Case Study

Reduction of a Lumbar Scoliosis & Improved Cervical Curve in a Geriatric Patient Following Network Spinal Analysis™ Care: A Case Study

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Abstract

Objective: This case describes the reduction of a lumbar scoliosis and improvement in the cervical curve in a 75 year old male patient under Network Spinal Analysis™ (NSA) care. Possible mechanisms for structural change through a low-force, tonal chiropractic adjustment technique are discussed.

Clinical Features: The patient was a 75 year old male who presented for wellness based chiropractic care. He also had a complaint of mild to moderate shoulder pain. A lumbar scoliosis with a Cobb Angle of 11 degrees was found on a standing radiograph, as well as a kyphotic cervical curve and reduced atlas plane line.

Intervention and Outcomes: The patient received NSA care under standard protocols for a two year period. The patient was also asked to do two rehabilitative stretches for home care. The Cobb Angle reduced to three degrees at one year, and less than one degree at two years. The atlas plane angle increased from 6 degrees to 22 degrees. The patient's subjective findings reflect these changes.

Conclusions: Network Spinal Analysis™ care, and other low force techniques, may be effective in reorganizational change by addressing structural deformities in the spine and in restoring normal spinal curves. More research is needed in this area.

Key Words: *scoliosis, vertebral subluxation, Network Spinal Analysis, entrainment, chiropractic, tone, exercise, geriatric, cervical curve, surface electromyography, thermography, reorganizational healing*

Introduction

According to Souza, idiopathic scoliosis is "truly an enigma."[1] The nature of this spinal deformity, its causes, and its consequences are contested in the literature. In the adolescent, scoliosis is more often considered a cause of clinical concern. This is due to the possibility for rapid progression during the pubertal growth spurt, with the possibility of permanent deformity and, rarely, visceral complications.[2]

But while the danger associated with rapid progression may be diminished in adulthood, the possibility for reduction or resolution is considered unlikely due to decreased flexibility of the spine in older age.[1] Furthermore, there is evidence that scoliosis may progress through adulthood, with an increased potential to do so in the elderly.[3] When the criteria of a 10 degree Cobb Angle is considered the minimum, an estimated 2.5-15 percent of adults have a scoliosis.[4] Bracing or surgery are only considered in the largest and most progressive curves, leaving the vast majority of the scoliotic population without a clear management protocol.

The research concerning the clinical significance of scoliosis and the efficacy of chiropractic management is mixed and contradictory. A recent review of the literature found Level IV "very weak" evidence to support chiropractic manipulation for the management of adult idiopathic scoliosis.[5] Even with a very weak evidence level the primary concern is maintenance and management of pain rather than spinal reorganization correction or improvement.

Conservative treatment and management, then, is most often aimed at pain and discomfort associated with scoliotic curves. At the same time, it has been reported that incidence of back

pain in adult idiopathic scoliosis is not appreciably different from that in the general population, but that it is more persistent, severe, and disabling than in the non-deformed adult population.[6] Given such ambivalent findings, it comes as a surprise when a recent review of non-surgical treatments for adult scoliosis begins by stating "adult deformity is a significant health issue within the aging population in both the United States and the world communities."[5]

It has also been argued that scoliosis is virtually a normal finding in the elderly due to its prevalence.[3] Cosmetic deformity, pain and stiffness are the most common complaints associated with scoliosis.[1] From a symptom-based perspective, there is only an imperative for conservative management when pain and symptoms are involved.

Ambivalence in the scoliosis literature notwithstanding, much research in the past decade has pointed to the need for normal spinal curves to promote healthy biomechanical and neurological functioning in the absence of pain and symptomatology.[7-9] In their review of the literature, Troyanvich, Harrison, and Harrison outline the effects of abnormal posture on physiological function.[8]

Increased stretching and tension of the spinal cord through holding abnormal positions such as lateral translations and flexion in a scoliosis or cervical kyphosis will cause increases in intermedullary pressure, increased CSF pressure, and increased pressure within the nerve cell, and eventual altered neurological function.[8] These authors present research that mechanical traction and pressure on nerve tissues results in a decreased threshold for firing and increased sympathetic tone.

Such processes are more likely to have culminated in the elderly, for whom regenerative mechanisms and spinal flexibility are likely to be reduced after years of aberrant spinal biomechanics. A recent study of 1353 community dwelling elderly men and women found hyperkyphosis in the thoracic spine to be linked with greater mortality, and in particular from atherosclerosis.[10]

In fact, the greater the hyperkyphosis, the higher the mortality rates. These authors pointed out that this was the case irrespective of osteoporosis (in the past thought to be the underlying cause both of hyperkyphosis as well as scoliosis), as well as when a variety of other factors and conditions were controlled for. Though this study does not concern scoliosis it suggests we pay greater attention to the chiropractic axiom that "posture is the window to the nervous system," particularly in the elderly.

These findings emphasizing the importance of healthy posture beg the question of how chiropractic can address vertebral subluxations associated with abnormal posture. Techniques such as Pettibon and Chiropractic Biophysics conceptualize subluxation as a global phenomenon, and focus on alteration of postural curves as the desired outcome of care.

