

The Role of Chiropractic in Traumatic Brain Injury: A Case Study

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ABSTRACT

Objective: To demonstrate the importance of chiropractic care as an integral part of the healing process of a patient with a Traumatic Brain Injury (TBI).

Clinical Features: A 55 year old female patient presented to the office with a history of two automobile accidents which had both caused a number of physical symptoms including whiplash, loss of range of motion in her right arm, SI joint pain, shoulder pain, hand pain, parasthesias in the upper and lower extremities, and loss of balance. Complicating the healing process was the onset of depression and suicide attempt after the death of her husband, six years after the second automobile accident.

Interventions and Outcomes: Torque Release Technique protocols were used to evaluate and adjust spinal subluxations as it provides a low force adjustment. Adjustments were performed

twice weekly over the documented seven months of care. Within one month of care, the patient noted a decrease in symptoms and an improvement in her quality of life. Periodic re-evaluations demonstrated an improvement in physical findings as well as improvement in the function of her autonomic and motor systems as documented by thermal and SEMG scanning.

Conclusion: The results of this case study indicate that patients with traumatic brain injury may benefit from including chiropractic care while healing from their physical and emotional stresses.

Key Words: *Chiropractic, Subluxation, Torque Release Technique, Traumatic Brain Injury, Surface Electromyography, Thermography,*

Introduction

Traumatic Brain Injuries (TBI) have the ability to drastically alter a person's lifestyle both temporarily and/or permanently for the rest of their life. There are physical, biochemical, and emotional stresses that are associated with a TBI. As one of the aims of chiropractic care is to reduce those stresses and find a balance in a person's life, it is a vital component to the healing process of any patient inflicted with a TBI. Care must be taken to evaluate the neurological integrity and spinal stability of the patient and tailoring the technique to be utilized to what the patient can tolerate.

The purpose of this case study was to document the healing process of a patient with a TBI and to demonstrate the role that chiropractic played in this process. Prior to beginning care, the chiropractor and patient discussed the goals for the patient with those goals being subluxation reduction, symptom reduction, and increased quality of life. Over a

documented seven months of care, the doctor and patient observed success in all three areas as demonstrated by physical exam findings, results of surface electromyography thermal scanning and patient subjective reports.

Case Report

History

A 55-year-old female patient presented to the author's office with significant neurological and neuromuscular symptoms due to a severe brain injury. The patient had a history of two car accidents within two years. The first was a head on collision, and the second, one year later, involved a half-ton truck accelerating into her parked car.

Immediately after the first car accident, the patient experienced a loss of range of motion in the right arm, severe

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whiplash, right SI pain, and a lump grew in her right breast due to seatbelt injury. The lump was later removed surgically. Pain began bilaterally in the scapulae and radiated to the right deltoid. At this time, the patient began chiropractic care at a different office and had her cervical spine adjusted manually. There was no relief in pain symptoms; however there was an 80% improvement in arm range of motion.

After the second car accident, the patient experienced mild whiplash, a loss of range of motion in her left arm, bilateral pain in the shoulders with certain movements, bilateral pain in hands, tingling sensation in the upper and lower extremities, and a loss of balance. Post-traumatic stress disorder was diagnosed by her medical doctor. Damage to the right occipital lobe caused disturbed vision characterized by floaters, bilateral blind spots, and vision that fluctuated in and out especially when tired. The patient walked either with a cane in her right hand or a walker and described the sensation as “feeling as if walking on a curb with the right foot up and the left foot down”. After chiropractic care and physical therapy, the patient re-gained 90% of range of motion; however there was very minimal change in other symptoms.

The patient first presented to the author 9 years after the 2nd accident. She was experiencing dizzy spells occurring when bending over, moving too quickly or rising up from a sitting or lying position. Other problems included pain in the right SI area that could be irritated by simple every-day tasks, pain between the scapulae, sore neck and shoulder muscles, pain that radiated from shoulders into mid-thoracic region with bilateral lateral flexion of the neck, an antalgic lean to the right, and symptoms previously reported due to both motor vehicle accidents.

