

Case Study

Resolution of Hypothyroidism & Improved Cervical Curve in a 52-Year-Old Female Undergoing Chiropractic Care for Vertebral Subluxation: A Case Study & Review of the Literature

Caitlin Reimer DC¹

1. Private Practice of
Chiropractic, Dania Beach, FL

Abstract

Objective: The purpose of this paper is to report the effects of subluxation based chiropractic care utilizing Diversified Technique with a 52-year-old female patient with hypothyroidism that was previously treated using prescription thyroid medication.

Clinical Features: A 52-year-old female presented for chiropractic care with a chief complaint of discomfort and/or paresthesia in the cervical spine, upper thoracic spine, bilateral cervical dorsal spine, mid thoracic spine, bilateral knee pain and bilateral hip pain with extensive sitting. She was previously diagnosed with hypothyroidism by her medical doctor and was prescribed medication to treat this condition.

Intervention and Outcomes: A thorough case history, physical examination and chiropractic examination were performed and it was found that the patient had vertebral subluxations of the cervical, thoracic and lumbar spine, sacrum and pelvis. After 9 months of regular, subluxation specific, chiropractic care, the patient reported that blood work indicated she no longer had hypothyroidism and her medical doctor had removed her from all medications. Six months following this, the patient's blood work indicated she was maintaining normal levels of TSH, without medication. The patient is still under regular chiropractic care.

Conclusions: Subluxation based chiropractic care may be a beneficial approach in reversing hypothyroidism, reduction of the symptoms of hypothyroidism and improving the quality of life for individuals with hypothyroidism. Further research is necessary to prove a correlation between chiropractic care and the reversal of hypothyroidism and to validate the benefit of chiropractic care for improved quality of life for persons diagnosed with hypothyroidism.

Key Words: *hypothyroidism, hypothyroid, thyroid, chiropractic, chiropractic adjustment, vertebral subluxation, Diversified Technique*

Introduction

Hypothyroidism is a common endocrine condition.¹ It is caused by any structural or functional derangement that interferes with the production of adequate levels of thyroid hormone.² Hypothyroidism can be classified several ways including by structure (primary or secondary) and severity (subclinical or overt).³ Primary hypothyroidism is characterized by a dysfunction in the thyroid gland itself.²⁻³ Whereas, secondary hypothyroidism is a result of pituitary and

hypothalamic disease (for example, pituitary tumour) causing dysfunction of messenger pathways associated with thyroid hormone production and metabolism.²⁻³

Primary hypothyroidism can be further divided into congenital, acquired, or autoimmune.² Congenital hypothyroidism is most often the result of endemic iodine deficiency in the diet.² Acquired hypothyroidism can be

caused by surgical or radiation-induced ablation of the thyroid gland.² Autoimmune hypothyroidism is the most common cause of hypothyroidism in iodine-sufficient areas of the world, with the vast majority of cases due to Hashimoto thyroiditis.²

In Western countries, the most common cause of primary hypothyroidism is autoimmune thyroiditis.⁴ However, in many parts of the world, iodine deficiency remains an important cause.⁴ Other common causes of hypothyroidism include thyroidectomy, radioiodine therapy, and drugs such as amiodarone, lithium, thionamide, iodine, interferon, sunitinib, rifampicin, and thalidomide.⁴ Autoimmune and iatrogenic causes constitute the most common sources of reduced thyroid hormone levels.³

Alternatively, hypothyroidism can be classified by severity as subclinical (mild) or overt (severe), based on the levels of thyroid hormones. Most experts agree that subclinical hypothyroidism represents early, mild thyroid failure.⁵ Subclinical hypothyroidism is characterised by elevated thyroid stimulating hormone (TSH) concentrations associated with normal thyroxine (T4) and triiodothyronine (T3) serum levels.³⁻⁷ By contrast, elevated TSH concentrations and low serum levels of T4 or T3 characterize overt hypothyroidism.³⁻⁵

The population reference range of TSH is around 0.4-4.5 mU/L⁴, subclinical hypothyroidism typically presents with TSH concentrations between 4.5-9 mU/L⁵, and overt hypothyroidism with TSH concentrations ≥ 10 mU/L.⁴⁻⁵ Subclinical hypothyroidism is usually progressive, although it is reversible in more cases than previously thought.⁵ Serum TSH values tend to return to normal more frequently in people with concentrations of 4-6 mU/L, whereas TSH values of more than 10-15 mU/L are associated with a reduced rate of normalisation of thyroid function.⁵

