehicle accident of her left shoulder, right wrist and ankle, all of which no complications were noted. On her initial health questionnaire, she claimed that her health was preventing her from breathing deeply and that if she had optimum health, she wouldn't be "debilitated by neck issues." In addition to the health questionnaire, thermal scanning, surface electromyography and x-rays were taken of the cervical, thoracic and lumbar spine.

SEMG Scan

The initial static electromyography (SEMG) scan was performed along the patient's paraspinous muscles to measure differences in muscle tension.⁶ The scan demonstrated areas of significant asymmetry at 10 levels, and severe elevation of muscle tension at 5 levels. Thermal scans used to assess aberrations in the function of the autonomic nervous system demonstrated severe asymmetry at C2 and C3 on the right. Ideally, a healthy individual's scan will demonstrate symmetry. Thus, asymmetrical temperature differences throughout the spine are indicative of autonomic nerve dysfunction.⁷ In this case, the patient's scans demonstrated both sympathetic nerve dysfunction as well as marked differences in paraspinous muscle activity, indicating a lack of coordination in the nervous system.

Radiology

Radiographic line analysis was performed on the lateral cervical x-ray. This included a cervical curve measurement using Chiropractic Biophysics protocol by drawing a line tangentially from the posterior vertebral bodies of the 2nd and 7th cervical vertebra. This line, the Absolute Rotational Angle, measured 10 degrees indicating a cervical kyphosis. According to CBP protocol and Kapandji, this angle ideally should measure 42.2 degrees and exhibit a lordotic curve.² The second line analyzed, the Atlas Plane Angle, is found by drawing a line bisecting the anterior tubercle and posterior arch of the Atlas and measuring the angle at the anterior tubercle as it intersects with a horizontal line drawn parallel to the top of the film. Harrison and Janik's studies indicated that the Atlas plane angle should ideally create a 28.7 degree angle to the horizontal plane line.⁸

Chiropractic Care

The patient began a 12 month care plan consisting of Network Spinal Analysis. This plan broke down to 3 visits per week

for the first 90 days, and 2 visits per week for the following 9 months for a total of 109 adjustments over a 1 year period. At each visit, the patient was analyzed using Network Spinal Analysis protocol. This entailed assessing heel tension, heel eversion stress, adduction and abduction stress, in addition to noting the presence of passive and active tension in the spine and surrounding musculature. In order to understand the fundamental mechanics of NSA, it is important to understand that in addition to vertebra and discs comprising the spine, the spinal cord is also suspended and supported by an intricate system of tissues called the meninges.

The meninges and spinal cord, along with the connective tissue that attaches this system to the top and bottom of the spine are subject to the physical and emotional stresses on the nervous system, resulting in tension and distortion.⁹ In Network Spinal Analysis, the presence of stress in the nervous system is translated into heel tension and eversion stress and is termed 'adverse mechanical cord tension'. Heel tension indicates flexion/extension cord tension, while heel eversion stress indicates lateral bending cord tension. Relating to this concept, Network created five "phases" with which to categorize the spinal cord tension patterns.

Entrainment

Depending on the criteria found in the assessment at each visit, the patient was adjusted with an NSA low force contact referred to as a Network Adjustment or 'Spinal Entrainment' at the appropriate 'Spinal Gateway' area. The 'Spinal Gateway' is an access point to the nervous system, connected either directly or indirectly an area of the spine associated with and connected to the dura matter.¹⁰ It has been proposed that an NSA contact appears to be associated with the brain/body shifting from stress physiology and its associated defense posture to that of an experience of "safety" that is more conducive to reassessment, growth and re-organization.¹⁰

Results

During the course of care the patient stated that her pain drastically diminished and as a result she was consistently more aware of her spine. She also claimed that she was more aware of her breathing, which became easier, deeper, and was felt in new areas of her spine. As movement became easier, she also noticed that she felt taller, more able to carry herself strongly, and recovered from injuries with more ease. In addition, she increasingly experienced the body's rhythms and was able to recognize when her body was restoring and releasing spinal tension.