A focus on posture as both a means and an end would also seem to necessitate forceful spinal adjustments and extensive rehabilitation to make up for years of compensations, inflammatory, and degenerative processes. Similar to such postural techniques, Network Spinal Analysis™ care also conceptualizes the subluxation as a global phenomenon involving the entire spine. However, NSA care does not focus on posture as the primary desired outcome. There has been a lack of research on how low-force and tonal techniques may affect posture instead through a focus on normalized physiological and neurological function.

Case Report

The following is a case-study of a geriatric patient under Network Spinal Analysis™ care. The patient, a 75 year old married white male, presented to a private practice of chiropractic in response to an advertisement in a local newspaper. When asked on an intake form to rate his top three health concerns, he listed high blood pressure, high cholesterol, and shoulder pain (as ranking 1, 2, and 3rd).

The patient cited a 20 year history of medical management for high blood pressure and high cholesterol, both conditions for which he was taking medication. He stated that he had been experiencing occasional "aching" and "tingling" in his right shoulder and arm for the past "couple of years." He said that physical activity helped relieve the pain, and he rated the severity of his shoulder pain as 2 out of 5 (on a 1-5 pain scale with 5 being the most severe).

On the review of systems, he also reported a recent history of constipation, acid reflux, and heartburn. He stated that he had never been hospitalized, and his only two surgeries were for hemorrhoids—both outpatient procedures. He reported a low level of daily stress. The patient said that he had never been under the care of a chiropractor, had his spine checked for subluxations, or had x-ray films taken of his spine. No history of trauma, motor vehicle accident, or other disease was reported.

The initial exam found forward head posture, a high left shoulder and a high right hip. On bilateral weight scales (used to detect postural imbalance) the patient was found to put 102.5 pounds on the left side, and 91.5 pounds on the right. The patient also had pain in right cervical rotation (records do not specify nature of location of this pain).

Radiographs were taken of the cervical, thoracic, and lumbar spine. In addition, surface electromyographic (sEMG) and thermal scans were performed. A care plan was initiated consisting of three visits per week with a re-assessment scheduled for 45 days. Re-assessments included exam, sEMG and thermography, and outcomes assessment tools (OATS) concerning his perception of progress under care. Cervical and lumbar films were again taken at one and two years after care was initiated to assess improvements in bony alignment.

Radiology

Lumbar films revealed a 10 degree left lumbar scoliosis with an apex at L3. The scoliotic angle was analyzed using the Cobb-Lippman method (Cobb Angle).[11] First, the segments involved in the scoliosis were determined. On the AP film a line was drawn along the superior border of the superior end vertebra, and a similar line is drawn along the inferior surface

of the inferior end vertebra. The horizontal angle between these two lines was measured. Some research has argued persuasively that the Cobb Angle lacks validity by not taking account of the 3 dimensional nature of scoliosis.[12] However, the measurement remains the standard for measuring and classifying scoliosis, and has been shown to have excellent inter and intra examiner reliability.[13] Cervical films revealed degenerative changes and a kyphotic cervical curve.

Using the Atlas Plane Line from CBP protocol, an angle of 6 degrees was found on the lateral cervical film. This line is found by connecting the midpoint of the drawing a line between the midpoint of the atlas the anterior tubercle and posterior arch. The angle between that line and a line horizontal to the top of the film should ideally create a 28.7 degree angle according to Harrison and Janik.[14]

sEMG and Thermography

Paraspinal surface electromyography (sEMG) and thermographic readings were taken using the Insight Millenium Subluxation Station (Chiropractic Leadership Alliance, Mahway, NJ). sEMG is used to measure asymmetrical paraspinal muscle activity, a common indicator for vertebral subluxation.[15] The Insight Millenium uses surface electrodes at specific vertebral levels (15 total) to measure the extent and severity of asymmetrical muscle activity that may be associated with subluxations, somato-visceral reflexes, and pain.

The Insight measures skin temperature with a rolling thermo-couple infrared scanner. Thermographs that display asymmetries and fixed "patterns" of cutaneous temperature asymmetry are thought to be associated with autonomic dysfunction— long considered a physiological indicator of neurological disturbance[16] and vertebral subluxation.

Scans were performed with the patient wearing a gown, seated, and with the spine and paraspinal region exposed. Based on normal office procedures, the patient had approximately five minutes to acclimate to the temperature inside the office, and approximately one minute from the time of gowning to temperature scan. Scans were performed from the sacrum to the second cervical vertebra, followed by bilateral scans of the mastoid fossas. Thermal scan and sEMG always preceded chiropractic adjustment/spinal entrainment.

At the initial exam, the patient demonstrated sEMG asymmetries at 8 out of 15 levels. Paraspinal muscular asymmetries were measured as "severe" at C3 on the right, and T12 and L1 on the left. Muscular asymmetry was recorded as "moderate" at T6 and T10 on the left. Paraspinal thermal asymmetries were severe at C1, T11, and T12, and moderate at T9, T10, L1, and L3. Thermal asymmetries were noted at a total of 15 of 24 vertebral levels.

