

Efficacy of Chiropractic Adjustment Stimulation of Autonomic Nervous System

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Abstract

Can the Chiropractic adjustment influence visceral diseases³ such as hyper- and/or hypothyroid? This review takes a look at the neural stimulation created by an adjustment and its affect in visceral organs; specifically the thyroid. Beginning with the normal function of the thyroid followed by dysfunction of the thyroid then reviewing the sympathetic and parasympathetic stimulation to find a connection between the endocrine and nervous systems to evaluate if neural stimulation can create change in the activity of the thyroid. Then finally introduce Chiropractic adjustments as the neurological therapy to increase or decrease thyroid activity naturally assisting hormonal balance.

Key Words: *chiropractic adjustment; sympathetic nervous system; parasympathetic nervous system; hyperthyroid; hypothyroid*

³ Neuroanatomy of the ANS;

Introduction

The nervous system controls the entire body. It is the primary system in the body; it controls all other systems in the body, including endocrine system. The nervous system tells the brain everything that the body sees, feels, and senses when it hurts. It also stimulates changes in the body such as making the skin turn red when it's scratched, starting the chain reaction of processes known as inflammation. If the nervous system is what causes inflammation of the skin it makes sense it also causes inflammation in the muscles and visceral organs of the body. The nervous system creates inflammation in the body whether it is in a specific area or throughout the body, the nervous system can also take away or reduce the inflammation. For example, if a patient has a goiter on the thyroid it is caused by over stimulation and/or inflammation, and some component must be contributed by the nervous system.. Thyroid disease is becoming more common in the U.S. The thyroid controls metabolism and other processes in the body via hormones, but there is a neurological component as well. The neurological component to the thyroid is how chiropractic adjustments can affect thyroid function.

Neurological components innervating the thyroid include the recurrent laryngeal nerve, superior laryngeal nerve and pharyngeal arch.¹⁰

Discussion

The thyroid is an endocrine gland crucial to proper metabolic function. It is located in the anterior part of the neck, below the larynx on either side and anterior to the trachea,¹⁹ some describe it as a bow tie shape and others described as a butterfly shape.

The thyroid is the largest of all the endocrine glands weighing approximately 15-20

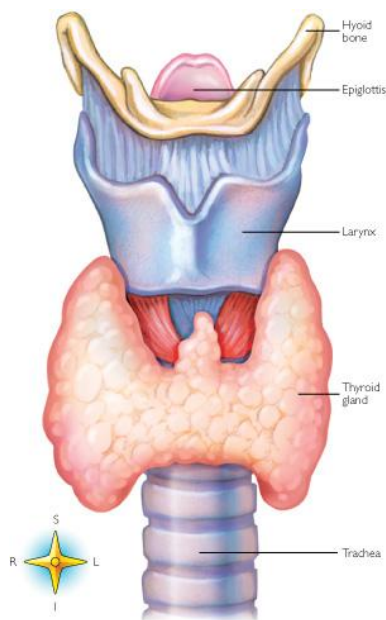
¹⁰ Cecil

¹⁹ Guyton and Hall Textbook of Medical Physiology

grams in the adult.¹⁹ The thyroid gland secretes thyroid hormones but lack of iodine can interfere with thyroid hormone production.¹⁹ This is one known contributing cause of a goiter. The gland receives innervations from both sympathetic and parasympathetic divisions of the Central Nervous System.

It is theorized adjusting the sympathetic or parasympathetic could increase or decrease neurological afferent and efferent stimulations to the brain and body. Therefore a condition of hypothyroidism could in theory be treated by adjusting the corresponding areas of the spine to increase input and increase neurological stimulation to the thyroid. The innervation of the thyroid occurs through looping of the superior laryngeal⁸ nerve with connections to the lateral cervical sympathetic chain.¹ The recurrent laryngeal nerve is also imperative to thyroid function and can receive damage during anterior neck/throat

