

Spine To Nerve Connection



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There still seems to be a wide-spread disconnect, even within regulatory bodies of healthcare, surrounding the chiropractic impact on the function on the nervous system. In this article, we are going to review some of the most interesting and relevant literature connecting the spinal system to the nervous system, for the purpose of creating a literature based foundation for communication with patients, the general public, medical providers, politicians, and regulatory figures.

Anatomy

Your spinal system is a complex network of vertebra (i.e., bones), discs (i.e., thick cartilage between the bones), ligaments (i.e., connective tissues that surround every aspect of the spinal bones and discs), arteries (i.e., running side of the spine and directly in front of your spine), cerebral spinal fluid (i.e., liquid inside the spine that protects nerves and supports nutrition and waste pathways) and nerves (central nervous system is inside your spine, spinal nerve roots and vagus nerves outside of your spine).

From a nerve perspective, there are two parts of your central nervous system which are located inside of your spine: the lower part of your brainstem is inside of C1, and the entirety of your spinal cord is located inside C2 (the second bone of the spine) through L1-L2 (the first and/or second bone of the lumbar spine). Your central nervous system is important because this is the system of your body that regulates all other systems, including how tissues repair and regenerate following physical or chemical trauma.²

Additionally, the vagus nerves (cranial nerves ten) exit the inside of the spine at brainstem level, above the level of C1, and run directly in front of C1 posterior to the carotid sheath as they travel down the front of the spine connecting the brain with the heart and many organs.^{7,8} Of equal importance are the C1 nerves (being the nerve root located between the C1 and C2 vertebra of the spine) which have been described as the body's EMT system, responsible for blood pressure as well as "physiological processes ranging from neuroendocrine responses to infection

and inflammation, glucose homeostasis, reproduction, breathing, thermoregulation, hypothalamic-pituitary axis (HPA) -mediated stress responses, and food consumption."¹³ These studies show that cardiac pain, organ referral pain (which can commonly present as back, neck and/or jaw pain) and angina is most often vagus nerve dysfunction that is transmitted to the brain through the C1-C2 spinal segments.^{4,9} Another fascinating study shows that the C1 nerves mediate inflammation directly through altering the function of the immune system both within state of pathology such as kidney disease and within normal homeostasis and physiology.^{5,6} The critical importance of the nervous system to human function and adaptability is likely why the notochord (which becomes the vertebral discs and spinal joints) and neural ectoderm (which becomes the brain, spinal cord and peripheral nerves) are considered the first tissue-structures to form in embryonic development.^{1,2}

Your spinal system is also designed to support human movement; flexion, extension, lateral movement and twisting which adds complexity to the spinal system and how it is connected with the nerves inside and outside of it, which does not exist in the skull-brain connection as there is limited movement in that part of human anatomy. Spinal movement is also more than just convenient for life. Spinal movement leads to electrical nerve signals (mechanoreception and proprioception) that are constantly being sent from the spinal cord to the brain for the purpose of letting the brain know where the spine is in space as well as help keep the brain functioning normally and tissues healthy. This is one of the reasons why when a person has a sedentary lifestyle with limited or no movements, their brain and their spine will become abnormal and dysfunctional.

Damage to the spinal system such as ligament instability, misalignment of the spinal system compromising normal movement of the spine or causing neural-arterial compression, and/or abnormal inflammation caused from an unhealthy spinal system all have the very real potential to negatively affect normal nerve function.^{3,27,28}

Chiropractic Literature

Now that some of the basics of anatomy regarding your spinal system are understood, it will be easier to understand how chiropractic care might change and improve neurological function with a myriad of health benefits as a byproduct.