Network Spinal Analysis™ Care

The details of Network Spinal Analysis™ theory and technique have been fully described elsewhere in the literature.[17] To summarize, the NSA care approach to the spine involves the advancement of spinal and neural integrity through associated "levels of care." Each level of care having unique outcomes derived from an advancing, more adaptable and dynamic spine and nervous system. Epstein draws upon the work of Breig and Panjabi to hypothesize that tension in neural tissues (termed "adverse mechanical cord tension") is shared between active (muscles and tendons), passive (ligaments, discs, and bones), and neural control (nerves and supportive tissues) "subsystems."[18] Marked facilitation in one or more subsystem indicates a loss of spinal and neural integrity, accompanied by a hyper-reactive, and physiologically unresponsive state of "defense physiology."[17]

During the Network adjustment, low-force contacts are made to the cervical spine and sacrum at regions called "spinal gateways" which are thought to initiate a shift toward a more responsive, self-reflective and adaptive state.[19] These are also areas with close association to the areas of dural connection in the spinal meninges. It is believed that contacts made at these regions initiate global changes throughout the body. The term "spinal entrainment" is often used in place of "adjustment" as a more descriptive term that signifies a harmonization or a synchronization of internal processes throughout the body, to result in a state that promotes healing and growth.

Spinal Entrainment

In Level One NSA care, the practitioner addresses stress physiology and loss of spinal and neural integrity through the entrainment process by checking and re-checking parameters associated with adverse mechanical cord tension (AMCT), and palpation of the active and passive subsystems. Decreases in tension are considered indicative of a release of tension patterns stored in the spinal cord and meninges.[17] Reduction and reorganization of these patters are also recognized through the development of two "waves" through the spine.

The Respiratory Wave, a visible, wave-like movement of breath up the spine, is associated with advancement through Level One care and reduction of tension in the three subsystems. The second wave, the Somatopsychic Wave is a movement wave, and is characterized by reorganization of stored tensions and the beginning of Level Two Intermediate Care.

The patient began a year-long care plan consisting of three visits per week for the duration of Level One care. This consisted of 33 visits in the first three months of care, at which time the care plan was changed to two times per week. The patient was seen a total of 100 visits in the first year of care, and 56 visits in the second year of care. The care plan was amended to 2-8 recommended visits per month after the first year.

Visits consisted of a practitioner assessment of spinal cord tension pattern and contacts at appropriate Spinal Gateway regions to promote tension reduction and establishment of the Respiratory Wave. Visits were five to ten minutes long. A re-examination was scheduled for 45 days.

Postural Exercises

In addition to spinal entrainments to address AMCT and

advance the progression of the Respiratory Wave and Somatopsychic Wave, the patient was also instructed on two corrective exercises aimed at restoring spinal curves.

These exercises are not part of NSA protocol but were part of the patient's care plan. The first exercise, the "lateral bend" or "spinal shift," involves the following. The patient is instructed to shift his or her shoulders as far to the left as possible, while maintaining a neutral position of the head and neck. The patient is instructed to hold this position for five seconds and repeat on the other side. The sequence is to be repeated ten times, 1-2 times per day.

This particular exercise is supported by a study in which adults with idiopathic scoliosis were instructed to do the exercise toward the concavity.[20] The second exercise, named here as the "neck curve exercise," is a form of cervical traction. The patient is instructed to lay on his or her bed, with or without a towel rolled underneath the cervical curve, and to allow the neck to extend and the head to hang off the edge of the mattress. The position is to be held for 1-2 minute increments to start, with gradual increases to as much as 15 minutes per day.

Outcomes Assessment Tools

Subjective assessments of practice member well-being are a very important measure of progress through NSA care. It is believed that self-reported wellbeing is the most important determinant of health.[21] At the initial exam and subsequent re-exams, questionnaires are used to evaluate the level of patient well-being and attainment of goals relevant to NSA care.

Answers are used to evaluate changes in the level of concern the practice member has with his or her original chief complaint or symptoms, and changes with respect to body awareness, breath, etc. The nature of the questions asked changes as the practice member advances through Network Spinal Analysis levels of care. In the initial questionnaire, the patient studied here rated his posture as a 5/10 (on a 1-10 scale with 10 being "excellent"). When asked how his life would change if he had optimal health, he responded that he would "be more active, less tired."

Results

At the first re-assessment (77 days and 34 visits into care), sEMG and thermal patterns changed. Two levels of musculature, C1 on the left and S1 on the left were measured as "severe" hypertonicities. C3 on the left and T12 on the left registered as moderate muscular asymmetries. Six out of 15 levels demonstrated muscular asymmetries, compared to eight initially.

Paraspinal thermography demonstrated severe imbalances at C1, and moderate imbalances at C2, L3, and L5. A total of 15 out of 24 levels demonstrated cutaneous temperature imbalances, which is the same as the initial scan. On the re-evaluation practice member questionnaire, the patient wrote that he was "still experiencing neck and shoulder pain" and "stiffness."

However, he also wrote that he "feels better" in an over-all sense. Interestingly, he also noted changes under care that in addition to still experiencing pain, "my balance is better." On the same form he wrote that as a result of care he is aware of a feeling of "balance as I walk."