SEMG demonstrated a shift in muscle tension asymmetry from 10 levels at the initial exam to 4 levels. The severity of muscle tension which was present at 5 levels initially resolved entirely at re-examination. In conjunction, thermal scans demonstrated increased symmetrical temperature patterns indicating a reduction of autonomic nerve dysfunction. Line analysis demonstrated significant sagittal curve improvement with an Atlas plane line measurement of 32° and an Absolute Rotational Angle (ARA) of -27°. The ARA angle not only improved by 41%, but the cervical curve moved from an unfavorable kyphosis to a restored lordosis.

Improvement occurred in the patient's SEMG and thermal scans and for the purpose of this case, this data serves to support the presence of coordination and reorganization occurring in the patient's body while under NSA care.¹¹ Coupled with an alteration of the cervical curve, these changes exemplify the enhanced spinal and neural integrity of the body system as it regains awareness allowing for its self-assessment and correction.

Network Spinal Analysis™ Care is a unique system for advancing integrity of the spine and nervous system by allowing for the development of new strategies of self-organization through enhancement in the patient's passive, active, neural and emotional sub-systems.^{12,13} In contrast to traditional chiropractic techniques that address an area of fixation and attempt to control a present problem, NSA seeks to promote new properties within the nervous system and spinal tissues and to assist in advancing self organization, allowing the expression of a greater degree of wellness.¹³ During Network care, two healing waves develop that are unique to Network. The first wave is a breathing wave that releases tension throughout the spine and musculature of the body and helps to relax the patient. The second wave, the somatopsychic wave, is characterized by an undulating movement through the spine and is associated with an advancing positive reorganization of the spine.¹⁴⁻¹⁶

Discussion

Research indicates that chiropractic adjustments alone have been shown to be largely unsuccessful at correcting spinal curves.¹⁷ Therefore, justification and utilization of muscle strengthening and stretching exercises, mirror image adjusting and traction have been employed for curve correction. In a prior study performed using cervical extension-compression traction combined with diversified and drop table adjusting, the average change in the absolute rotation angle was found to be 13.2 degrees.¹⁷

In comparison, this patient receiving NSA care accomplished a 17 degree change, a 22% improvement over spinal adjustments combined with traction. The comparison of these numerical values does not imply that Network care is better or superior to CBP or Pettibon in the correction of the cervical curve; however, it sets the stage to explore the benefits Network care may have apart from the subjective quality of life improvements that have been researched in the past.¹⁸

Tone

The improvement of the cervical curve through the application of Network Spinal Analysis can be assessed through the concept of tone. Representative of the normal degree of tension, activity, strength, excitability and integrity of nerves and muscles, tone is observed in a state of health, whereas any compromise to 'health' can be attributed to any variation or breakdown in the compressional (vertebral) or tensional (soft tissue) structures.^{12,19}

As DD Palmer stated a century ago, "life is the expression of tone," a statement today that can be incorporated into the model of tensegrity.²⁰ In their review of posture related

research, Oakley et al stated, "with mal-alignment in neutral posture, static and especially dynamic function from this mal-alignment dictates altered stress/strain relationships of associated spinal structures, including bones, intervertebral discs, facet joints, musculo-tendinous tissues, ligamentous tissues, and neural elements".²¹

Tensegrity

It is the altered stress/strain relationships within the human spine that is created by the poor alignment, yet it also facilitates the aberrant structure and creates tonal changes. Ingber articulated this idea very clearly when he wrote, "transmission of tension through a tensegrity array means to distribute forces to all interconnected elements and at the same time to couple or 'tune' the whole system mechanically as one".¹⁹ This tuning of the body may possibly be aided by the charge created by the piezoelectric charge which is postulated to be read by nearby cells which respond by augmenting, reducing or changing the intercellular elements in the area to best accommodate the stress.²² On this note, the interwoven effect of tensegrity structures explains a possible mechanism, why a gentle and specific contact to the spine during NSA care is experienced far removed from the site of application.