The prevalence of hypothyroidism in the general population ranges from 3.8%-4.6%.⁴ The prevalence of subclinical hypothyroidism in blacks is one third that in whites, and a similar low prevalence is seen in some populations with iodine deficiency.⁸ The prevalence increases with age, and in women older than 60 years, subclinical hypothyroidism is present in up to 20%.⁸ There appears to be geographical variation in the incidence of hypothyroidism.⁴ Epidemiological studies suggest Denmark has nine times fewer new cases of hypothyroidism than the UK.⁴ The prevalence of subclinical hypothyroidism in the US population was 4.3% in NHANES III, and 9.5% in the Colorado Study of more than 25,000 people attending statewide health fairs.⁵

The symptoms of hypothyroidism are neither sensitive, nor specific;⁵ they can be subtle and are often confused with the signs of aging.³ The common clinical features associated with hypothyroidism are tiredness, weight gain, dry skin, cold intolerance, constipation, muscle weakness, puffiness around the eyes, hoarse voice, and poor memory.⁴ Although the likelihood of hypothyroidism increases with increasing numbers of symptoms, absence of symptoms does not exclude diagnosis; therefore diagnosis must be made biochemically.⁴

Subclinical hypothyroidism should be distinguished from other causes of physiological, artifactual, transiently increased

serum TSH.⁵ Serum TSH concentrations should be reassessed after 3-6 months to rule out laboratory error or a transient increase, for example, by drugs that interfere with thyroid function, thyroiditis, and possible toxic injury to the thyroid gland.⁵ Serum TSH concentrations are raised in overweight and obese individuals, which might falsely suggest subclinical hypothyroidism.⁵ This altered thyroid hormone pattern is reversible with weight loss.⁵

Predisposition to autoimmune thyroiditis might be increased by familial and genetic risk factors, such as family history of autoimmune thyroid disease, endocrine, or systemic autoimmune disorders, or genetic disorders.⁵ Possible consequences of subclinical hypothyroidism include cardiac dysfunction or adverse cardiac end points (including atherosclerotic disease and cardiovascular mortality), elevation in total and low-density lipoprotein (LDL) cholesterol, systemic hypothyroid symptoms, and progression to overt, symptomatic hypothyroidism.⁸

In 1891, Murray described the first regimen of thyroid hormone replacement, subcutaneously injecting extract of sheep thyroid into a patient with hypothyroidism.⁴ It was soon shown that oral administration of thyroid extract was as effective.⁴ In 1914, Kendall purified thyroxine crystals, which became commercially available.⁴ Harrington identified the structure of thyroxine in 1926 and synthetic thyroxine was available for clinical use by the 1930s.⁴ However, it took many more years before thyroxine became preferable to desiccated thyroid extract as the treatment of choice for hypothyroidism.⁴ In 1952, Gross and Pitts-River identified the more potent liothyronine.⁴ Today, the standard treatment for hypothyroidism is the synthetic thyroid hormone, levothyroxine.^{3-4,9} In the UK, over 23 million prescriptions for levothyroxine were written in 2010, making it the third most prescribed medication after simvastatin and aspirin.⁴

Case Narrative

History

A 52-year-old, Caucasian, female presented for chiropractic care with a chief complaint of discomfort and/or paresthesia in the cervical spine, upper thoracic spine, bilateral cervical dorsal spine, mid thoracic spine, bilateral knee pain and bilateral hip pain with extensive sitting. The patient described the pain as moderate, sharp and intermittent and rated the pain a 7/10 on a pain scale from 0-10 with 10 being the worst. The patient stated she had the pain on and off for years and that it had been getting progressively worse over the last 5 years. She was previously diagnosed with hypothyroidism by her medical doctor and was prescribed medication to treat this condition.

Examination

An initial examination and evaluation was performed using Diversified technique. The initial chiropractic assessment consisted of static and motion palpation and revealed cervico-thoracic and upper thoracic pain and tenderness and moderate muscle spasms in the posterior cervical, upper thoracic, and mid thoracic regions were noted. Postural analysis displayed forward flexion of the head and a lumbar curve to the right. Range of motion testing was recorded as moderately reduced

with pain noted in cervical flexion, cervical left rotation and cervical right rotation.