Her medical physician was currently treating the patient for different health issues. She was on medications for menopause that later caused fibroids and vaginal bleeding, according to the patient. She was also experiencing painful and burning urination, spastic colon, and pain in the left lower quadrant that had been suggested to be “bladder or bowel problems”.

Six years after the second accident the patient experienced severe depression and attempted suicide after the death of her husband. She was currently on *Paxil* for depression, *Atenolol* for hypertension, *Clonazepam* for panic disorders, *Losec DR* (aka Prilosec) for acid indigestion, and *Mobicox* for pain control.

Exam Findings

Upon examination the following findings were noted:

Range of Motion

Range of motion studies were unable to be recorded with a numerical value due to extreme pain produced by the initiation of movements. The following was the patient’s account of the pain:

- Cervical flexion and extension produced pain in the mid-scapular region.
- Left cervical rotation produced pain in the right SCM and mid-thoracic region.

- Right cervical rotation produced pain in the left SCM and mid-thoracic region.
- Bilateral cervical lateral flexion produced pain in the trapezius muscles bilaterally.
- Bilateral cervical Kemp’s test produced pain on the opposite side at T1.
- Cervical Distraction and Compression produced pain in the occipital region, scapula, and mid-trapezius muscle.
- Lumbar Range of Motion was unable to be performed due to pain.
- Lumbar Kemp’s tests were unable to be performed due to pain.
- Heel/Toe walk was unable to be performed due to pain in low back and lack of balance.

Muscle Tests

	<u>Left</u>	<u>Right*</u>
• Grip	10	10
• Deltoid	4/5	4/5
• Biceps	1/5	1/5
• Triceps	1/5	1/5
• Wrist Extension	1/5	1/5
• Wrist Flexion	1/5	1/5
• Finger Abduction	1/5	1/5
• Finger Adduction	1/5	1/5
• Hamstrings	1/5	1/5
• Quadriceps	1/5	1/5
• Hip Flexion	1/5	1/5
• Psoas	1/5	1/5
• Hip Abduction	1/5	1/5
• Hip Adduction	1/5	1/5
• Gluteus	1/5	1/5
• Foot Dorsi-Flexion	1/5	1/5
• Foot Plantar-Flexion	1/5	1/5

There was muscle hypertonicity observed in the trapezius, bilateral SCM, bilateral rhomboids, and right quadratus lumborum.

Reflexes

Wexler Deep Tendon Reflex Grading Chart

	<u>Left</u>	<u>Right</u>
• Biceps	+2	+2
• Triceps	0	0
• Brachioradialis	+2	+2
• Patellar	0	+2
• Achilles	0	+5

Dermatome Testing

- C4 and C5 increased on the left.
- C6, C7, and C8 increased on the right.
- L4 and L5 increased on the right.

- S1 was tested in the seated position. However, while in the seated position the patient experienced a loss of balance and dizziness; and therefore examiner felt that it was unable to be recorded accurately.

Postural Analysis

With the patient standing and the examiner located posterior to the patient, she presented with a right antalgic lean, right low ear, left low shoulder, right low pelvis, and anterior head carriage of one inch. Patient walks with cane in right hand.

Surface Static EMG Results

An Insight 7000 surface EMG was utilized to assess somatic paraspinal muscle tone and symmetry. Standardized protocols and established normative data were utilized for computer analysis and comparison.

The scan revealed an overall shift in hypertonicity to the left in the cervical spine with severe hypertonicity bilaterally at C1 and moderate hypertonicity bilaterally at C3.

Thermal Scanning Results

An Insight 7000 thermal scanner was used to assess sympathetic nerve function. Standardized protocols and established normative data were utilized for computer analysis and comparison.