Two years into care, instrumentation findings were severe on the right at T10, moderate at C7, and mild at T1, T8, and S1. One year after care began, sEMG asymmetries were moderate at L5 and S1 and moderate at L3. Imbalances remained on the thermal scans at the one and two year mark, but the patterns were different on each (see figures).

Radiographs improved dramatically. The scoliotic curve reduced to 3 degrees after one year of care, and was less than one degree after two years. The cervical curve showed marked improvement, with an atlas plane line improvement from 6 degrees to 21 degrees at one year, which maintained its measure at the second year.

Patient perception of health and quality of life changes were notable as well. A year and a half into care, the patient reported that his neck and shoulder were "much improved" and "more mobile." And despite reporting a slip and fall on the ice, the patient reported no resultant complications.

Discussion

"Conservative Care" and Scoliosis

There have been several recent articles investigating the possible usefulness of "conservative care" in the management of adult scoliosis. Some of this research is centered on postural approaches such as Chiropractic Biophysics or Pettibon.[22] Other case study research centers on forceful manipulations to mobilize fixated segments and increase spinal flexibility.[6,23]

Despite the lack of prospectively planned analyses, the results of case studies and retrospective analyses do make a case for chiropractic as conservative care in scoliosis management. A 1990 retrospective analysis of 16 chiropractic patients randomly chosen from the files of scoliotic patients in two private chiropractic practices found a statistically significant 4 degree improvement in Cobb angle in patients who were treated with heel lifts, Logan Basic technique, and diversified adjustments.[13]

Much of the research on scoliosis in adults and the elderly take the perspective that unless it is accompanied by pain or extreme cosmetic deformity, it's not worth treating. A 1982 study on scoliosis and the elderly found that not only was there no direct relationship between scoliosis and back pain, but that because scoliosis in the elderly "seldom becomes a problem of clinical significance, there would appear to be no valid reason for a more extensive study of the condition at this time."[3]

The study is noteworthy in that it included follow-up radiographs, something that is lacking in most of the studies. That study began in the late 1960s with 3600 randomly chosen adults in Israel ages 45-84 who were part of an osteoporosis study at had AP and lateral films taken of the thoracic and

lumbar spine. In the original study curves of with a 10 degree Cobb measurement were found in 30 percent of the sample.

At a follow up (7-13 years later) on 15 percent of those subjects, those with larger curves to begin with and in the older group had an average progression of 4 degrees. 65 percent of the group from 65-84 had an increase in their scoliosis.

A 2010 study published in *Spine* concluded that the monetary costs of non-surgical conservative management of the non-operative scoliosis greatly outweighed the benefits.[4] The researchers prospectively studied a group of scoliotic patients who used chiropractic care, physical therapy, exercises, bracing, and bed rest. The authors concluded that "among the 68 adult scoliosis patients who used nonoperative resources, there was no significant change in any of the HRQOL outcome parameters." These outcome parameters consisted of the SRS-22, SF- 12, and ODI.

Part of the inclusion criteria for the 2010 *Spine* study is a scoliosis of 30 degrees or greater. It is noteworthy that even with a scoliosis much more severe than the patient in this study, patients were not shown to benefit from care they received. It is not known what type of chiropractic care these patients received.

That they did not benefit may also be a relic of the outcomes assessment tools used as well—which were centered on pain, disability, and impairment rather than on wellbeing. Pre and post x-rays were not done in this study. That the patient in this case was seen to benefit, in response to questions on OATS, x-rays, and thermography and sEMG indicates the importance of a focus that includes patient subjective assessments as well as objective measures of neurological function.

As it is implied by the term "conservative," chiropractic care for scoliosis tends to be focused on either pain management or on prevention of the curve from progressing. The 2010 Spine study did not use follow up radiographs in their determination that conservative treatments are not beneficial for adult scoliosis. The unstated assumption in these studies' failure to address possible improvements in adult scoliosis is that the condition is necessarily debilitating and permanent.

Furthermore, a 1986 review and case series states "There is no scientific documentation that chiropractic treatment or any other conservative treatment can permanently reduce these curvatures. In fact, most idiopathic curves are structural with bony deformity which cannot be altered."[6] These authors go on to argue that chiropractors can address scoliosis through the management of associated back pain.

As discussed earlier, we do not know to what extent this patient's scoliosis would be considered a structural or a functional curve based on exam findings. The initial radiograph does not demonstrate an obvious rotatory component. Minimal spinal degeneration in the lumbar spine, as well as the smallness of the curve would seem to argue in favor of a functional nature of his curve.

Indeed, improvements in surface EMG that correspond directly to improvements in the scoliosis as well as the patient's cervical curve. For example, after one year of care a severe muscular asymmetry emerges on the right side of the lower thoracic spine (the concavity), whereas the hypertonic muscular activity had been on the left one year prior.

But there is significant reason to suspect that functional scoliosis is a step in the progression toward more severe structural deformity. According to Wolff's law, bone adapts and remodels according to the stresses placed upon it by muscular attachments.