¹⁹ Guyton and Hall text book of Medical Physiology; ⁸ The Anatomical Relationship of the Superior Laryngeal Nerve to The Thyroid Gland.; ¹ Thyroid Hormone modulates glucose production via a sympathetic pathway from the hypothalamic paraventricular nucleus to the liver; ⁹ Vein Wrapping Technique; ⁴ The Thyroid and its Diseases; ¹⁰ Goldman's Cecil Medicine



surgery.⁹ Thyroid function is hormonally controlled by the hypothalamus and pituitary gland. The hypothalamus releases TRH (thyroid releasing hormone) to the anterior pituitary, releasing TSH (thyroid stimulating hormone), created from thyrotrophic cells, which is then transported in circulation to the thyroid gland, causing secretion of T3 (triiodothyronine) and T4 (tetraiodothyronine or Thyroxine), thyroid hormones¹⁰. Ideally thyroxine makes up 93% of the thyroid hormones secreted by the thyroid and triiodothyronine makes up the other 7% of hormones secreted.¹⁹ The thyroid hormone, secreted by follicles, creates a negative feedback system with the hypothalamus and pituitary gland. Primary hypothyroidism (myxedema) thyroid dysfunction presents with decreased T3/4 and increased TSH.

Secondary hypothyroidism, also known as, central hypothyroidism is a dysfunction of thyroid gland decrease of TSH via pituitary or hypothalamus disorders.

Grave's disease is a form of hyperthyroidism caused by an autoimmune disorder. The diagnosis of Grave's disease is easily made by the observation of eye signs⁴ such as bulging known as exophthalmos, a goiter, increased metabolism, weight loss among other symptoms such as seizures, tremors, hyperreflexia, ankle clonus and positive babinski's sign indicating neuropathy.¹³ Other signs of hyperthyroidism include warm smooth skin, tachycardia and atrial fibrillation

Hashimoto's thyroiditis is more a complicated disorder; there is over stimulation of an under active thyroid. Therefore a neurologic intervention should consist of not just

¹³ Bates; ⁴ The Thyroid and its diseases

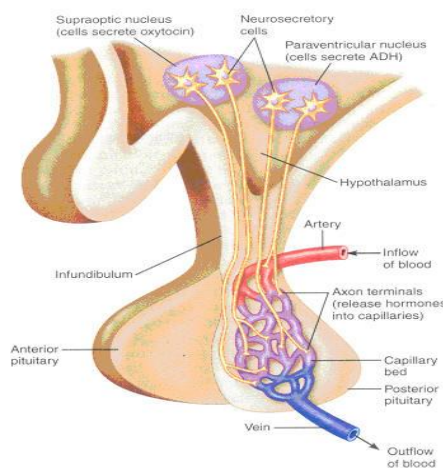
increasing stimulation of the sympathetic nervous system, but the parasympathetic system should be stimulated instead. Hashimoto's thyroiditis is the result of a long standing auto-immune disease usually diagnosed with low thyroid hormone or auto-antibodies also known as thyroid peroxidase thyroglobulin antibodies.¹¹ A goiter, infiltration of lymphoid cells into the thyroid gland,⁴ can manifest from hyperthyroidism or hypothyroidism and is one of the symptoms of Hashimoto's disease as well as myxedema, abdominal weight gain, decreased metabolism, constipation, fatigue, dry coarse skin with cold intolerance.¹³ The signs of a patient with under active thyroid include bradycardia, peripheral neuropathy, carpal tunnel syndrome, mixed memory, and the loss of the lateral one third of the eyebrow. Profound and prolonged untreated hypothyroidism can lead to seizures and/or coma.¹²

The hypothalamus, a collection of nuclei and axonal tracts, regulates visceral autonomic activity¹⁵ either through descending pathways to nuclei in the brainstem reticular formation and spinal cord or through the pituitary gland, stemming from the base of the hypothalamus by a stalk and receives axonal nervous innervations from the hypothalamus, to influence autonomic function hormonally. There are three major zones formed sagittally within the hypothalamus including lateral and medial as well as the periventricular zone.¹⁷ Numerous tracts and nuclei¹⁷ are within or descending from the

¹¹ Pathology Secrets;¹² Clinical Neurology; ¹⁵ Netter's Atlas of Neuroscience;³ Neuroanatomy of the ANS

¹⁷ Basic Clinical Neuroscience; ³ Basic and Clinical Anatomy of the Spine, Spinal Cord and ANS

hypothalamus including dorsal longitudinal fasciculus, medial forebrain bundle (also has ascending fibers), intermedialateral from the lateral horn, and mammillotegmental³ but their boundaries are not well known.¹⁷ These nuclei receive input extensively from higher centers including the hypothalamus³ and the tracts descend or ascend transferring input and output synapses. The hypothalamic regulatory hormones reach the anterior pituitary indirectly via small neurons mostly in the tuberal region that produce the hormones followed by the regulatory hormones entering the hypophyseal portal system,¹⁷ a vascular system from hypothalamus to the anterior pituitary. Therefore the hormones are transported from the hypothalamus to the anterior pituitary via the hypophyseal portal system, derived from the medial eminence³ and the infundibulum, all of which are parts



of the Central Nervous System.

