Asia-Pacific Chiropractic Journal

ASRF CASE REPORT PROJECT

Reversal of cervical spinal ligament instabilities and severe abnormal cervical spine alignment in concurrence with improved sleep, pain, and mental and emotional function in a 44-year-old male with chronic Major Depression Symptoms: A case report

Sarah Kotlerman, Avery Martin, Jeffrey Clark, Amarajit Dhaliwal, Ruth Postlethwaite, Clare McIvor

Background: A 44-year-old male presented for care with a primary concern of chronic Major Depression symptoms.

Intervention: He underwent a series of concentrated Chiropractic care weeks, during which he was managed using the Averio Functional Neurological Technique.

Outcomes: Over the course of care, repeated objective tests revealed significant improvements, including reversal of cervical spinal ligament instability, reduction in severe abnormal cervical spine alignment, as well as self-reported significant reductions in pain along with improvements in sleep, mental health and emotional function.

Conclusion: These outcomes highlight the need for further clinical trials investigating the effects of concentrated chiropractic care on mental health conditions such as major depression. Expanding research in this area would help to clarify the relationship between chiropractic and mental health outcomes, and potentially offer new avenues for care.

Indexing Terms: Chiropractic; subluxation; concentrated care; depression; cervical alignment.

Introduction

Depression is a leading cause of disability worldwide, with major depressive disorder (MDD) affecting more than 280 million people annually. (1) It is a multifactorial condition influenced by biological, psychological, and social factors, making it challenging to treat with a single

'... The patient's recovery underscores the potential role of subluxation-based Chiropractic care in influencing neurological and physiological processes that may underpin mood disorders ...'

therapeutic approach. (2) While conventional treatment often focuses on pharmacological interventions and psychotherapy, there is increasing interest in the role of nervous system regulation in the onset and management of depressive symptoms.

This creates room for vital conversation, and indeed investigation, into the role Chiropractic may play in the neurobiological aspects of depression. Chiropractic care stands at an important juncture in the research continuum, with advancements in our understanding of the impact of the Chiropractic adjustment on aspects of brain health and sensorimotor integration. (3) Major Depressive Disorder, with its vast impact on the burden of disease, may indeed be an area of under-claiming and thus underserved in terms of the patients and practice members attended to by Chiropractors.

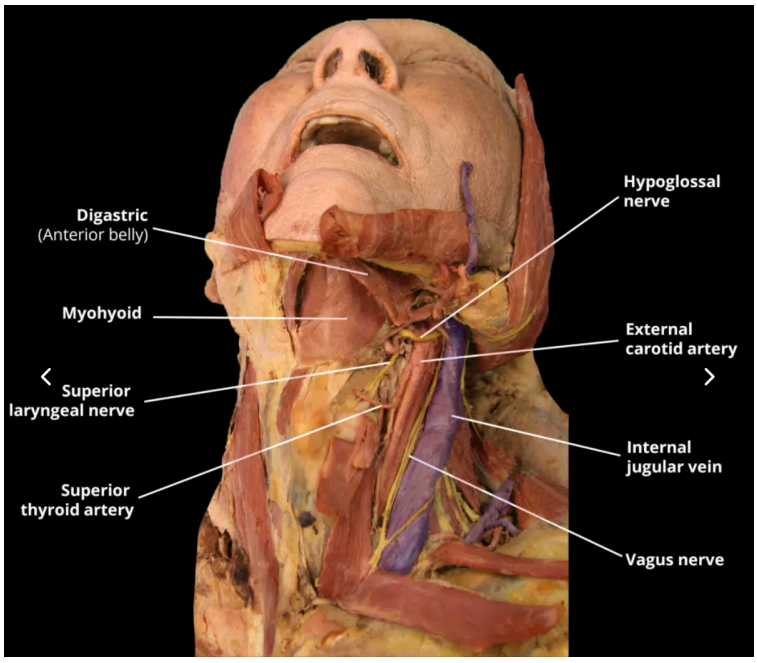
In recent years, research has highlighted the critical role of the autonomic nervous system in mental health. Chief among these mechanisms is the vagus nerve, a key component of the parasympathetic nervous system, which has been shown to play an essential role in emotional regulation and stress recovery. (4) Vagal tone, which reflects the activity of the vagus nerve, is a biomarker of an individual's ability to manage stress and maintain physiological balance. Low vagal tone has been associated with depression, anxiety, and poor resilience to stress. (5) These findings suggest that interventions aimed at improving vagal function could have a meaningful impact on mood regulation.

Chiropractic, like the traditional medical research arena, still stands to learn a vast amount about the potential impacts of vagal tone and the impacts of Chiropractic care upon it.

Chiropractic adjustments, particularly those applied to the upper cervical spine, have been shown in some studies to influence autonomic nervous system function, including vagal activity. (6) By addressing subluxations that may interfere with neural communication, Chiropractic care may help restore the balance between sympathetic and parasympathetic systems and optimise neurological function. This balance is critical for healthy emotional regulation and adaptive stress responses.

Additionally, there is an anatomical perspective towards Chiropractic improving vagal tone according to where the vagus nerves are located in relationship to the upper cervical spine. According to several cadaver studies, the vagus nerves, which are connected to the brainstem, exit through the jugular foramen and run anteriorly to the cervical spine, right in front of the cervical ligaments at C1, C2, and C3, and posterior to the carotid sheath. (8, 9)

Figure 1: Course of the proximal vagus n.



This means that if a person were to lose normal spinal alignment and have their spine shift abnormally to the anterior, which is a common type of gross spinal misalignment pattern, the vagus nerves would be abnormally affected, stretched, and possibly damaged. The anatomy of the cervical spine, as well as how commonly the neck becomes abnormal in alignment anteriorly, argues for not only a single Chiropractic adjustment to restore vagal tone, but the necessity for a series of Chiropractic adjustments to restore normal spinal alignment to as normal as possible.