Therefore, especially in the case of a geriatric patient whose regenerative mechanisms may be limited, the "conservative care" model should be reconsidered. Simply conserving a scoliotic curve, when accompanied by significant muscular facilitation, may be an oxymoron. That the patient's scoliosis was not accompanied by acute pain as might be expected in the case of reflex muscular spasm[1] or physical deformity and yet improvements were attained would seem to argue against the rationale for chiropractic care as a form of "conservative care." A paradigm shift in adult scoliosis management is needed toward a focus on optimum neurological function that minimizes aberrant activity in the muscular system.

Posture and Tone

Kent's 1996 article on subluxation models outlines three main approaches to addressing the vertebral subluxation—segmental, postural, and tonal.[24] In the postural model, the vertebral subluxation complex is considered a global, system wide phenomenon. Interference with proprioceptive mechanisms, and altered biomechanics throughout the body are said to create and maintain this distortion. Similarly, tonal approaches consider subluxation and methods of addressing subluxation according to the overall state of the nervous system.

Even upper cervical techniques, though focused primarily on subluxation at C1, do so as a matter of addressing system-wide autonomic imbalance evidenced through pattern analysis. Similarly, Network Spinal Analysis™ focuses its intervention on specific Spinal Gateway regions to achieve outcomes concerning the nervous system as a whole. There is one recently published case study authored by Rohrbach and the authors of the present study that documents an improvement in cervical curve under NSA care.[25]

Postural approaches to the subluxation have supplied a great deal of the theoretical orientation and the data in support of improvement of spinal curves as a desired neurological outcome. Harrison and Troyanovich in particular have drawn upon the cadaveric studies of Alf Breig and concepts of biomechanical engineering to outline how postural distortions alter nerve tissue and reduce neurological function.

Flexion distortions, seen in cervical kyphosis and also a component of scoliotic curves, are argued to create the greatest strain on the spinal cord and potential for aberrant neurology.[9] While straight transverse "shear" forces are hypothesized to create stress on neural tissues, when the 3 dimensional global phenomenon of scoliosis is considered, that stress is likely to be much more damaging.

Through the understanding offered by Panjabi, tension may have increased in the active, muscular system as a result of a loss of control at the neural-control subsystem. It is possible that by addressing neurological function through the spinal entrainment process, spinal and neural integrity increased and the scoliosis diminished.

Exercise

As mentioned above, research concerning rehabilitative or therapeutic exercise and scoliosis most often focuses on intensive corrective regimens. The difficulty home-care exercise is that compliance is often not known, so it is difficult to determine the impact. Mamyama reported on 69 adults instructed to use the "side-shift" exercise toward the concavity of their scoliosis.[20] It was found at a four year follow-up that their curves either stayed the same or slightly improved.

The authors stated that a limitation of their study is that compliance was not known. Because exercises were not the primary focus of care in this study, it would be premature to credit the exercises with the improvements in this case. Similarly, two other case studies use exercises to address scoliosis; one study focused on the reduction of pain through Sacro Occipital Technique in conjunction with Pilates exercises, and the other prescribed a specific exercise based on Applied Spinal Biomechanical Engineering.[26,27]

Both suffer from the shortcoming of the difficulties of monitoring and recording patient participation and compliance. Because of these issues, more care needs to be taken in researching the effects of rehabilitative exercises, especially in conjunction with chiropractic care, in order to draw any conclusions.

Geriatric Population

The finding that low force adjusting may initiate a structural change in the spine is particularly interesting with reference to the geriatric population. As discussed earlier, geriatric spines are generally thought to be less flexible, subject to degenerative processes, and likely to worsen, as evidenced by the hesitancy even to recommend "conservative" care in the literature.

The results this patient experienced in NSA care provide a counter-point to this orientation toward helping the elderly. Improvement of spinal curves on x-ray, improvement in thermal scan and sEMG, and patient perception of gaining balance and the ability to walk in a more erect fashion all have direct implications for problems typically facing the elderly. Deteriorating organ systems, spinal stenosis, inactivity, slips and falls and resultant disability—these might all be theoretically be addressed through chiropractic care that focuses on increased neurological function.

Those in the profession who advocate imposition of an extremely limited number of chiropractic office visits to ameliorate most diagnoses are sure to question the efficacy of the care plans and number of visits presented in this case report. However, considered in the context of sky-rocketing health care costs and Medicare dollars spent managing chronic conditions in the final years of life, there is no doubt that more research into the benefits of chiropractic care for the elderly is warranted.

The patient in this study was 75 years old, experienced both decreased pain and an increased sense of overall wellbeing. He reported only being on two prescriptions. He even reported experiencing one fall during care with no resultant injury or residual disability. Without further research, we do not know if these results are due to the possibility that this patient is part of a self-selecting group of NSA patients that are more health conscious than the average health-care consumer.[21] Nevertheless, an elderly population made up of mobile, healthy people with high neurological function is likely to be a benefit to the wider society.

Limitations

There are several limitations to this study. First and foremost are those limitations inherent in any case study. A research finding from one non-randomly selected patient provides only anecdotal evidence for the existence of any phenomenon. However, existence of a case that demonstrates a phenomenon should provide interest in how to reproduce that outcome, creating impetus for further research.