- Temperature differences one to two standard deviations greater than the mean were observed at: C5, T1, T2, T8, T9, and S1, indicative of mild asymmetry.
- Temperature differences two to three standard deviations greater than the mean were observed at L4, indicative of moderate asymmetry.
- Temperature differences three to four standard deviations greater than the mean were observed at C4, indicative of severe asymmetry.

Radiological Examination

Lateral Cervical, Flexion/Extension, Lateral Lumbar, and AP Full Spine x-rays were taken. All x-rays were taken from a weight-bearing position.

Findings were as follows: Lateral Cervical showed diminished cervical curve (military neck), mild degeneration and decreased disc space at C5, C6, and C7, retrolisthesis of C4, and approximation of occiput and C1 in the posterior aspect of the spine. Cervical Flexion/Extension series showed little-to-no flexion and decreased extension at all levels.

Vertebral subluxations at multiple levels were diagnosed As follows: Bilateral occiput, C1, C2, C6, C7, T1, T5, T6, T8, T9, T12, L3, L4, L5, and Sacrum.

Summary of Examination

Vertebral subluxations with components of dyskinesia, facilitation, kinesiotherapy, neuropathophysiology, and myopathy were observed.

Chiropractic Care

Patient began chiropractic care after appropriate consent was received. The technique utilized throughout was Torque Release Technique with the care plan for this patient being directed according to indicators assessed by Torque Release Technique protocol and palpation. Description of this technique protocol and use of the Integrator instrument has been described previously.^{1,2}

TRT is a non-mechanistic, non-linear technique. It utilizes the Integrator Recoil instrument, specially designed to reproduce the different components of the adjustment: thrust, torque, and recoil but at the speed of 1/10,000th of a second.¹ Considering the severity of the neurological integrity of the patient in this study, TRT was an ideal adjusting technique to use.

The examiner felt that the patient required intensive chiropractic care; however due to the nature of the patient's chronic condition and extensive symptoms, a care plan of twice a week was established in order for the patient to adapt to care.

For the first two visits, patient noted dizziness immediately following chiropractic adjustment. After one month of care, patient noted that dizziness had decreased dramatically, specifically when rising from a supine or seated position to standing.

PROGRESS EXAMINATION - ONE MONTH

Static EMG Results

This follow-up scan revealed an improvement in the left shift of hypertonicity to a more balanced pattern of paraspinal muscular activity. The upper cervical hypertonicity has decreased.

Thermal Scanning Results

- Temperature differences one to two standard deviations greater than the mean were observed at T3, L2, and L4. This is indicative of mild asymmetry.
- Temperature differences two to three standard deviations greater than the mean were observed at T2, T9, T11, L1, and L3. This is indicative of moderate asymmetry.
- Temperature differences three to four standard deviations greater than the mean were observed at C3, T10, and L5. This is indicative of severe asymmetry.
- Temperature differences four or more standard deviations greater than the mean were observed at: C1 and T4. This is indicative of very severe asymmetry.

Chiropractic care continued at two times per week.

COMPARATIVE EXAMINATION - 4 MONTHS

Range of motion

Initial examination of the patient's range of motion produced extreme pain and so a numerical value could not be recorded. Noting improvement on the re-examination, all of the following motions were now able to be performed without pain and therefore have a numerical value.

- Cervical extension 50/60
- Cervical flexion 45/50
- Left cervical rotation 60/80
- Right cervical rotation 65/80
- Left cervical lateral flexion 35/45
- Right cervical rotation 35/45

- Bilateral cervical Kemp's tests were negative.
- Cervical Distraction and Compression were negative.

- Lumbar extension 5/25
- Lumbar flexion 0/60
- Left lumbar rotation 0/25
with pain in mid-scapular region
- Right lumbar rotation 0/25
with pain in mid-scapular region
- Left lumbar lateral flexion 25/25
- Right lumbar lateral flexion 25/25

- Bilateral lumbar Kemp's tests were negative.
- Heel/Toe Walk was unable to be performed due to lack of balance.