A 2015 study in the *Journal of Experimental Brain Research* showed that a single chiropractic treatment improved cortical drive (measured via SEMG on the maximum voluntary contraction of planar flexors) and reduced muscle fatigue compared to the control group.¹⁰

A 2016 study published in the *Journal of Manipulative and Physiological Therapeutics* showed improvement in sensorimotor function and multiple sensory integration in elderly adults (through testing static posture, ankle joint position sense, sound-induced flash illusion and choice stepping time) following three chiropractic adjustments.¹⁵ Sensorimotor function is a function of the central nervous system.¹⁶

A 2016 study also published in the *Journal of Manipulative and Physiological Therapeutics* showed very interesting findings in a cohort of women, some who were in their second trimester of pregnancy and some who were not pregnant. The women who received chiropractic care while pregnant showed an increase in elevator hiatal area indicating relaxation of the pelvic floor which was confirmed with trans-perineal ultrasound. This relaxation of the pelvic floor muscles did not occur in the non-pregnant cohort which indicates that chiropractic care is not only changing how the brain regulates muscles, but that the change is intelligent to specific life stages.¹⁷ This critical understanding of chiropractic care which works with the body towards normal function, differs greatly from pharmacology which is often dose dependent towards a particular outcome regardless of whether that outcome is helpful or harmful to the body.

A 2016 study published in the *Journal of Neural Plasticity* showed that a single chiropractic adjustment improved somatosensory processing at the cortical level, specifically within the prefrontal cortex as verified on 62-lead brain EEG.¹⁹ This study shows untapped potential for chiropractic care in the management and reversal of mental health problems as the prefrontal cortex is one of the primary centers of the brain responsible for emotional regulation, decision making, social cognition, and psychopathology.²⁰

A 2018 study published in the *Journal of Electromyography and Kinesiology* showed that a single chiropractic treatment reduces the cortical silent period and increases the threshold for motoneurons excitability in the low limb muscles.¹¹ What this means in lay terms is that a single chiropractic adjustment is showing a positive effect on the brain's ability to regulate leg muscle function.

Additionally, this non-chiropractic study published in the medical journal *Clinical Neurophysiology* in 2020 reports that the ability to modulate motoneuron excitability is "profoundly important for the clinical diagnosis and treatment of neurological disorders".¹³

A 2019 meta-analysis published in the journal *Headaches* found that multiple studies indicated that chiropractic treatments reduced migraine days as well as reducing pain and intensity.¹⁸

A 2020 study published in the journal *ACTA Biomedica* indicates that chiropractic care and adjustments help with the regulation of the autonomic nervous system at both a peripheral and central nervous system level and could be considered an "effective therapy for major depression."²¹

Several studies published in 2019 and 2020 in the journals *Brain Science and Scientific Reports* indicate that a single session of chiropractic care increased the amplitude of the N30 SEP peak (i.e. brain function) as well as the patient's functional connectivity between different parts of the brain in chronic stroke patients as verified by brain EEG.^{22,23} Additionally, increases in muscle strength were noted in connection with increases in the V-wave and H-reflex, further indicators of chiropractic care changing central nervous system function and regulation.²⁴

A 2021 study published in the *European Journal of Pain* discussed that neck and back pain are the primary cases of disability worldwide, accounting for more than 10% of the total years lived with disability. The study goes into reviewing the mechanisms of chiropractic care and the likelihood of chiropractic inhibiting pain through changing function in the spinal cord.¹⁴

A 2024 study published in the *Journal of Brain Science* showed that changes in brain waves following chiropractic care lead to improved overall quality of life, including significant improvement in sleep as well as reduction in anxiety, depression, fatigue and pain.²⁵

A 2024 study published in the medical journal *Cureus* discusses the "multifaceted influence of chiropractic care on processes of the neuroendocrine-immune system and integrated physiology" including functional improvements in blood pressure, heart rate variability, and sleep following chiropractic care to the spinal system.²⁶

In conclusion, there is good published scientific evidence that chiropractic adjustments positively affect the function of the nervous system through treatment of the spinal system. Hopefully, this data can become regular discussion points within chiropractic offices so that someday in the near future, the spine to nerve connection can become a basic understanding for the general public, medical providers, politicians, and regulatory figures.

See page 24 for citations for this article.