In this case we have seen that a patient undergoing low-force chiropractic care to address imbalances in the nervous system experienced major changes in the structure of his spine that could not be accounted for by structural adjustments with rehabilitative exercises of the kind thought to do the most to affect postural outcomes.

Another limitation is imposed by the information recorded in the patient file. For example, we know that the patient was asked to do two home exercises for the improvement of spinal curves. Since there was no one with him at home, it is unknown if the patient actually did these exercises and how often, however on the questionnaire one and a half years into care the patient responded that he was doing the exercises daily. There is no other documentation to support that, and he was not asked to do them during office visits. Such factors could be monitored more closely in a prospectively planned study.

While a scoliotic curve was revealed on the radiograph, further assessments were not done to determine the nature of the scoliosis. Adam's test, a standard in the assessment of a "structural" versus a "functional" scoliosis was not performed. Such a test would have served as an indicator for the severity of the lateral deformity and the likelihood of response to care through changes in muscle activation.

There were only two patient questionnaires that fell within the time period of study. More questionnaires, with more repeated questions would have allowed us increased insight into changes in the patient's perceptions and quality of life. Because changes in diet, exercise, and the adoption of "healthy practices" has been documented as an effect of NSA care,[21] more investigation into these would have been useful..

Conclusion

This case provides limited evidence that Network Spinal

Analysis care may be effective in addressing scoliosis and structural abnormalities in the spine. This case provides a complement to an extensive body of literature that documents the interrelated effects of abnormal posture, stresses on neurological tissues, decreased neurological function, and worsening biomechanics.

A possible mechanism is that the NSA entrainment initiates a shift from stress physiology and "defense posture." Stress physiology is associated adverse mechanical cord tension and loss of coordination between the spinal stability subsystems. In this model, it may be supposed that adult idiopathic scoliosis represents a potentially reversible adaptation to stresses.

This model should be compared to the two sides of the conservative care coin, where adult idiopathic scoliosis is either an inevitable march toward increasing deformity and pain through old age, or a clinical irrelevancy where there is no pain. These findings support the necessity of chiropractic care that moves beyond the symptom-oriented "conservative care" approach. The possible benefits of such an approach on a rapidly aging population are likely to be well worth the effort.

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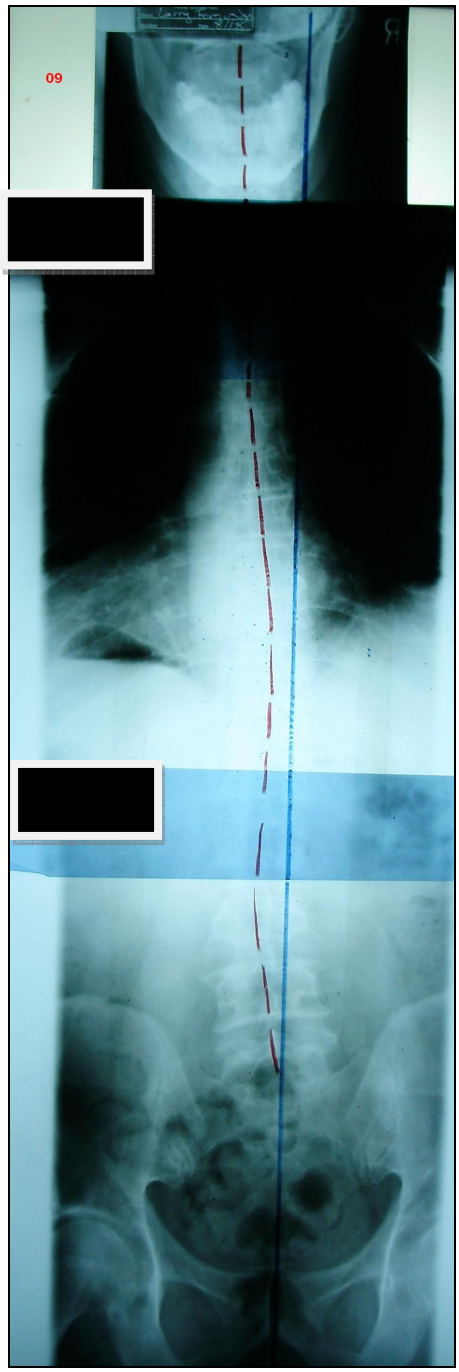
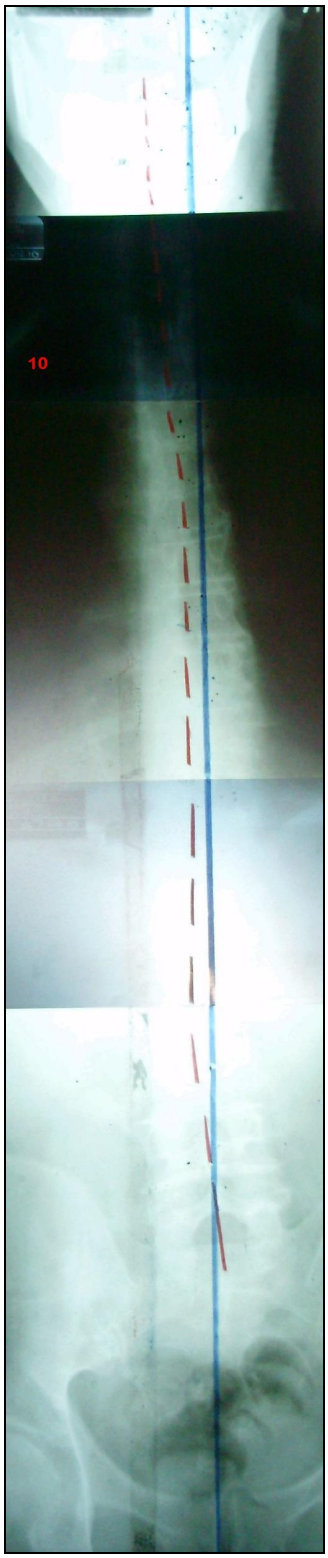
Figures