Normal anatomy in the cervical spine is noted at -42° for an adult and -27° for a paediatric patient. These normals in the spinal curve are constants unless the brain is damaged by physical injury, toxicity, or sustained mental and emotional stressors. When the brain has become damaged, the spinal alignment, which is determined by mental impulses from a normally functioning brain, will also become damaged, and there is much that can be learned about the stressors of the patient through the exact analysis of the patient's spine and how the functioning of their spinal system has been damaged. One of the most important analyses of the lateral cervical spinal radiograph is how far the head has moved from normal alignment. This is often called anterior head carriage, and what might be dismissed as a small thing becomes distinctly relevant when you consider that the vagus nerves are impinged anatomically on the front of the spine.

Additionally, cervical spine alignment has been investigated in other regions of science that also boast a connection with vagus nerve function. In a 2022 review, published in the Journal of Clinical Neurology & Neuroscience, a connection was made between obesity, cervical spine degeneration, and myelopathy, and cervical alignment with the findings being that the group of patients that suffered from the greatest amount of obesity and spinal degeneration where also those with the greatest mean cervical sagittal axis, or what a Chiropractor would define as anterior head carriage. (10) This aligns with our understanding of the functions of the vagus nerves, being the primary parasympathetic nerve support to the heart and most of the organs in the digestive system; therefore, it is important for digestive function and metabolism. (11 - 14)

A 2013 review published in the Journal of Neurosurgery & Spine connects abnormal cervical spinal alignment as a causative force in adjacent segment disorder (abnormal spinal degeneration and disc degeneration), myelopathy, and overall cervical deformity. (15) The review argues that cervical spine breakdown has long-lasting negative effects on healthcare outcomes, primarily due to the significant neurology (vagus nerves, brainstem, and spinal cord) located both within and outside the cervical spine. This justifies spinal surgery in cases of abnormal cervical alignment. However, spinal surgery has various complications and sometimes negative outcomes, including increased adjacent segment disease and degeneration. (16 - 20) These studies indicate that a surgical intervention for spinal damage might be causative of more spinal damage in the near future, leaving the individual dependent on the medical system to continue to address problems that the medical system created with previous interventions.

If the cervical spine alignment and tissues can be sustainably regenerated through a series of sustained contact, low-force Chiropractic adjustments, as is shown in this case report, that would be a markedly safer and less traumatic intervention for the individual.

While further research is needed to establish definitive mechanisms, there are multiple biologically plausible pathways through which Chiropractic care could support the repair and function of vagus nerves, allowing for improvement or reversal of depressive symptoms.

For the purpose of this case report, which is the case of a 44-year-old male Amish farrier presenting with MDD, the definition of Chiropractic subluxation is '*a diminished state of being, comprising a state of reduced coherence, altered biomechanical function, altered neurological function, and altered neurological adaptability*'.

Case details

A 44-year-old male presented for concentrated Chiropractic care with a chief complaint of Major Depression. He was an Amish farrier with a high level of activity due to the nature of his work and lifestyle. He reported regular manual Chiropractic care for back and hip pain relief, but had not previously committed to any series of Chiropractic care, nor any spinal radiographic imaging or other Chiropractic objective testing. Medical history included a diagnosis of Lyme Disease and an appendectomy.

The patient reported that his first depressive episode was in May of 2007, approximately sixteen years prior to presentation. He originally started taking supplements for depression following this episode and took them until November of the same year with no changes in his symptomatology. The patient reported that his second major depressive episode occurred in 2019, in which he had to take several weeks away from his duties to recover.

The patient reports that he fell off a load of hay at five years of age into a gravel driveway, hitting his head and suffering a mild concussion. He further reported that at eighteen years of age, he flipped backward off a horse, hitting his head and right hip. The patient reports that his Lyme disease was tested and treated in a medical clinic in Mexico in 2023. Prior to that treatment, he had experienced 1.5 years of chronic fatigue and muscle weakness, further noting that the muscle weakness was worst in his hands and wrist, and he would have times when he could barely move his hands after physical labor due to weakness and swelling. Other than this, traumatic injuries were limited to one minor buggy accident with no hospitalisation.

Additionally, the patient reports significant chemical sensitivity, specifically that he could not tolerate the smell of chemicals or smoke for more than thirty minutes without getting a severe headache and brain fog. He noted that his chemical/smoke/dust sensitivity had worsened over the course of the last fifteen years. The patient was able to present a record of a brain MRI and blood labs taken in the Mexico clinic in 2023.

Whilst the primary complaint was the major depressive episode, he also presented with frequent right hip pain and frequent wrist, shoulder, and elbow pain. Other significant health issues included anosmia, chronic fatigue, self-described mental and emotional weakness, worsening vision, loss of hearing, numbness, and tingling in hands and arms.

It is relevant to mention that this patient was not scheduled for a week-long program when he first arrived at Averio Health Institute. He was escorting his wife, who has many chronic inflammatory health issues, and they were seeking help for his wife's concerns.. However, once this patient heard the initial Monday morning orientation and learned some basics of how Chiropractic care can positively affect brain function, he adamantly requested to be allowed to enter the weeklong program due to his worsening depression symptoms and overall feeling of mental and emotional weakness.