The redistribution of tension throughout the spine can be seen manifested as the oscillatory patterns of organization created during an NSA entrainment. Two unique healing waves develop that are associated with spontaneous release of spinal and life tensions, and the use of existing tension as fuel for spinal re-organization and enhanced wellness. The validity of the organic nature of these waves has been documented in Bohacek and Jonckheere's study on surface electromyography signals.²³ This study demonstrated that the Somatopsychic wave experienced during Network care exhibited a "non-linear characteristic distinct from voluntary muscle contraction," further emphasizing its possible correlation with the dissipation of tensioning in the body or other neurophysiological processes.^{1,23}

As the tone in the body changes and tension decreases, the body moves away from the defense physiology and becomes more receptive to change. As Panjabi stated so simply, "as our brain is better able to inventory the body, it can better orchestrate healing".¹²

Studies performed at the University of Southern California for the past 10 years have postulated that sEMG signals recorded on the paraspinal muscles during the Network entrainment provide a "window" through which to view the central nervous system by demonstrating that as a patient progresses through the levels of Network care, the sEMG signals become less random and more predictable to reveal a better "organization" of the neural circuitry.¹⁵ This finding highlights the higher cognitive functioning of the brain as it becomes aware of the spine; the main conduit of consciousness, the coordinator of body function, and a proposed location of the subconscious mind.¹⁴

Conclusion

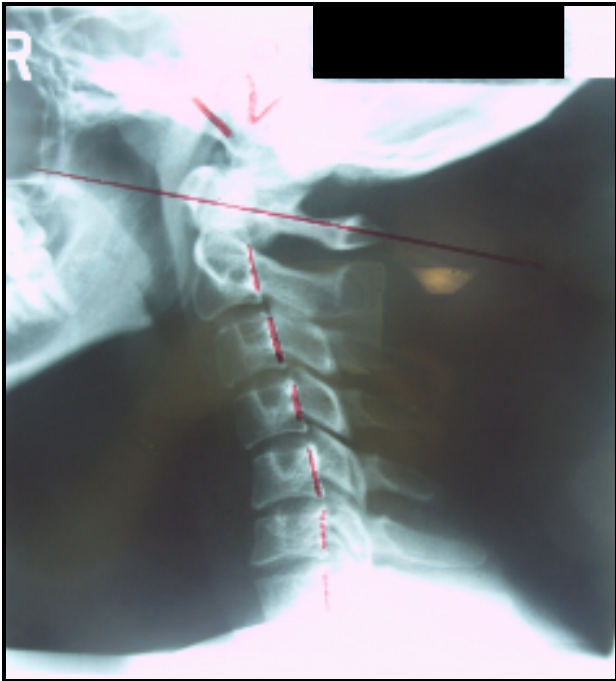
Although the exact mechanism in which Network Spinal

Analysis care facilitates an improvement in the cervical curve is unknown, the evidence of the change exists in this case. The reorganization of the cervical curve may be possible without the use of forceful adjustments, manual muscular retraining or head devices. Following the principle of tensegrity, a gentle contact to the spine with the intent to allow the spine to correct vertebral subluxations and the nervous system to balance to the optimal tone for function and healing becomes possible. However, further research is necessary to determine how the somatopsychic and respiratory waves created during a Network Entrainment causes the dissipation of tension thereby allowing the healing process to commence. What holds true, regardless of our ability to quantify or visualize the process, is the body's ability to reconnect, recognize itself, and self-correct.