X-ray examination was also performed, anterior to posterior (AP) and lateral cervical and lumbar views were taken. Analysis indicated a 26.6mm anterior head carriage, and a cervical lordosis of 15.8°. A normal cervical lordosis measures -42.0°, the difference represents a 137.6% reduction in the patient's cervical curve. The patient's head was shifted 1.4mm to the left, and a mid-neck tilt angle of 3.5° to the left and a lower neck tilt of 1.3° to the right were noted. In the lumbar spine the rib cage was positioned 5.7mm backward relative to the patient's pelvis. The lumbar lordosis measured -40.8° and normal is -40°, the difference representing a 2.0% increase in the patient's lumbar curve. The low back was shifted 5.0mm to the left of the plumb as measured from T11-L5 and a mid low back tilt angle of 8.8° and a lower tilt of 0.3° were noted.

Gross posture, in addition to spinal alignment as seen on plain film radiographs is vitally important to the determination of healthy structure.¹⁰ Harrison et al holds that deviations from this ideal, stated normal, increase risk factors for spinal health.¹⁰

Diagnoses

Based on the physical and radiographic examination findings vertebral subluxations were diagnosed at C1, C4, and C5 on the left, T1 and L2 on the right, L4 and L5 on the left, and sacrum and pelvis on the right.

Intervention

The patient began a chiropractic care plan pain relief care phase for 20 visits at a frequency of 3 times per week, at which point the patient was moved to corrective care phase for 60 visits at a frequency of 2-3 times per week. After 30 visits the patient was re-evaluated and x-rays were taken for progressive analysis.

In the pain relief care phase each office visit included pre-adjustment stretching using a flexion/distraction table and subluxation specific manual chiropractic adjustments with the use of a drop table as necessary.

The corrective care phase included both the pre-adjustment stretching using the flexion/distraction table and subluxation specific manual chiropractic adjustments with the use of a drop table as necessary. Further, in this phase of care the patient began undergoing neuromuscular retraining. For this procedure, the patient sat in a specially made chair that is slightly angled back and had The Posture Pump placed under her neck.¹¹ The device helps to retrain the muscles and ligaments that support the cervical spine.

After her re-evaluation, on her thirtieth visit, the patient added an additional component to her office visits, neurological strengthening and conditioning exercises. A series of exercises were done using gym equipment, which helps to place positive stress on the central nervous system. The ultimate goal of neurological strengthening and conditioning exercises is a stronger nervous system that in turn powers the muscles and organs to function at a higher level of health.

Outcomes

The patient received regular subluxation-based chiropractic care over the course of one year and three months. On her 20th visit, when she progressed from pain relief care to corrective care, she reported her average pain had decreased to 4/10 on a pain scale from 0-10 with 10 being the worst. On her 30th visit she was re-evaluated and lateral cervical and AP lumbar x-rays were taken for progressive analysis.

Analysis indicated a 25.8mm anterior head carriage, showing a 3.0% improvement from the original 26.6mm, and a cervical lordosis of 11.2° showing a total change of 29.1% from the original 15.8°. Segmental changes in the cervical spine were analyzed and compared to the original films and the results shown in Table 1. The low back was shifted 0.4mm to the left of the plumb as compared to the original 5.0mm to the left of the plumb from T11-L5. This accounts for a 92.0% improvement. With regards to the low back tilt no change was noted as the measurement remained 0.3°.

On her 31st visit the patient reported that after running laboratory tests, her medical doctor informed her that she no longer has hypothyroidism, and she was taken off her thyroid medication. The results of laboratory testing for TSH are outlined in Table 2. The patient is and will continue to be under regular chiropractic care.

Diversified Technique

Diversified is the most common of chiropractic techniques and is considered the most generic of the chiropractic technique systems.¹²⁻¹³ Varying reports state that 91-95% of chiropractors claim to use Diversified.¹³⁻¹⁴ The technique, as it is applied today, is largely attributed to the work of Joe Janse, DC.¹²⁻¹⁴ His 1947 *Chiropractic Principles and Technic* remains Diversified technique's crowning achievement.¹³ Diversified technique has a broad scope of specific adjustments that are typically characterized by a high velocity, low-amplitude thrust, delivered manually.¹²⁻¹⁴ The adjustment can be delivered with the assistance of tools such as a block or a drop table. It oftentimes results in a cavitation of a joint (a "cracking" or "popping" sound indicating a pressure release in vertebral segments).¹⁴ Diversified technique attempts to apply the most ideal technique within the context of each particular patient's needs.¹³