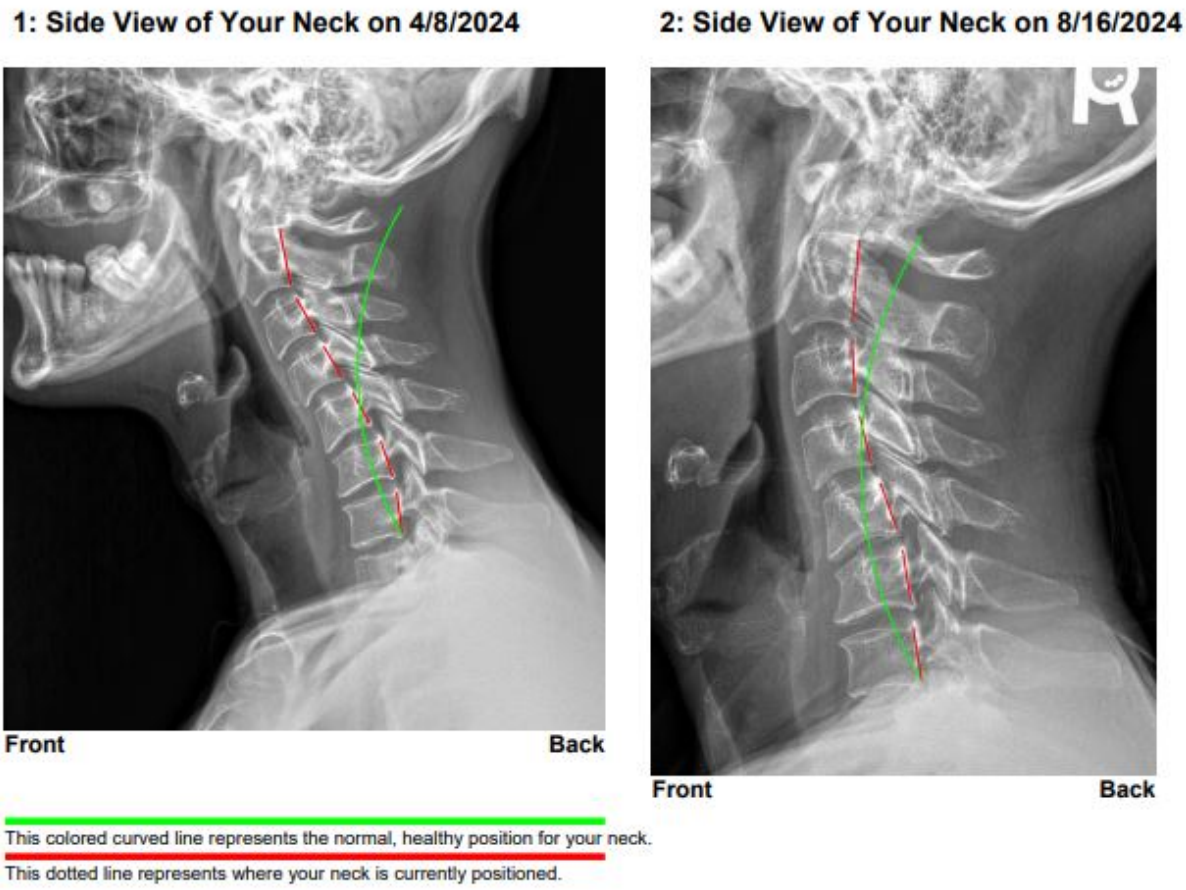
Clinical findings

The patient underwent standard Averio Functional Neurological Protocol testing upon presentation to the clinic. Such program testing includes pre- and post-spinal EMG, body composition testing, modified CTSIB (functional brain testing), vitals examination, bilateral blood pressure, bilateral weight testing, bilateral pulse oxygen, breath test, salivary nitrogen oxide test, patient-reported symptom analysis, and post-spinal radiographic review. Other measures used in this case included pre- and post-analysed spinal radiographs, blood analysis, and provoked urine analysis for total toxicity (i.e., heavy metals, environmental toxins, and mycotoxins).

These tests revealed severe abnormal cervical spine alignment, specifically a loss of 109% of the normal curve with severe anterior head carriage and severe ligament instability. (Figure 2) The patient presented with:

- 5.0mm transitional instability C3-C4
- 22.4° wedging instability C3-C4
- 3.6mm transitional instability C4-C5
- 15.8° wedging instability C5-C6