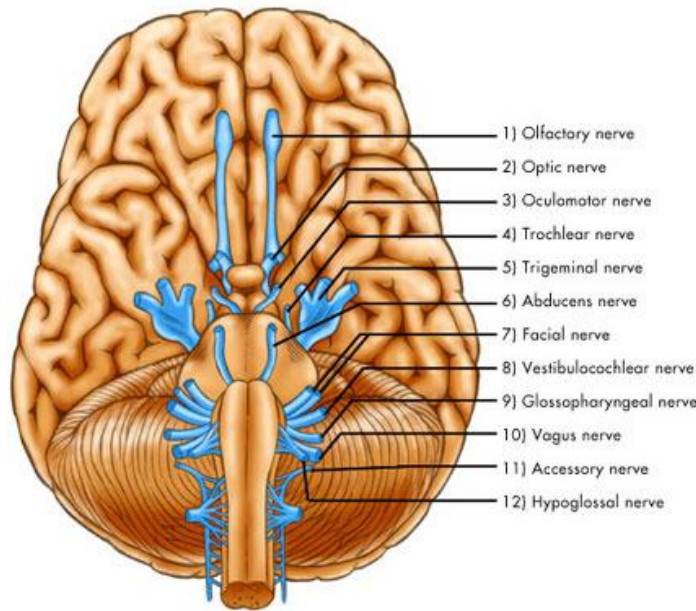
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The central nervous system (CNS) composed of the brain and spinal cord is defined as the integrating and controlling division of the entire nervous system by receiving input from internal and external environments and provides output after

¹⁸ <http://blog-imgs-26.fc2.com/i/g/n/ignatia/20080805202415.jpg>

interpreting the information received.¹⁷ The remaining nerves outside the CNS are referred to as the peripheral nervous system (PNS) composed of cranial nerves, spinal nerves, and autonomic nerves with their ganglia.¹⁷ The primary mechanism of CNS is regulating ANS (autonomic nervous system) function, innervating viscera, smooth muscle contractions and glandular secretions³, from visceral somatic sensations, therefore it is reflexogenic. “The ANS is defined as the self-regulating visceral, motor (efferent) portion of the nervous system”^{3, 17} The ANS has an afferent component as well as an efferent component, therefore being able to communicate via the nervous system back and forth from viscera to the ANS and CNS to viscera. Efferent signals activate organ systems including the glandular system (exocrine and endocrine).³ Recent research has shown that the autonomic nervous system can affect the body’s immune activity via lymphoid tissue.³

³ Basic Clinical Anatomy of the Spine, Spinal Cord, and ANS; ¹¹ Pathology Secrets

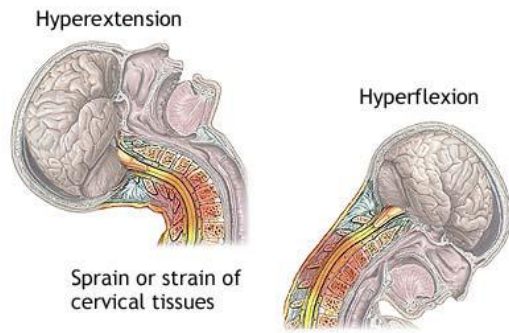


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Environmental stimuli, such as a whiplash injury, are transmitted via the afferent connection. When an organ/gland functions abnormally because of pathology or injury,¹¹ visceral afferent neurons conduct sensation to spinal cord segments supplying involved viscera. The nervous system responds with efferent signals to affect viscera with the overall goal being to maintain homeostasis. In the case of a whiplash injury, symptoms of irritation of the sympathetic nerve supply in the neck occurs, it is not possible to determine the extent of soft tissue damage, but tenderness swelling, spasm, and restricted motion occur regularly. Irritation of the sympathetic nerve supply gives rise to vasoconstriction of the arteries that are supplied by sympathetic fibers and is indicated by a wide blood pressure variation between arms, most joint dysfunction from whiplash are mostly cervical subluxations (joint dysfunction) followed by C7-T1.³