In Diversified technique, vertebral subluxations are assessed using static and motion palpation. They can be confirmed radiographically using anterior to posterior and lateral views of the cervical, thoracic, and lumbar regions of the spine as well as anterior to posterior pelvic views on plain film x-rays. All motion segment malpositions are described with the position of the upper vertebra with comparison to the lower vertebrae.¹⁵

Spinal listings are named according to how the vertebral body has misaligned.¹⁵ Specifically referred to for static listings are: (1) the inferiority of the anterior or posterior aspect of the body; (2) the inferiority of the right or left side of the body; (3) the posteriority of the right or left side of the body; or (4) the anteriority, posteriority or laterality of the entire body.¹⁵ While dynamic listings are differentiated according to: (1) the left

posterior inferiority or superiority; or (2) the right posterior inferiority or superiority.¹⁵

X-Rays

Alternatively, X-Ray analysis can also be performed using a model that measures spinal alignment by way of measuring the curves in the various regions of the spine, globally and segmentally, and comparing them to normal values. The normal values for all spinal angles and distances utilized have been reported in the Index Medicus literature.¹⁴ The measurements taken are mathematical utilizing geometric methods. This geometric line drawing analysis has been shown to be very reliable and valid.¹⁴

Laboratory Testing (TSH Blood Test)

Thyroid Stimulating Hormone (TSH) Blood Test is used to check for thyroid gland dysfunction. In the United States it is common to undergo progressive testing whereby, if the results of the TSH Blood Test come back within the normal limits of 0.5-4.5 mU/L, no further testing is done at that time. However, if the results come back exceeding the normal limit, further testing of T3, free T3, T4 and/or free T4 may be performed. In many other countries, TSH, T3/free T3 and T4/free T4 are routinely tested at the same time.

Discussion

Review of Chiropractic Literature

A broad search of the term “Thyroid” in the Index of Chiropractic Literature yields only 18 results, of those 18 only three results concerned themselves with using a chiropractic technique in the treatment of hypothyroidism.¹⁰ Those three articles were Jacob’s et al’s 1985 study on the use of Applied Kinesiology (AK) in the diagnosis of hypothyroid, Bablis and Pollard’s 2009 case study on NET and the treatment of hypothyroid, and Bak and Engelhardt’s 2015 case study on improvement of cervical curve and hypothyroidism following reduction of subluxations using Chiropractic Biophysics (CBP).^{10,16-17} Jacob’s study discusses only the diagnosis of hypothyroidism using AK and does not discuss its management using the chiropractic technique. As such, only two of the 18 directly address the management of hypothyroidism using chiropractic techniques.

A similar search in PubMed using the terms “Thyroid” AND “Chiropractic” yields only 13 results, of those 13 only three relate to using a chiropractic technique in the treatment of hypothyroidism. Two of those three relate to the same study, Brown et al’s 2010 protocol for a pilot study and 2015 randomized controlled trial of a biopsychosocial approach (NET) to primary hypothyroidism, and Bablis and Pollard’s previously mentioned case study, also using NET.^{1,17-18}

Bablis and Pollard’s case study discussed the management of two separate instances wherein hypothyroidism symptoms were improved using Neuroemotional technique (NET).^{10,17} Each case involved a patient with substandard thyroid function.^{10,17} The first patient had been objectively determined via TSH to have primary hypothyroidism, however she had not elected to engage in pharmaceutical treatment of her

condition, instead deciding on alternative methods of care.^{10,17}

Her pre-adjustment TSH was 13.9mU/L and following 8 weeks of NET treatments her TSH was retested and found to be 5.81mU/L, which is just outside the threshold for normal thyroid function.^{10,17} A long-term follow-up was conducted nine months post treatment, and the patient’s TSH was measured at 1.45mU/L.^{10,17} The second patient had been medically managed for her hypothyroid for one year.^{10,17} Her pre-adjustment TSH was 14.8mU/L.^{10,17} She was then seen four times over the course of two months.^{10,17} Her post-intervention TSH was 5.81mU/L.^{10,17} Long-term follow-up was conducted and the patient’s TSH was 0.82mU/L.^{10,17}