Figure 2: Lateral neutral cervical radiographs pre/post



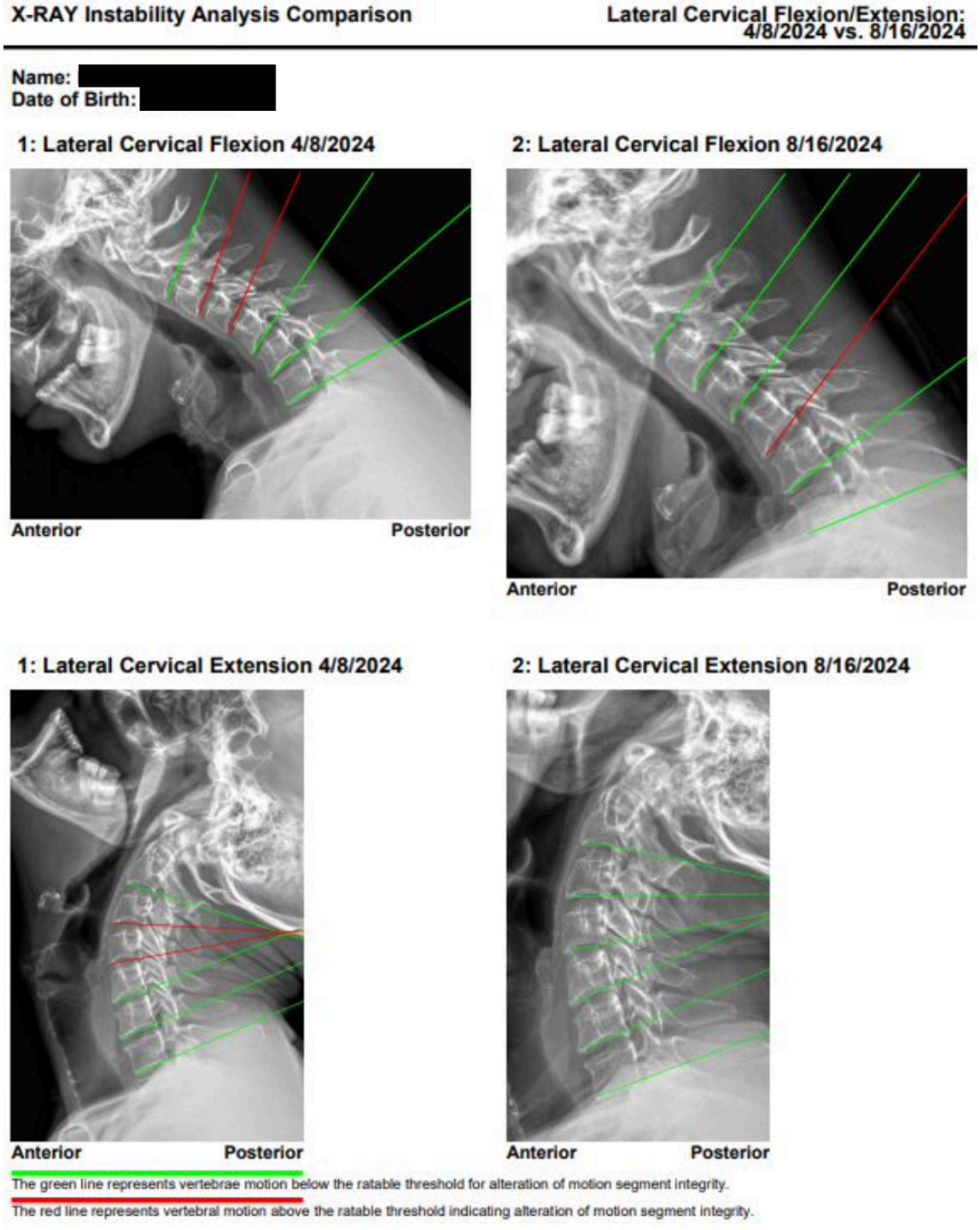
The location of spinal ligament instability or spinal damage is often relevant to the patient's symptomatology and diagnosis, as there are different spinal nerve roots in different areas of the spine, as well as other accessory neurology, such as specific ganglia or anterior or peripheral nerves that might become damaged with substantial spinal abnormalities. Different nerves communicate with different organs and different parts of the brain, so spinal damage will affect people differently depending on where the spinal damage is located, the extent of the damage, and what type of spinal damage it is.

Spinal damage at C3-C4 is the primary of this case with a large instability of 5.0mm (normal limits being at or under 3.5mm) noted between C3-C4 on a transition (Figure 3) meaning on a horizontal plane the vertebrae have moved away from each other putting abnormal stress and irritation on the cord and spinal nerve roots in that area in addition to a 22.4° wedging instability, which is again, a very large instability (normal limits being at or under 11°) that is negatively impacting the disc and lateral ligaments. It is possible and likely that the specific spinal damage in this case is affecting the superior cervical ganglion, a thickening of the central nervous system located at C2-C3. (24) One of the initial connections between the superior cervical ganglion and emotions was in the 1980s by Dr. Candace Pert, who discovered opioid receptors in the brain, and

she also started to notice that there were receptors for emotional nerve signals in many other parts of the body, not just the brain. (21) The superior cervical ganglion is one of these areas of very important receptors for the purpose of emotional and sympathetic regulation. (22, 23, 25)

This study, conducted on rabbits, demonstrated that the '*ganglia of the sympathetic nervous system (i.e., the superior cervical ganglion and several sympathetic branches of the vagus nerves) are part of a major mechanism of blood pressure regulation under acute experimental emotional/ painful stress*'. During the study, electrical stimuli were provided in order to induce emotional stress in the animals, and blood pressure, as well as metabolic activity in the superior cervical ganglion, were recorded. The stress-resistant animals showed low levels of metabolic activity in the superior ganglion and low rises in blood pressure; the animals showing significant emotional stress showed the reverse, with high levels of metabolic activity in the superior cervical ganglion and high blood pressure. (26)

Figure 3: Lateral flexion/extension cervical radiographs pre/post



Additional studies have been done on rabbits, showing similar findings in the superior cervical ganglion, and that this is a critical area of neurology in the mammalian stress response. (28, 29) There are also several studies connecting emotional stress and damage to the superior cervical ganglion and its long-lasting negative effects on arterial wall damage in the heart and heart failure. (27, 30)

This patient also presented with an abnormal enlargement of the heart into the right side of the lung field and a moderate reverse lumbar curve. From a Chiropractic perspective the enlargement of the heart is likely connected to spinal degeneration, specifically the stress and strain on the right and left vagus nerves from the abnormal anterior head carriage as well as the very likely compromise of the superior cervical ganglion from the spinal ligament instability at C3-C4; these are all nerve pathways critical to the normal function of the heart. (27, 30 - 35)

In addition to the above, the patient presented with abnormal brain tests (modified CTSIB), abnormal spinal EMG, severe toxicity specifically in the class of mycotoxins, severely low body water as clinical dehydration, and was hypotensive. He also had omega-3 fatty acid deficiency, scoring 3.2% by weight. Normal for adults is > 8%.

Subluxation was found at every level of the cervical spine. Severe ligament instability was a chief concern, as the American Medical Association lists a single area of spine ligament instability as a 25-28% whole-body impairment rating on the DRE class IV impairment rating. This patient had four areas of significant ligament instability. The impairment rating was high.

Management

The patient was recommended an Averio weeklong program every 4 months until his spinal damage was reversed. This program uses the Averio Functional Neurological Technique (Averio FNT) as its primary foundational Chiropractic treatment in combination with supportive regenerative therapy modalities and functional whole-food nutrition.