¹⁶ http://www.bayareaneurosurgery.com/anatomy/anat_br_nerves.jpg

³ Basic and Clinical Anatomy of the Spine, Spinal Cord and the ANS



ADAM.²⁷

The ANS is made up of sympathetic and parasympathetic systems stemming from preganglionic neurons in the CNS. Myelinated axons connect the preganglion to dendrites of post ganglionic neurons in the peripheral ganglia. The ANS is composed of sympathetic and parasympathetic divisions.³ These divisions are described as separate, however fibers of both divisions are tonically active, and do not function as either “on” or “off”.³ Many tissues have dual innervations, a balance of activity exists between the division fibers in these cases, such that when one division increases the other division decreases its activity. The CNS has the ability to alter this balance, and interact with the somatic nervous system and different hormonal systems to stabilize the internal environment and maintain homeostasis during normal and emergency situations. The innervations of autonomic effectors is organized differently than the innervations of skeletal muscle; the axons of alpha and gamma motor neurons course directly to skeletal muscles, the innervations of ANS effectors requires a chain of two neurons called the

²⁷ <http://www.spinalhealthgroup.com/images/spinal-chart.jpg>

pre-ganglionic and postganglionic neurons.³ The cell body of the pre-ganglionic neuron always is located in the CNS, either in the cord or brain stem. These axons leave the CNS within a specific ventral root of the spinal cord or within certain cranial nerves exiting the brain stem. The cell body of the postganglionic neuron is located in numerous places outside the CNS. The post-ganglionic neuron is unmyelinated and innervates the effector organs, which travel in components of the peripheral nervous system, and is intermingled with afferents and somatic motor neurons of peripheral nerves. These fibers produce antagonistic but coordinated responses in the effectors. Descending input from higher centers of the brain such as the hypothalamus and reach the cell bodies of pre-ganglionic fibers to regulate and adjust their activity.⁵ The descending input is part of several specific visceral reflex pathways and is used by higher centers to institute widespread bodily changes. Homeostasis is the balance between the sympathetic and parasympathetic regions of the autonomic nervous system. The sympathetic nervous system is known as the “fight or flight system.” The parasympathetic division of the ANS is responsible for metabolic processes and is known as the “rest and digest” division of the nervous system.³

Sympathetic ganglia are short and near the CNS whereas parasympathetic ganglia are long and located closer to the viscera; therefore the sympathetic division can respond more quickly on the body's muscles reiterating the phrase “fight or flight.”³ On the other hand the parasympathetic ganglia react more slowly being farther away from the CNS

⁵ Leach;³ Basic and Clinical Anatomy of the Spine, Spinal Cord and ANS

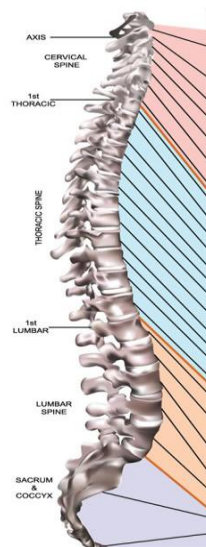
and closer to the efferent organ reiterating the phrase “rest and digest.”³ Activation of the parasympathetic division is disguised as a vegetative state that can increase metabolic rates. Sato et. al. demonstrated a visceral response, decreased gastric motility, of somatic stimulation, skin pinch, a step toward elucidating the mechanics of Chiropractic manipulation therapy may affect visceral function. Altered biomechanics treated by vertebral/joint manipulation can be characteristic symptoms of hyper or hypo-autonomic pathology creating the reflexes known as visceros-somatic and/or somatic-visceral.

Clusters of pre-vertebral ganglia contain postganglionic neurons and splanchnic nerves innervating vascular nerve plexuses,⁵ conduction of postganglionic axons to their target viscera. Parasympathetic levels of the cord border the sympathetic levels therefore the parasympathetic levels are above T1 vertebra and below L3 vertebra and into the sacral region. Each arterial nerve plexus supplies motor muscle in the wall of the vessels it passes and terminates by innervating viscera supplied by the vessel.⁵ Sympathetic division of the cord is located at described thoraco-lumbar levels T1-L3,³ indicating stimulation to this region would create a sympathetic response and/or a inhibition of this region would create a lesser sympathetic response or seemingly stronger parasympathetic response otherwise known as an imbalance in the ANS. Referred pain occurs from viscera to the thoracic spine. Thoracic joint dysfunction commonly stimulates visceral disease through ANS.³ The state of the spinal column affects the functional status of organs. Patients may have both visceral disease and biomechanical disease of the spine

⁵ Leach;² Gatterman, Meridel; ⁷ Gatterman, Meridel; ⁹Vein Wrapping Technique;³Basic and Clinical Anatomy of the Spine, Spinal Cord and ANS

in associated segments. “A growing body of evidence suggests there exists a close correlation between somatic functions and visceral functions.”² Somatic-visceral and visceral-somatic reflexes involving the nervous system can effect somatic and visceral functions suggests therapies such as vertebral manipulation can alter somatic sensation, such as proprioception, to in turn alter visceral function/activity.