Bak and Engelhardt’s case study discusses a single patient who had been previously diagnosed with Hashimoto, or Autoimmune Thyroid Disease, by her endocrinologist.¹⁰ Using the CBP method, postural and X-ray analysis were performed and the patient was found to have severe changes in her spinal alignment.¹⁰ One month into care the patient presented with a different symptomatology and was recommended to return to her endocrinologist.¹⁰ The recommendation was followed and it was found that her TSH levels had changed from being within the parameters for hypothyroidism to those for hyperthyroidism and it was suggested she reduce the dosage of Armour Thyroid, a desiccated thyroid replacement.¹⁰

The patient’s six month progressive examination revealed structural improvements in concert with her previously documented functional improvements.¹⁰ The evidence garnered in this case study would suggest that CBP care may contribute to improvement in overall thyroid function by improving spinal alignment and posture.¹⁰

In Brown et al’s randomized controlled trial, 90 participants over the age of 18 were selected.^{1,18} They had to have received a diagnosis of primary overt hypothyroidism from a qualified medical practitioner or specialist at least six months prior to engaging in the study.^{1,18} The study looked at the short-term effects of NET on those with hypothyroidism and consisted of 10 intervention sessions over 6 weeks.^{1,18} The study resulted in no clinically relevant changes at seven weeks or six months.¹

CAM Management

In a report by the American Thyroid Association on Complementary and Alternative Medicine (CAM), manipulative and body-based practices are listed in the types of CAM, and specifically mentioned is chiropraxy (a term used synonymously for chiropractic).¹⁹ Other types of CAM include mind-body medicines such as yoga and meditation, biologically based practices like vitamins and herbs, and energy medicine such as reiki and tai chi.¹⁹

Some of the reasons patients with thyroid disease choose CAM include: (1) to help cope with the side effects of medications; (2) to ease the stress and anxiety of medication; (3) feel that it could help with their care; and (4) try to treat or cure their disease.¹⁹

Allopathic Treatment

The current gold-standard treatment for individuals suffering

from hypothyroidism is hormone replacement therapy using the synthetic thyroid hormone, levothyroxine.^{1,3-4,9,20-21} It has a 7-day half-life, which is advantageous in allowing daily dosing.^{4,21} The treatment dosage of thyroid hormone is gradually titrated upwards until an individual displays normal physiological concentrations of free T3, free T4 and TSH in the serum.¹ Patients are required to take 50-150 µg of levothyroxine daily for the rest of their lives.³

Many patients on thyroid hormone replacement are either under-replaced or over-replaced⁴ and it has been said that overzealous supplementation can lead to an increased risk of osteoporosis in postmenopausal women and atrial fibrillation in the elderly.^{3,22} When initiating levothyroxine therapy, serum TSH should be measured to monitor for adequate replacement.⁴ TSH can take up to 4 months to normalize and it is recommended that the TSH is measured 6-8 weeks after initiation of, or a change in levothyroxine dose.⁴ Once the patient is on a stable dose of levothyroxine, thyroid hormones are monitored every 6-12 months to ensure that hormone levels are being maintained within physiological norms.³⁻⁴

A significant number of patients on thyroid hormone replacement report not feeling well despite having thyroid function tests well within the healthy reference range.⁴ The decreased quality of life that is observed in hypothyroid individuals does not always improve with the appropriate treatment.¹ This has brought into question the use of combination therapy over monotherapy.^{9,21} Generally, levothyroxine does not improve mood, cognition or symptoms in patients with subclinical hypothyroidism unless the serum TSH concentration is more than 10 mU/L.⁵ If the disease were to be approached from a more holistic standpoint, solutions to current management problems may be revealed.³

Proposed Mechanism

The thyroid gland is positioned in the region of the throat.²³ It consists of two lateral masses on either side of the trachea, joined by a connecting isthmus that crosses the midline, just inferior to the larynx.²³ The primary innervation of the thyroid gland is the autonomic nervous system. It receives parasympathetic innervation from the vagus nerve and sympathetic innervation from the ganglia of the sympathetic trunk.

Stress places people into a high sympathetic, low parasympathetic state. It is postulated then that if spinal dysfunction is the stressor causing the alteration in the autonomic nervous system the result could be decreased endocrine function of the thyroid gland due to imbalanced innervation of thyroid gland.