During this patient's first week-long program, forty-eight Averio FNT Chiropractic adjustments were delivered via sustained-contact, low-force adjustments. The cervical spine was the main area of this subluxation-based Chiropractic care with the aim of stimulating a repair of the abnormal ligaments in the cervical spine through reversing neurological Chiropractic subluxations between the brain and the damaged areas. Secondary goals included repairing the alignment of the neck back towards normal limits so that the vagus nerves could function without mechanical interference. Tertiary goals included reversing the nutritional deficiencies and toxicology concerns with targeted whole-food nutritional and herbal protocols.

Additional care recommendations were:

- Whole food, anti-inflammatory dietary recommendations
- Spinal and functional neurological exercises
- Active and passive motion therapies
- Hot and cold therapies include ice massage, hot water/cold plunge, and contrast therapy
- Photobiomodulation class 2 laser protocols
- Nutritional therapy protocols include whole food and minimally processed supplementation.

Outcomes

Following The First Week-long period of concentrated Chiropractic care:

The patient demonstrated remarkable changes following his initial weeklong program in April 2024. Objective structural measures revealed a 77% improvement in head-to-shoulder alignment

and a 323% improvement in cervical curvature, shifting from a reversed curve toward a near-normal cervical spinal curve. Segmental analysis of digitally analysed spinal radiographs showed dramatic gains, including a 971% improvement toward normal alignment at C3–C4, a 610% improvement at C4–C5, and a 123% improvement at C1. Notably, the patient's height increased by three-quarters of an inch, 2cm, between Monday and Friday of their his week of concentrated Chiropractic care, showing a measurable postural correction.

Subjectively, the patient reported a marked improvement in mental clarity and a reduction in depressive symptoms by the end of the week, further reinforcing the significance of these structural and functional changes on the nervous system. Patient reports a complete elimination of low back and hip pain by the end of the first week-long program of concentrated Chiropractic care.

Following the second week-long period of concentrated Chiropractic care:

The patient completed his second Averio weeklong program of concentrated Chiropractic care in August 2024 (four months following his first weeklong program). The patient received 53 spinal chiropractic adjustments using the Averio FNT adjusting technique of sustained contact, low-force spinal contacts.

The patient noted significant improvements in his modified CTSIB (functional brain testing for balance and fall risk), with an improvement of 19% in proprioception, an improvement of 10% in vision, and an improvement of 33% in vestibular function. It is also relevant to note that a decrease of 15% in overall standard brain function was noted, and it is speculated that this is likely a normal finding due to the amount of tissue regeneration that had to occur for the various areas of ligament instability to be repaired and the extent to which that amount of tissue repair could have on the overall central nervous system.

On post-radiographic analysis we noted significant improvements in his spinal ligament instability with a reversal of the 5.0mm ligament instability at C3-C4, with the post-radiographic reading at this level indicated at 1.4mm, which is well below the limits (3.5mm) for cervical ligament instability. Additionally, the 3.6mm ligament instability at C4-C5 reversed to a post-radiographic reading of 1.9mm, again, well below the limits for cervical ligament instability as set out by the American Medical Association impairment guidelines. The wedging instability at C3-C4 remains largely unchanged, with a pre-reading of 22.2° and a post-reading of 20.4°, both of which still indicate wedging spinal ligament instability at this level.

Additionally, following the second weeklong program of concentrated Chiropractic, a post-lateral lumbar radiograph was taken, and the patient's reverse lumbar curve had been repaired, showing a 109.4% improvement in lumbar curve from a curve of -26.7° to a -55.9° curve (-40° is the ideal normal).

Figure 5: Lateral lumbar radiographs pre/post

Subjectively, the patient reports that less than 10% of his thoughts during the day are negative and that he does not feel depressed anymore. He also reported better quality and duration of sleep, less fatigue during the day, and no remaining neck and shoulder stiffness, and reduced episodes of hand and arm numbness and tingling. The patient's low back and hip pain have not returned since the first weeklong program of concentrated Chiropractic care.

Discussion

Cse reports often tell a story of how the body heals and repairs as a system, as well as breaks down as a system. When objective tests are conducted, multiple areas of damage are typically found. Most chronic patients will present with multiple levels of degeneration in their spine, abnormal functional brain tests, toxicity burdens, deficiency burdens, and infections (bacterial or viral) burdens because each of these systems is intrinsically linked together.

As an example, in this case the damage in the cervical spine from the multiple head traumas is likely the cause of the enlargement of the heart and the deficiency in the immune system and detoxification system that leads to the toxicity burden. However, if all you tested was the toxicity burden and you missed the cervical damage, the patient could never return to normal limits because the basis of human physiology is that the central nervous system controls and regulates all other systems to a cellular levels, so if a patient is left with spinal damage and Chiropractic subluxation, there will be abnormal function in other system irregardless of other medical or healthcare interventions.

This case highlights the profound impact Chiropractic care can have on an individual's Quality of Life, particularly in the context of major depression. Over the course of care, the patient experienced a transformation that enabled him to return to work, regain normal daily function, and, most importantly, re-engage with his family as a present and caring father and husband. These changes reflect not only the alleviation of depressive symptoms but also the restoration of his sense of purpose and connection to those around him.

From a clinical perspective, this case suggests that when individuals are able to access consistent and comprehensive Chiropractic care, meaningful improvements may occur more quickly and with greater depth. The patient's recovery underscores the potential role of subluxation-based Chiropractic care in influencing neurological and physiological processes that may underpin mood disorders. While the exact mechanisms are still being explored, improved nervous system function through Chiropractic adjustments may help reduce stress responses and enhance overall well-being, creating an environment conducive to recovery.