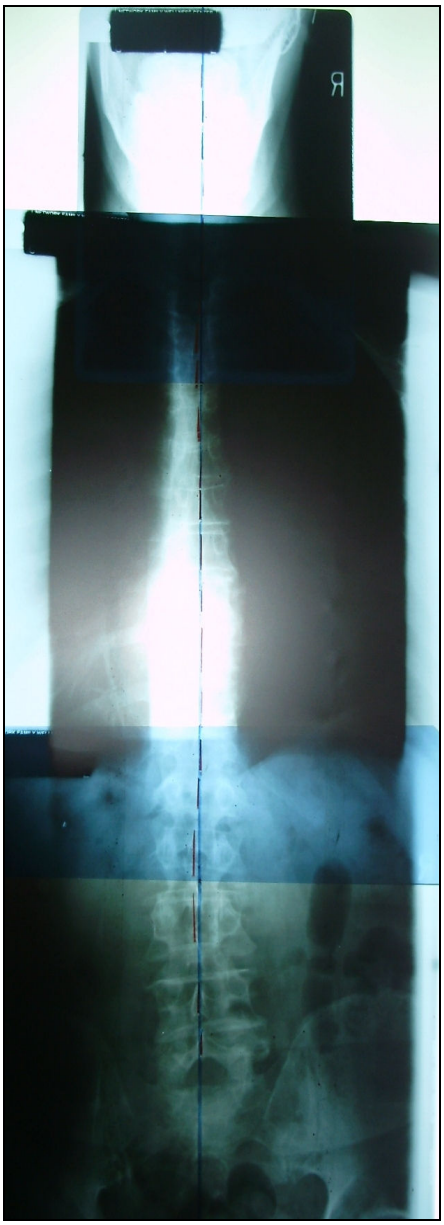
Full Spine Radiograph at Start of Care

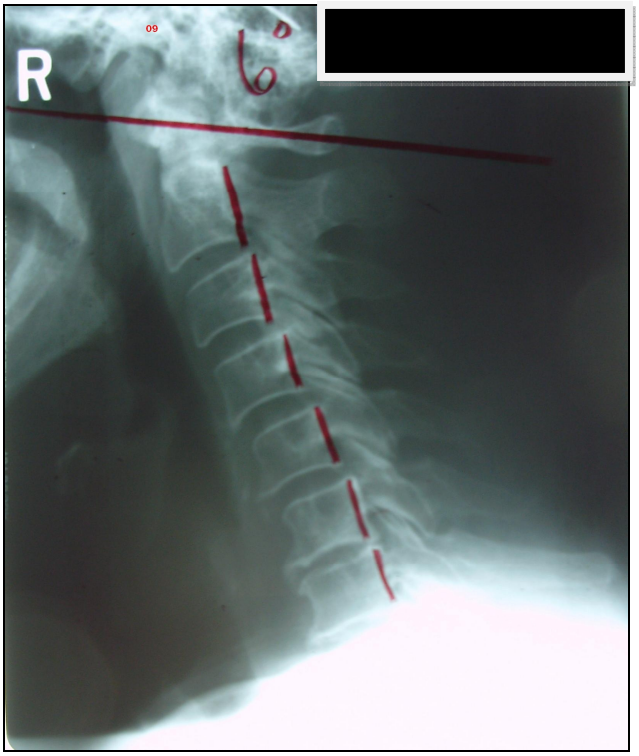


Full Spine Radiograph after 1-Year



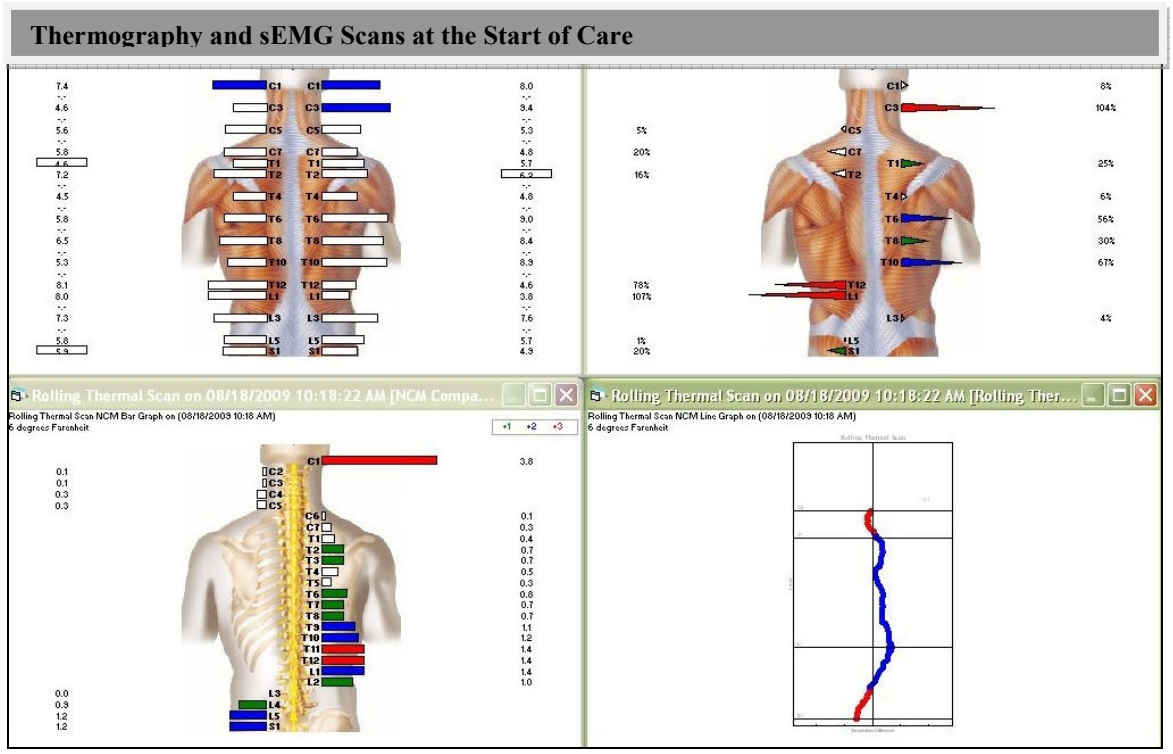
Full Spine Radiograph after 2-Years