VERTEBRAL SUBLUXATION AND NERVE CHART



Vertebrae	Areas & Parts of Body	Possible symptoms
C1	Blood supply to the head, pituitary gland, occipital bone of the face, brain, inner and middle ear sympathetic nervous system.	Headaches, nervousness, insomnia, heart colds, high blood pressure, migraines, headaches, nervous breakdowns, anemias, chronic tiredness, dizziness
C2	Eyes, optic nerves, auditory nerves, sinuses, mastoid bones, tongue, forehead.	Sinus trouble, allergies, pain around the eyes, earache, tearing spells, certain cases of blindness, crossed eyes, deafness
C3	Chin, outer ear, face bones, teeth, infraorbital nerve.	Neuralgia, neuritis, acne or pimples, eczema
C4	Nose, lips, mouth, eustachian tube.	Hay fever, runny nose, hearing loss, adenoids
C5	Vocal cords, neck glands, pharynx.	Laryngitis, hoarseness, throat conditions such as sore throat or quinsy
C6	Neck muscles, shoulders, tonsils.	Stiff neck, pain in upper arm, tonsillitis, chronic cough, croup
C7	Thyroid gland, bones in the shoulder, elbows.	Bursitis, colitis, thyroid conditions
T1	Arms from the elbows down, including hands, wrists, and fingers, esophagus and trachea.	Asthma, cough, difficult breathing, shortness of breath, pain in lower arms and hands
T2	Heart, including its valves and covering, coronary and aortic.	Functional heart conditions and certain chest conditions
T3	Lungs, bronchial tubes, pleura, chest, breast.	Bronchitis, pleurisy, pneumonia, congestion, influenza
T4	Gallbladder, common duct.	Gallbladder conditions, jaundice, shingles
T5	Liver, solar plexus, circulation (general).	Liver conditions, fevers, blood pressure problems, poor circulation, arthritis
T6	Stomach.	Stomach troubles including nervous stomach, indigestion, heartburn, dyspepsia
T7	Pancreas, duodenum.	Ulcers, gastritis
T8	Spleen.	Lowered resistance
T9	Adrenal and suprarenal glands.	Allergies, hives
T10	Kidneys.	Kidney troubles, hardening of the arteries, chronic tiredness, nephritis, pyelitis
T11	Kidneys, and kidney ureters.	Skin conditions such as acne, pimples, eczema
T12	Small intestines, lymph circulation.	Rheumatism, gas pains, certain types of sterility
L1	Large intestines, inguinal rings.	Constipation, colitis, dysentery, diarrhea, some rupture of nerves
L2	Appendix, abdomen, upper leg.	Cramps, difficulty breathing, minor varicose veins
L3	Sex organs, uterus, bladder, knees.	Bladder troubles, menstrual troubles such as painful or irregular periods, miscarriages, bed wetting, impotency, changes of life symptoms, many knee pains
L4	Prostate gland, muscles of the lower back, sciatic nerve.	Sciatica, lumbago, difficult painful or too frequent urination, backaches
L5	Lower legs, ankles, feet.	Poor circulation in the legs, swollen ankles, weak ankles and ankles, cold feet, weakness in the legs, leg cramps
SACRUM	Hip bones, buttocks.	Sacroileal conditions, spinal curvatures
COCCYX	Rectum, anus.	Hemorrhoids (piles), prolaps (itching), pain at end of spine on sitting

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The internal carotid plexus along with other nerve branches of superior cervical ganglion innervate structures within the neck and thorax.⁹ The middle cervical ganglion is related to inferior thyroid artery, innervated from the sympathetic plexus. Post-ganglionic sympathetic axons are distributed throughout the neck including the thyroid and parathyroid glands.⁹ If sympathetic function in inferior cervical ganglion is

compromised abnormal biomechanics of lower cervical, upper thoracic spine can occur as a visceral-somatic reflex.