Conclusion

It is important to acknowledge the limitations of this case report. The observations are based on a single individual's experience rather than a controlled group, and thus cannot be generalised without caution. However, this outcome highlights the need for further clinical trials investigating the effects of concentrated Chiropractic care on mental health conditions such as major depression. Expanding research in this area would help to clarify the relationship between Chiropractic and mental health outcomes, and potentially offer new avenues for care.

In reflecting on this case, it is evident that Chiropractic care has the capacity to impact lives in profound ways. The patient's journey from dysfunction and despair to restored health and connection illustrates the importance of continued research and access to care for individuals facing similar challenges.

Avery Martin
BS, DC CCEP
The Averio Institute

Amarjit Dhaliwal
BS, DC
The Averio Institute

Jeffrey Clark
DC
The Averio Institute

Ruth Postlethwaite
BBiomedSc
Writer, ASRF

Clare McIvor
BBus(Admin),
GD Comms(ProfWrit,Edit),
GD(Psych)(Cand)
Writer, ASRF

Sarah Kotlerman
BS, DC, NTP
The Averio Institute
drkotlerman@averiohealth.com

Cite: Kotlerman S, Martin A, Clark J, Dhaliwal A, Postlethwaite R, McIvor C. Reversal of cervical spinal ligament instabilities and severe abnormal cervical spine alignment in concurrence with improved sleep, pain, and mental and emotional function in a 44-year-old male with chronic Major Depression Symptoms: A case report. Asia-Pac Chiropr J. 2025;6.2. www.apcj.net/Papers-Issue-6-2/#KotlermanDepression

References

1. World Health Organization. (2023). Depression. https://www.who.int/news-room/fact-sheets/detail/depression
2. Malhi, G. S., & Mann, J. J. (2018). Depression. The Lancet, 392(10161), 2299-2312. https://doi.org/10.1016/S0140-6736(18)31948-2
3. Haavik, H., & Murphy, B. (2012). The role of spinal manipulation in addressing disordered sensorimotor integration and altered motor control. Journal of Electromyography and Kinesiology, 22(5), 768-776. https://doi.org/10.1016/j.jelekin.2012.02.012
4. Breit, S., Kupferberg, A., Rogler, G., & Hasler, G. (2018). Vagus nerve as modulator of the brain-gut axis in psychiatric and inflammatory disorders. Frontiers in Psychiatry, 9, 44. https://doi.org/10.3389/fpsyt.2018.00044
5. Kemp, A. H., Quintana, D. S., Gray, M. A., Felmingham, K. L., Brown, K., & Gatt, J. M. (2010). Impact of depression and antidepressant treatment on heart rate variability: A review and meta-analysis. Biological Psychiatry, 67(11), 1067-1074. https://doi.org/10.1016/j.biopsych.2009.12.012
6. Haavik, H., Niazi, I. K., Holt, K., Murphy, B., & Türker, K. S. (2017). Effects of a single session of chiropractic care on strength, cortical drive, and spinal excitability in stroke patients. Scientific Reports, 7, 11120. https://doi.org/10.1038/s41598-017-11310-5
7. Zhang, J., Dean, D., Nosco, D., Strathopulos, D., & Floros, M. (2006). Effect of chiropractic care on heart rate variability and pain in a multisite clinical study. Journal of Manipulative and Physiological Therapeutics, 29(4), 267-274. https://pubmed.ncbi.nlm.nih.gov/16690380/
8. Dionigi G, Chiang FY, Rausei S, Wu CW, Boni L, Lee KW, Rovera F, Cantone G, Bacuzzi A. Surgical anatomy and neurophysiology of the vagus nerve (VN) for standardised intraoperative neuromonitoring (IONM) of the inferior laryngeal nerve (ILN) during thyroidectomy. Langenbecks Arch Surg. 2010 Sep;395(7):893-9. DOI 10.1007/s00423-010-0693-3. Epub 2010 Jul 23. PMID: 20652584.
9. Kronsteiner B, Carrero-Rojas G, Reissig LF, Moghaddam AS, Schwendt KM, Gerges S, Maierhofer U, Aszmann OC, Pastor AM, Kiss A, Podesser BK, Birkfellner W, Moscato F, Blumer R, Weninger WJ. Characterization, number, and spatial organization of nerve fibers in the human cervical vagus nerve and its superior cardiac branch. Brain Stimul. 2024 May-Jun;17(3):510-524. DOI 10.1016/j.brs.2024.04.016. Epub 2024 Apr 25. PMID: 38677543.
10. Perez EA, Woodroffe RW, Park B, Gold C, Helland LC, Seaman SC, Hitchon PW. Cervical alignment in the obese population following posterior cervical fusion for cervical myelopathy. Clin Neurol Neurosurg. 2022 Jan;212:107059. doi: 10.1016/j.clineuro.2021.107059. Epub 2021 Nov 25. PMID: 34861469.
11. Furness JB, Callaghan BP, Rivera LR, Cho HJ. The enteric nervous system and gastrointestinal innervation: integrated local and central control. Adv Exp Med Biol. 2014;817:39-71. DOI 10.1007/978-1-4939-0897-4_3. PMID: 24997029.

12. Bonaz B. Enteric neuropathy and the vagus nerve: Therapeutic implications. Neurogastroenterol Motil. 2025 Aug;37(8):e14842. DOI 10.1111/nmo.14842. Epub 2024 Jun 14. PMID: 38873822; PMCID: PMC12287902.

13. Grabauskas G, Owyang C. Plasticity of vagal afferent signaling in the gut. Medicina (Kaunas). 2017;53(2):73-84. DOI 10.1016/j.medici.2017.03.002. Epub 2017 Apr 10. PMID: 28454890; PMCID: PMC6318799.