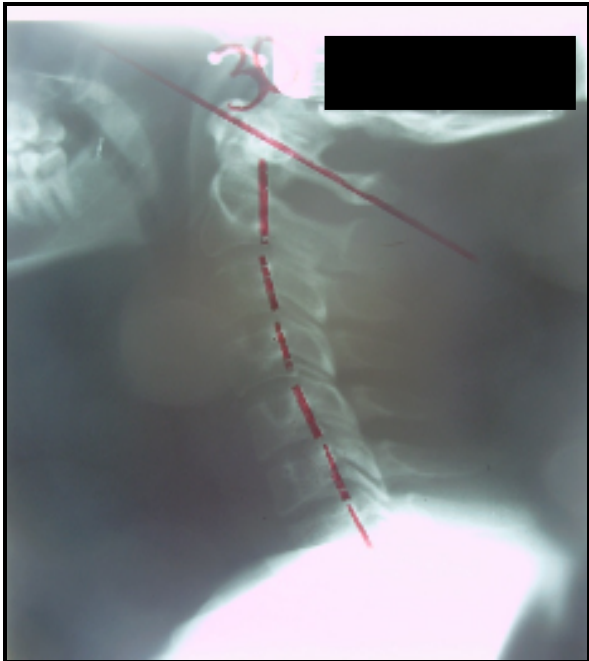
References

1. Epstein DM. The transition of Network Spinal Analysis care: Hallmarks of a client-centered wellness education multi-component system of health care delivery. *JVSR*. 2004 April 5:1-7.
2. Morningstar M. Cervical curve restoration and forward head posture reduction for the treatment of mechanical thoracic pain using the Pettibon Corrective and Rehabilitative procedures. *J Chiropr Med*. 2002 Summer;3(1):113-115.
3. Moore KL. Before we are born. 6th ed. Philadelphia: Saunders; 2003.
4. Leach RA. An evaluation of the effect of chiropractic manipulative therapy of hypolordosis of the cervical spine. *J Manipulative Physiol Ther*. 1983 Mar;6(1):17-23.
5. Harrison DE, Harrison DD, Betz JJ, Janik TJ, Holland B, Colloca CJ, et al. Increasing the cervical lordosis with Chiropractic Biophysics seated combined extension-compression and transverse load cervical traction with cervical manipulation: nonrandomized clinical control trial. *J Manipulative Manip Ther*. 2003;26 (3):139-151.
6. Kent C, Gentempo P. Normative data for paraspinial surface electromyographic scanning using a 25-500 Hz bandpass. *J Vert Sublux Res*. 1996; 1(1):43.
7. Uematsu S, Edwin DH, Jankel WR, Kozikowski J, Trattner M. Quantification of thermal asymmetry. *J Neurosurg*. 1998 Oct; 69(4):552-5.
8. Harrison DD, Janik TJ, Troyanovich SJ, Holland B. Comparisons of lordotic cervical spine curvatures to a theoretical ideal model of the static sagittal cervical spine. *Spine* 1996; 21:667-75.
9. Epstein D. Allowing a higher level of human function. *Positive Health Magazine* (112). 2005 Jun:
10. Epstein D. Introducing the concept of the 'Spinal Gateway'. *Chiropr J*. 2002 Feb.
11. Epstein D, Senzon SA, Lemberger D. Reorganizational Healing : A paradigm for the advancement of wellness, behavior change, holistic practice, and healing. *J Altern Complement Med*. 2009; 15:475-487.
12. Panjabi MM. The stabilizing system of the spine. Part 1. Function, dysfunction, adaptation, and enhancement. *J Spinal Disord*. 1992 Dec; 5(4):383-9
13. Epstein D. Network Spinal Analysis™: A research perspective. *Chiropr J*. 2000 Sep.
14. Epstein D. Network Spinal Analysis: A system of health care delivery within the subluxation-based chiropractic model. . *J. Vert Sublux Res*. 1996 Aug; 1(1): 1-9.
15. Jonkheere EA. Letter to the Editor: Network Spinal Analysis. *J Altern Complement Med*. 2009; 15(5):469-70.
16. Jonkheere E, Lohsoonthorn P, Musuvarthy S, Mahajan V, Stefanovic M. On a standing wave central pattern generator and the coherence problem. *Biomedical Signal Processing and Control*. 2010. 5(4): 336-347.
17. Harrison DD, Jackson BL, Troyanovich S, Robertson G, de George D, Barker WF. The efficacy of cervical-extension-compression traction combined with diversified manipulation and drop table adjustments in the rehabilitation of cervical lordosis: a pilot study. *J Manipulative Physiol Ther*. 1994 Sep;17(7):454-64.
18. Pauli Y. Quality of life improvements and spontaneous lifestyle changes in a patient undergoing subluxation-centered Chiropractic care: A case study. *J. Vert Sublux Res*. 2006 Oct 11:1-15.
19. Ingber DE: "The architecture of life." *Sci Am*. 1998; 278(1):48-57.
20. Palmer DD. Textbook of the science, art and philosophy of chiropractic for students and practitioners. Portland: Portland Printing House Co; 1910.
21. Oakley, PA, Harrison DD, Harrison DE, Hass JW. Evidence –based protocol for structural rehabilitation of the spine and posture: review of clinical biomechanics of posture (CBP) publications. *J Can Chiropr Assoc*. 2005; 49(4):270-296.
22. Blum CL. Non-synaptic messaging: Piezoelectricity, bioelectric fields, neuromelanin and dentocranial implications. *J Vert Sublux Res*. 2007 Jan 30:1-6.
23. Bohacek S, Jonckheere E. Chaotic modeling in Network Spinal Analysis: nonlinear canonical correlation with alternating conditional expectation (ACE): a preliminary report. *J Vert Sublux Res*. 2(4):1-8.