“A large body of evidence is accumulating rapidly in the scientific literature that indicates the nervous system exerts a profound regulatory response influencing immune activity and this effect may be manifested through activation of the ANS.”⁷

Vertebral subluxation includes the spine, bony misalignment, and lastly interference in the expression “innate intelligence of body via nervous system’. Vertebrae do move, if not we could not function correctly, although the movement is slight, it is through many vertebra. Innate intelligence primarily concerned about integrity of the nervous system.⁶ There is a fourth criterion of subluxation is interference with transmission of mental impulse following loss or juxtaposition, occlusion of an opening and impingement of a nerve.⁶ When a subluxation is present, lack of proper body function occurs.⁶ Adjustment means to bring into right relationship, meaning vertebrae removing interference at the vertebral/ neurological level and restoring proper function of specific joints. Spinal manipulation elicits viscerosomatic effects. An adjustment with objective of restoring proper joint function is correcting symptomatic or physiological changes.⁶

Physiological or symptomatic changes are observed by the doctors, in this case, Chiropractic physicians. Orthopedic tests are used to identify structural changes such as the Soto-hall test and Lhermitte’s sign. Soto-hall test is used to test for ligament sprain and/or strain of the spine and a positive Lhermitte’s sign indicates spinal cord

⁶ Chiropractic Philosophy, Strauss

degeneration, injury or insult by a sudden transient shock-like sensation spreading through the spine and extremities. These orthopedic tests differentiate between a musculoskeletal and neurological disorder, both of which can be treated with Chiropractic adjustment depending on the cause of spinal cord degeneration. Some orthopedic tests can merely confirm the existence of a subluxation or the decreased function and movement of a joint. When a patient presents with a disease that is not musculoskeletal or neurologic, such as an immune system disorder a doctor, Chiropractic physician, can use orthopedic tests and range of motion as well as static and motion palpation to determine any musculoskeletal symptoms causing a somatic-visceral reflex or musculoskeletal conditions caused by visceral-somatic reflexes. These reflexes are a result of the immune system and nervous system being interlaced with each other, medical science has been continuously discovering the immune system does not work in isolation of the body's other systemic functions.²⁴

Despite the advances in science and the medical field, the health of the population seems to continue to decline, leaving people to struggle with disabilities interfering with their activities of daily living. Chiropractic began in the year 1895 and shortly following its discovery, the growth of Chiropractic treatment expanded exponentially. Millions of people have become patients of Chiropractic treatment because it has provided a “cornerstone of our knowledge of the normal and abnormal functions of the human systems.” Chiropractic treatment's success to make sick people well has provided several contributions to modern science described by four principles: 1. Anatomical disrelation (known today as disarticulation of a joint and/or subluxation) may create functional disturbances in the body, 2. Many diseases and conditions are primarily

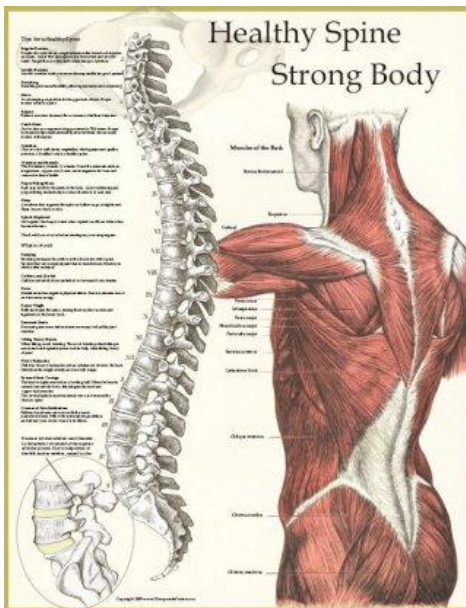
²⁴ Beyond Back Pain

disturbances of the nervous system, 3. Spinal subluxations are a cause of nerve irritation or interference (stimulations of the ANS) and lastly, 4. The viscera-spinal principle: nerve irritation or stimulation may lead to the dysfunction of one or more internal organs of the body. Many persons have the opinion Chiropractic treatment is painful or harmful, especially in the region of the cervical spine, some examples given of peoples beliefs include receiving massages, hitting your back, and twisting you and your limbs causing harm.²²