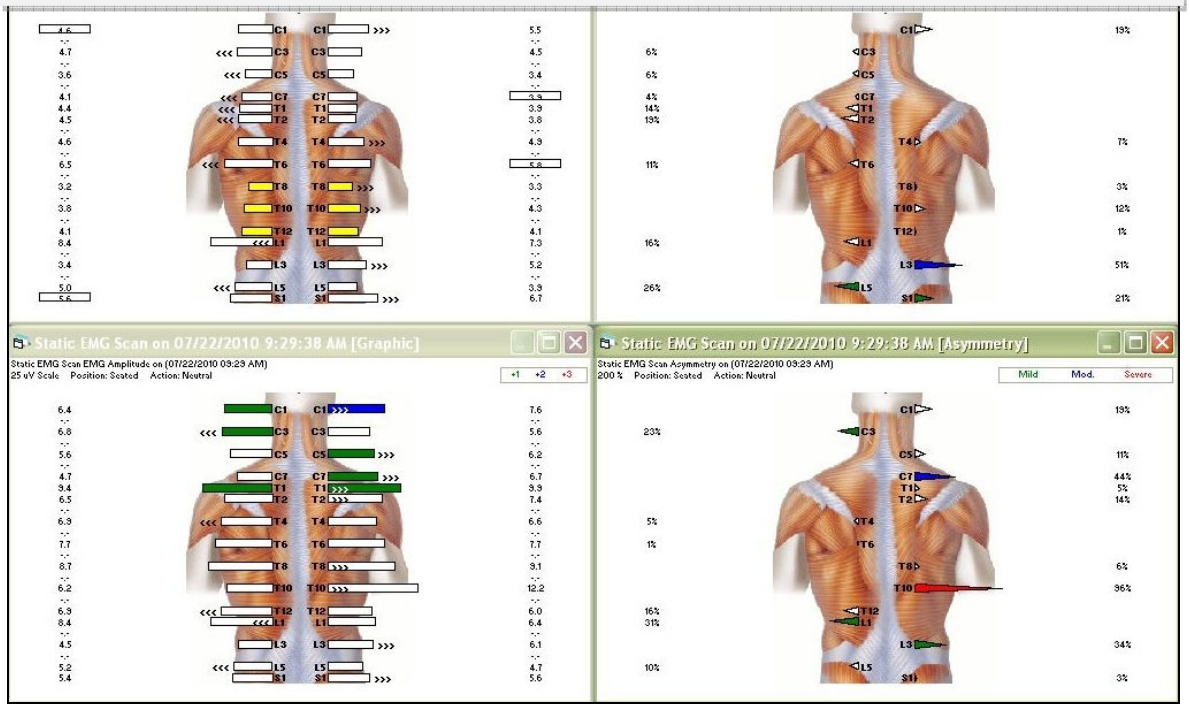


Lateral Cervical Radiograph at the Start of Care

Lateral Cervical Radiograph after 2-Years



sEMG Scans after 1-Year of Care (bottom) and 2- Years of Care (top)



Thermography Scans after 1-Year of Care (bottom) and 2-Years of Care (top)