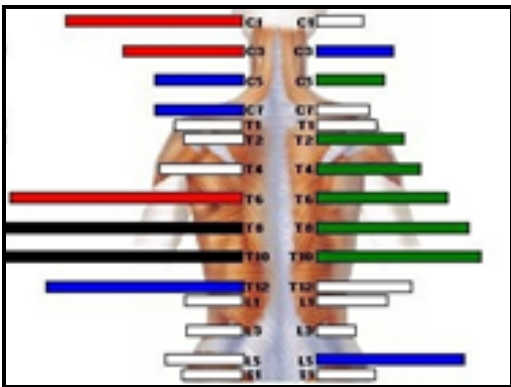
Radiographs & Instrumentation



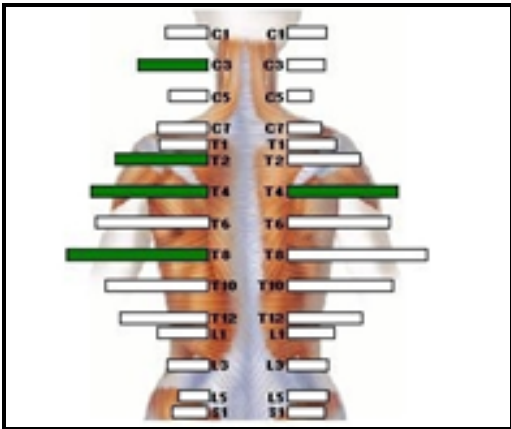
Initial lateral cervical film demonstrating a reversed (kyphotic) cervical curve.



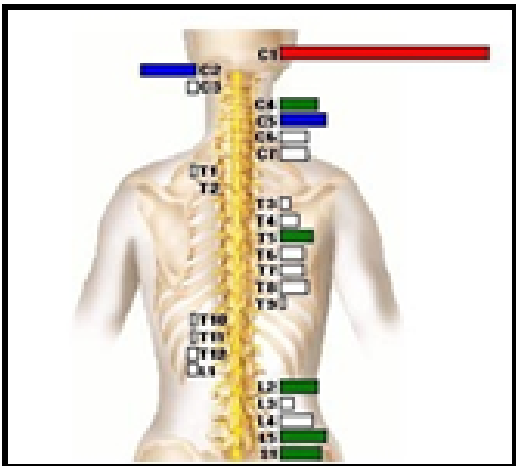
Lateral cervical film taken 12 months into care demonstrating the restoration of the patient's lordotic cervical curve.



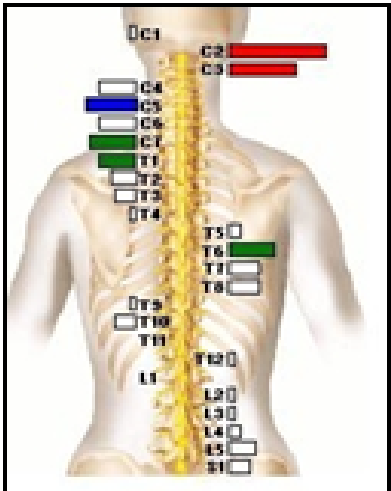
Initial Static Electromyographic Scan



Post Static Electromyographic scan 12 months after starting care



Initial Thermal Scan



Post Thermal scan 12 months after starting care