Chiropractic treatment involves manual or instrument adjusting and/or manipulation of the joints within the body, mostly referring to the spine. Multiple techniques can be used to adjust the body; this procedure restores joint function throughout the spine and/or extremities as well as the neurological integrity. By restoring or maintaining the neurological integrity of the body, physiologic components of the body can be restored or maintained in turn. As stated previously, environmental factors affect the neurological and physiological components. A Chiropractic adjustment is a highly specific external factor creating a direct change in structure and function of the joint(s) affected. Above all Chiropractic is a science primarily dealing with the spine and the CNS. Scientific principles include using diagnostic testing and observation and treatment unlike any other, the adjustment. How powerful is the adjustment? The role of Chiropractic treatment is generally considered to treat back pain, neck pain and headaches but the extent of Chiropractic can only be measured by the subluxation, or cause of the diagnosis. The very first Chiropractic Adjustment was performed by the father of Chiropractic, D.D. Palmer. The very first Chiropractic patient was Harvey Lillard who claimed he had lost his hearing after bending down one day and felling a

²² Your Health and Chiropractic

“pop” sensation in his back. D.D. Palmer treated Harvey by influencing the misaligned vertebra, identified by the very prominent bump on Harvey’s back, back into place. Harvey had been deaf for approximately 17 years, after the “hand treatment” Harvey noticed immediate but slight improvement in his hearing. The bump remained prominent therefore D.D. Palmer continued the treatment for a few days and Harvey’s hearing seemed to return to normal.²² Another Chiropractor, Leonard W. Ruthorford claimed to



²² Your Health and Chiropractic

²⁵ http://floridawell.com/clients/4586/images/.resized/.resized_319x415_Healthy_Spine_Poster.jpg

²⁶ <http://www.spokane-chiropractic.com/images/chiropractor-spokane.jpg>

²⁶ <http://www.spokane-chiropractic.com/images/chiropractor-spokane.jpg>

restore the eyesight of a five year old girl. The treatment needed only one adjustment of the C1 vertebra (atlas) for the girl's eyesight to return completely.²³ The limited amount of treatments may be due to the acuteness of the condition. "Chiropractic is science, an art, and a philosophy."¹⁴

Conclusion

A lack of randomized double blind controlled studies make it difficult to reach a definitive conclusion. Chiropractic adjustments are external stimulations to the body known to cause neurological and physiological responses. The responses to the external stimulation to Chiropractic adjustments depend on the parts of the spine affected. Subluxations, or joint dysfunctions, of the spine may excite or inhibit the region of sympathetic and parasympathetic nervous system. Clinically from static and motion palpation as well as the signs and symptoms of the patient the location of joint dysfunction can be identified. According to the Meric Chart¹⁶ the thyroid gland is innervated and/or affected by the C7 vertebral level, which is included in the parasympathetic division of the spine,³ but also keep in mind the difficult part about research and science is that no two people are the same, implying one person's parasympathetic spinal region could include C7 vertebral level, but the next person's may not include that spinal segment. For example the median nerve was found to be closer to the radial side of the forearm in 75% of cases and only 3.33% of cases it was located on the ulnar side of the forearm. (28) Another example of anatomic variations is the recurrent laryngeal nerve, which was not present at all in 4.3% of cases. This structure

²³ The Role of Chiropractic

¹⁴ Lenarz, Michael

¹⁶ <http://www.spinalhealthgroup.com/images/spinal-chart.jpg>

³ Basic and Clinical Anatomy of the Spine, Spinal Cord, and ANS

formed one branch in 69.34% of cases and two branches in 29.11% of cases.(29). These anatomical variations indicate the significance of the patient's signs and symptoms to explain if the problem is excitatory or inhibitory, sympathetic or parasympathetic and at what vertebral level. It is commonly believed the Meric Chart gives doctors an area of the spine to begin searching for restrictions and malpositions as well as changes in the soft tissues surrounding the area while using the four criteria needed to be met to diagnose a subluxation.⁶

“It is most necessary to know the nature of the spine, what its natural purposes are, for such knowledge will be a requisite for many diseases. One or more vertebrae of the spine may or may not go out of place very much. They might give way very little, and if they do, they are likely to produce serious complications, and even death, if not properly adjusted.” Hippocrates, the Father of Healing²³

⁶ Strauss, Chiropractic Philosophy; 28: Median Nerve Thenar Motor Branch Anatomical Variations
(29) A Closer look at Laryngeal Nerves During Thyroid Surgery: A Descriptive of 584 Nerves

²³ The Role of Chiropractic

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