It is apparent that spinal dysfunction has the potential to both produce and be the product of visceral or somatic dysfunction or disease.¹⁵ The three classically separated areas of neuroscience, endocrinology, and immunology, with their various organs- the brain; the glands; and the spleen, bone marrow and lymph nodes, respectively- are actually joined to one another in a multidirectional network of communication.¹⁵

Despite the limited evidence suggesting that changes in autonomic activity are consistently linked to chiropractic

adjustments, autonomic mediated reflex responses including changes in heart rate, blood pressure, pupillary diameter, and distal skin temperature, as well as endocrine and immune system effects, have been clearly demonstrated.²⁴

Because of the proximity of the upper cervical vertebrae to the brainstem, parasympathetic influences dominate these segmental levels; and therefore a cervical adjustment could likely result in parasympathetic response.²⁴ Similarly, if a thoracic segment was adjusted, a sympathetic response could be elicited because the upper thoracic, especially the C7-T1 junctions, involve the stellate ganglion that stimulates the sympathetic chain ganglia.²⁴

Theoretically, normalizing the structure of the spine through chiropractic adjustments could regulate and balance the function of the entire autonomic nervous system. Appropriate functioning of the parasympathetic nervous system and sympathetic nervous system could then provide the necessary innervation to restore normal function to the thyroid gland.

Limitations

The case study is unique in that there is no previous study mentioning the treatment of hypothyroidism using any management protocol other than medication. There are several limitations that impact the effectiveness of this study. Primarily, the patient's continued use of hypothyroid medication until normalization of TSH in the blood. It is plausible that the hypothyroid medication may be responsible for the patient's return to normal TSH levels. It cannot be inferred that the patient's reversal of hypothyroidism was directly related subluxation-based chiropractic care. Second, because it is a single case study it cannot be generalized to the greater population of people with hypothyroidism receiving subluxation-based chiropractic care. Finally, there is no treatment control group or randomization, and as such there will be limited statistical validity.

Conclusion

This case report should not be used to generalize a correlation between the reversal of hypothyroidism and subluxation-based chiropractic care. Current research does show that mild cases of hypothyroidism can be reversible.⁵ This case is most interesting in regards to the correlation between the resolution of hypothyroidism and the timing of the onset of chiropractic care. With the increasing prevalence of thyroid disorders and the potential of adverse effects of thyroid hormone replacement medications, more research is warranted regarding the efficacy of subluxation-based chiropractic care as an alternative treatment approach for patients presenting with hypothyroidism.

References

1. Brown BT, Graham PL, Bonello R, Pollard H. A biopsychosocial approach to primary hypothyroidism: treatment and harms data from a randomized controlled trial. *Chiropr Man Therap*. 2015 Aug 20;23:24.
2. Kumar V, Abbas AK, Fausto N, Aster JC. Robbins and Cotran: pathologic basis of disease. 8th ed. Philadelphia: Elsevier Saunders; 2010. p. 1107-1110.