14. Uneyama H, San Gabriel A, Kawai M, Tomoe M, Torii K. Physiological role of dietary free glutamate in the food digestion. Asia Pac J Clin Nutr. 2008;17 Suppl 1:372-5. PMID: 18296382.

15. Scheer JK, Tang JA, Smith JS, Acosta FL Jr, Protopsaltis TS, Blondel B, Bess S, Shaffrey CI, Deviren V, Lafage V, Schwab F, Ames CP; International Spine Study Group. Cervical spine alignment, sagittal deformity, and clinical implications: a review. J Neurosurg Spine. 2013 Aug;19(2):141-59. DOI 10.3171/2013.4.SPINE12838. Epub 2013 Jun 14. PMID: 23768023.

16. Hashimoto K, Aizawa T, Kanno H, Itoi E. Adjacent segment degeneration after fusion spinal surgery-a systematic review. Int Orthop. 2019 Apr;43(4):987-993. DOI 10.1007/s00264-018-4241-z. Epub 2018 Nov 23. PMID: 30470865.

17. Rubio-Haro R, DE Andrés-Serrano C, Noriega González DC, Bordes-García C, DE Andrés J. Adjacent segment syndrome after failed back surgery: biomechanics, diagnosis, and treatment. Minerva Anestesiol. 2022 Apr;88(4):282-292. DOI 10.23736/S0375-9393.21.15939-5. Epub 2021 Oct 28. PMID: 34709016.

18. Kim YH, Ha KY, Ahn J, Park HY, Chang DG, Lim JH, Kim SI. Risk factors for mechanical complications after fusion extension surgery for lumbar adjacent segment disease. Eur Spine J. 2024 Jan;33(1):324-331. DOI 10.1007/s00586-023-07880-5. Epub 2023 Aug 10. PMID: 37558910.

19. Ma X, Du Y, Wang S, Ma J, Wang T, Kuang M, Ma B. Adjacent segment degeneration after intervertebral fusion surgery by means of cervical block vertebrae. Eur Spine J. 2018 Jun;27(6):1401-1407. DOI 10.1007/s00586-017-5371-5. Epub 2017 Nov 10. PMID: 29127511.

20. Seok SY, Cho JH, Lee HR, Lee DH, Hwang CJ, Lee CS. Risk Factors for Worsening of Sagittal Imbalance After Revision Posterior Fusion Surgery in Patients With Adjacent Segment Disease. World Neurosurg. 2022 Feb;158:e914-e921. DOI 10.1016/j.wneu.2021.11.114. Epub 2021 Nov 30. PMID: 34861453.

21. Pert CB. The wisdom of the receptors: neuropeptides, the emotions, and bodymind. 1986. Adv Mind Body Med. 2002 Fall;18(1):30-5. PMID: 12523304.

22. Zhang R, Kranz GS, Zou W, Deng Y, Huang X, Lin K, Lee TMC. Rumination network dysfunction in major depression: A brain connectome study. Prog Neuropsychopharmacol Biol Psychiatry. 2020 Mar 2;98:109819. DOI 10.1016/j.pnpbp.2019.109819. Epub 2019 Nov 14. PMID: 31734293.

23. Gejman PV, Cardinali DP. Hormone effects on muscarinic cholinergic binding in bovine and rat sympathetic superior cervical ganglia. Life Sci. 1983 Feb 28;32(9):965-72. DOI 10.1016/0024-3205(83)90926-8. PMID: 6402631.

24. Mitsuoka K, Kikutani T, Sato I. Morphological relationship between the superior cervical ganglion and cervical nerves in Japanese cadaver donors. Brain Behav. 2016 Dec 29;7(2):e00619. DOI 10.1002/brb3.619. PMID: 28239529; PMCID: PMC5318372.

25. Lin YQ, Graham K, Bennett MR. Depression of transmitter release at synapses in the rat superior cervical ganglion: the role of transmitter depletion. Auton Neurosci. 2001 Apr 12;88(1-2):16-24. DOI 10.1016/S1566-0702(00)00287-3. PMID: 11474542.

26. Gorbunova AV. Autonomic ganglionic neurones in rabbits with differing resistance to emotional stress. Stress. 2000 Nov;3(4):309-18. DOI 10.3109/10253890009001136. PMID: 11342396.

27. Hao Z, Jiang X, Sharafeih R, Shen S, Hand AR, Cone RE, O'Rourke J. Stimulated release of tissue plasminogen activator from artery wall sympathetic nerves: implications for stress-associated wall damage. Stress. 2005 Jun;8(2):141-9. DOI 10.1080/10253890500168098. PMID: 16019605.

28. Portugalov VV, Goncharuk VD. O mekhanizme izmeneniĭ nervnykh kletok pri ostrom éksperimental'nom émotsional'nom stresse [Mechanism of changes in nerve cells in acute experimental emotional stress]. Biull Eksp Biol Med. 1981 Jun;91(6):745-8. Russian. PMID: 7196783.

29. Gorbunova AV, Kashtanov SI. Aktivnost' monoaminoksidazy v gangliiakh vegetativnoĭ nervnoĭ sistemy krolikov s raznoĭ ustoĭchivost'iu serdechno-sosudistykh funktsiĭ k émotsional'nomu stressu [Monoamine oxidase activity in autonomic ganglia of rabbits with differing resistance of cardiovascular functions to emotional stress]. Biull Eksp Biol Med. 1983 Oct;96(10):111-3. Russian. PMID: 6684958.

30. Li YL. Stellate Ganglia and Cardiac Sympathetic Overactivation in Heart Failure. Int J Mol Sci. 2022 Nov 1;23(21):13311. DOI 10.3390/ijms232113311. PMID: 36362099; PMCID: PMC9653702.

31. Pelz JO, Belau E, Menze I, Woost TB, Classen J, Weise D. Correlation between sonographic morphology and function of the cervical vagus nerves. Auton Neurosci. 2019 Sep;220:102552. DOI 10.1016/j.autneu.2019.05.004. Epub 2019 May 17. PMID: 31126827.

32. Topchieva EP. Electrical responses in individual neurons in intramural ganglia of frog heart to stimulation of vagus and sympathetic nerves. Fed Proc Transl Suppl. 1966 Sep-Oct;25(5):739-42. PMID: 5223549.

33. Smirnov VM. K analizu mekhanizmov raznonapravlennogo vliianiia bluzhdaiushchikh nervov na rabotu serdtsa [Analysis of the differing mechanisms of action of the vagus nerves on the work of the heart]. Kardiologiia. 1983 Oct;23(10):96-8. Russian. PMID: 6417389.

34. Booth LC, Saseetharan B, May CN, Yao ST. Selective efferent vagal stimulation in heart failure. Exp Physiol. 2024 Dec;109(12):2001-2005. DOI 10.1113/EP090866. Epub 2023 Sep 26. PMID: 37755233; PMCID: PMC11607613.

35. Hsueh HW, Chao CC, Lin YH, Tseng PH, Su MY, Hsieh ST. Neck triangle nerve enlargement in hereditary transthyretin amyloidosis correlates with changes in the autonomic, cardiac, and gastrointestinal systems. J Intern Med. 2024 Dec;296(6):495-509. DOI 10.1111/joim.20019. Epub 2024 Oct 22. PMID: 39436674.

Declarations

Patient consent was documented and is held by the lead Author.

All data with appropriate clinical commentary were provided by the lead author.

About the Case Report project

This Case Report is a part of the ASRF Case Report Project, a project designed to gather client studies from chiropractors and transform them into much-needed case reports, focused on the effects of chiropractic care on clinical presentations highly relevant to chiropractic, such as stress, immunity and adaptability.

This valuable project is made possible by the generous fundraising and contributions of ASRF supporters.

ASRF definition of subluxation

> *'A vertebral subluxation is a diminished state of being, comprising a state of reduced coherence, altered biomechanical function, altered neurological function and altered adaptability.'*

About the authors

Dr Sarah Kotlerman BS DC NTP is the Clinical Director for Averio Health Institute.

Dr Avery N. Martin BS DC is the founder of Averio Health Institute, now retired, and helps train and mentor the next generation of Doctors of Chiropractic.

Dr Amarjit Dhaliwal BS DC is a Clinical Manager at Averio Health Institute, assisting in the recommendation of labwork, assessment, and protocols.

Dr Jeffrey Clark DC is a Floor Doctor providing Chiropractic care and management of patients while onsite at Averio Health Institute.

Also by Dr Kotlerman

Kotlerman S, Martin A, Dhaliwal A, Clark J, Scheunemann Z, Postlethwaite R, McIvor C. Improvement in Atrial Fibrillation, Vision, Blood Pressure, and Energy in an 80-year-old male under Chiropractic care: A case report. Asia-Pac Chiropr J. 2025;6.1. www.apcj.net/Papers-Issue-6-1/#KotlermanAFib

Kotlerman S, Martin A, Pierce D, Postlethwaite R, McIvor C. Improvement in Hemiplegic Migraines, Drop Seizures, Sleep, and Quality of Life in a 23-year-old female undergoing concentrated Chiropractic care: A case report. Asia-Pac Chiropr J. 2024;5.2. apcj.net/Papers-Issue-5-2/#KotlermanAnxiety

Kotlerman S, Martin A, Pierce D, Postlethwaite R, McIvor C. Improvements in anxiety and suicidal ideation in a 14-year-old female undergoing a concentrated program of Chiropractic care. Asia-Pac Chiropr J. 2024;5.1. apcj.net/Papers-Issue-5-1/#Kotlermananxiety

Kotlerman S, Martin A, Carter M, Postlethwaite R, McIvor C. Improvement in sleep, mental health, heavy metal toxicity and adaptability concomitant with Chiropractic care in a 47-year-old female cancer-patient undergoing chemotherapy: A Case Report. Asia-Pac Chiropr J. 2024;4.4. apcj.net/Papers-Issue-4-4/#AverioChemotherapy

Kotlerman S, Martin A, Postlethwaite R, McIvor C. Chiropractic Management of an 18-year old female with lupus: A Case Report. Asia-Pac Chiropr J. 2021;2.3. URL apcj.net/paper-issue-2-5/#AverioLupus

Kotlerman S, Martin A, Postlethwaite R, McIvor C. Improvement in memory, balance and hearing in a 91-year-old male under chiropractic care: A Case Report. Asia-Pac Chiropr J. 2021;2.6. URL apcj.net/papers-issue-2-6/#AverioMemory

McIvor C, Postlethwaite R, Kotlerman S, Martin A. Depression, ligament Instability and chronic pain improvement concomitant with a course of concentrated Chiropractic Care: A Case Report. Asia-Pac Chiropr J. 2023;3.3 URL apcj.net/Papers-Issue-3-3/#AverioDepressionChronicPain

McIvor C, Postlethwaite R, Martin A, Kotlerman S. Improved fertility outcomes following multiple IVF failures in a patient with Chronic Fatigue Syndrome and Hashimoto's Disease: A Case Report. Asia-Pac Chiropr J. 2023;4.1 URL apcj.net/Papers-Issue-4-1/#AverioHashimoto

Kotlerman S, Martin A, Carter M, Postlethwaite R, McIvor C. Reversal of Cervical Artery Stenosis and improvement in physical functioning in a 78-year-old stroke survivor under concentrated Chiropractic care: A Case Report. Asia-Pac Chiropr J. 2024;4.3. apcj.net/Papers-Issue-4-3/#AverioStenosisReversal

ASRF
CASE REPORT PROJECT