3. Brown BT, Bonello R, Pollard H. The biopsychosocial model and hypothyroidism. *Chiropr Osteopat*. 2005 Apr 12;13(1):5.
4. Chakera AJ, Pearce SH, Vaidya B. Treatment for primary hypothyroidism: current approaches and future possibilities. *Drug Des Devel Ther*. 2012;6:1-11.
5. Cooper DS, Biondi B. Subclinical thyroid disease. *Lancet*. 2012 Mar 24;379(9821):1142-54.
6. Baldini IM, Colasanti A, Orsatti A, Airaghi L, Mauri MC, Cappellini MD. Neuropsychological functions and metabolic aspects in subclinical hypothyroidism: the effects of L-thyroxine. *Prog Neuropsychopharmacol Biol Psychiatry*. 2009 Aug 1;33(5):854-9.
7. Baldini IM, Vita A, Mauri MC, Amodei V, Carrisi M, Bravin S, et al. Psychopathological and cognitive features in subclinical hypothyroidism. *Prog Neuropsychopharmacol Biol Psychiatry*. 1997 Aug;21(6):925-35.
8. Surks MI, Ortiz E, Daniels GH, Sawin CT, Col NF, Cobin RH, et al. Subclinical thyroid disease: scientific review and guidelines for diagnosis and management. *JAMA*. 2004 Jan 14;291(2):28-38.
9. McAninch EA, Bianco AC. The history and future of treatment of hypothyroidism. *Ann Intern Med*. 2016 Jan 5;164(1):50-6.
10. Bak AD, Engelhardt PR. Improvement in cervical curve and hypothyroidism following reduction of subluxation utilizing chiropractic biophysics: a case study and selective review of the literature. *Ann Vert Sublux Res*. 2015 Fall;2015(4):Online access only p 226-237.
11. PostureCo, inventor; Sigafosse and Jackson Chiropractic, assignee. X-ray report of findings. United States patent US 8721567. 2014 May 13.
12. Cooperstein R, Gleberston BJ. Technique systems in chiropractic. Edinburgh: Churchill Livingstone; 2004.
13. Cooperstein R. On diversified chiropractic technique. *J Chiropr Humanit*. 1995;5(1):50-55.
14. Zielinski E, Acanfora M. Resolution of trigeminal neuralgia following subluxation based chiropractic care: a case study and review of literature. *Ann Vert Sublux Res*. 2013 Summer;2013(3):Online access only p 33-45.
15. Bergmann TF, Peterson DH. Chiropractic technique: principles and procedures. 3rd ed. St. Louis: Mosby; 2011.
16. Jacobs GE, Franks TL, Gilman PG. Diagnosis of thyroid dysfunction: Applied kinesiology compared to clinical observations and laboratory tests. *J Manipulative Physiol Ther*. 1984 Jun;7(2):99-104.
17. Bablis P, Pollard H. A mind-body treatment for hypothyroid dysfunction: a report of two cases. *Complement Ther Clin Pract*. 2009 May;15(2):67-71.
18. Brown BT, Bonello R, Pollard H, Graham P. The influence of a biopsychosocial-based treatment approach to primary overt hypothyroidism: a protocol for a pilot study. *Trials*. 2010 Nov 15;11:106.
19. American Thyroid Association [Internet]. Falls Church (VA): The Association; c2017 [cited 2017 Mar 12]. Thyroid Disease and Complementary and Alternative Medicine (CAM). Available from: <http://www.thyroid.org/thyroid-disease-cam/>
20. Gullo D, Latina A, Frasca F, Le Moli R, Pellegriti G, Vigneri R. Levothyroxine monotherapy cannot guarantee euthyroidism in all athyreotic patients. *PLoS One*. 2011;6(8):e22552.
21. Wiersinga WM, Duntas L, Fadeyev V, Nygaard B, Vanderpump MP. 2012 ETA guidelines: the use of L-T4 + L-T3 in the treatment of hypothyroidism. *Eur Thyroid J*. 2012 Jul;1(2):55-71.
22. Pies RW. The diagnosis and treatment of subclinical hypothyroid states in depressed patients. *Gen Hosp Psychiatry*. 1997 Sep;19(5):344-54.
23. Nowak TJ, Handford AG. Pathophysiology: concepts and applications for health care professionals. 3rd ed. New York: McGraw-Hill; 2004. p. 453-456.
24. Welch A, Boone R. Sympathetic and parasympathetic responses to specific diversified adjustments to chiropractic vertebral subluxations of the cervical and thoracic spine. *J Chiropr Med*. 2008 Sep;7(3):86-93.

Segment	Normal Values	XRay 1 Values	Versus Normal	XRay 2 Values	Versus Normal	%Change Xray 1:2
C1 to Horizontal	-29.0°	-14.9°	48.6%	-16.2°	44.1%	8.7%
C2-C3	-10.0°	4.6°	146.0%	0.3°	103.0%	93.5%
C3-C4	-8.0°	6.9°	186.2%	14.6°	282.5%	111.6%
C4-C5	-8.0°	11.1°	238.8%	2.6°	132.5%	76.6%
C5-C6	-8.0°	4.4°	155.0%	1.1°	113.8%	75.0%
C6-C7	-8.0°	-11.2°	40.0%	-7.4°	7.5%	33.9%

Table 1: Relative Rotational Angle of Measurement (RRA) Segmentally for the Cervical Spine¹¹

Date	Result (mU/L)	Reference Range (mU/L)
04/15/2013	4.51	0.30-5.00
08/05/2014	3.37	0.30-5.00
06/05/2015	6.33	0.30-5.00
01/15/2016	3.87	0.30-5.00
07/22/2015	3.05	0.30-5.00

Table 2: Result Trend for Thyroid Stimulating Hormone (TSH) Laboratory Findings