Muscle Tests

	<u>Left</u>	<u>Right*</u>
• Grip Strength	30	80
• Deltoids	4/5	4/5
• Biceps	1/5	1/5
• Triceps	1/5	1/5
• Wrist Extension	5/5	5/5
• Wrist Flexion	2/5	2/5
• Finger Abduction	2/5	2/5
• Finger Adduction	2/5	2/5
• Hamstrings	1/5	1/5
• Quadriceps	1/5	1/5
• Hip Flexion	5/5	5/5
• Psoas	0/5	0/5
• Hip Abduction	5/5	5/5
• Hip Adduction	5/5	5/5
• Gluteus	2/5	2/5
• Foot Dorsi-Flexion	5/5	5/5
• Foot Plantar-Flexion	5/5	5/5

* Indicates right-handedness

Muscle hypertonicity was noted bilaterally in the scalenes, levator scapula, and upper trapezius.

Reflexes

	<u>Left</u>	<u>Right</u>
• Biceps	+2	+2
• Triceps	+2	+2
• Brachioradialis	+2	+2
• Patellar	+2	+2
• Achilles	+2	+2

Dermatome Testing

- C5, C6, C7, C8, and T1 were increased on the right.
- L3, L4, L5, and S1 were increased on the right.

Postural Analysis

Anterior Head Translation of 1.5 inches, right low ear, left low shoulder, and right low hip were all noted.

Static EMG Results

This exam revealed a return to the left shift in hypertonicity but this is met by an increase in muscular activity on the right - though not to the same degree. A more normal paraspinal pattern appears to be emerging.

Thermal Narrative

- Temperature differences one to two standard deviations greater than the mean were observed at T5, T8, and T9. This is indicative of a mild asymmetry.
- Temperature differences two to three standard deviations greater than the mean were observed at T10 and T11. This is indicative of a moderate asymmetry.
- Temperature differences four or more standard deviations greater than the mean were observed at C1. This is indicative of a very severe asymmetry.

Chiropractic care was continued at two times per week.

PROGRESS EXAMINATION - 6 MONTHS

Static EMG Results

Overall hypertonicity has reduced with only two spinal levels (C1 & T4) showing increased tonicity.

Thermal Scanning Results

- Temperature differences one to two standard deviations greater than the mean were observed at L4 and L5. This is indicative of a mild asymmetry.
- Temperature differences three to four standard deviations greater than the mean were observed at C1 and T5. This is indicative of a severe asymmetry.
- Temperature differences four or more standard deviations greater than the mean were observed at T4. This is indicative of a very severe asymmetry.

Summary of Patient Care

The patient has reported dramatic improvements in her health status as well as ability to accomplish daily activities. Her dizziness has completely resolved. She feels more stable and comfortable when walking, although use of a cane is still mandatory. Muscle strength in her arms, shoulders, and legs have improved and she notes she no longer has pain in her SI joints. The documented improvements in the surface EMG and thermal scans give us an objective measure of a decrease

in paraspinal muscle activity and an improvement in the integrity of the autonomic nervous system respectively.

Discussion

The Brain Injury Association of America defines a brain injury as:

*"...an insult to the brain, not of a degenerative or congenital nature but caused by an external physical force, that may produce a diminished or altered state of consciousness, which results in an impairment of cognitive abilities or physical functioning. It can also result in the disturbance of behavioral or emotional functioning. These impairments may be either temporary or permanent and cause partial or total functional disability or psychosocial maladjustment."*³

There are two general types of brain injuries: traumatic and acquired. A traumatic brain injury (TBI) occurs when an external force causes damage to the head by inducing motion of the brain within the skull. A TBI can affect only one part of the brain or several different areas. The severity of a TBI depends on the type and amount of force that is acquired. Traumatic brain injuries are sub-divided into two categories: primary and secondary. A primary injury occurs at the point of trauma and a secondary injury occurs after trauma and produces effects that continue for long periods of time.⁴

In the case of this patient, the primary injury occurred during the two motor vehicle accidents. The secondary injury was caused by the *effects* of the primary injuries, specifically cellular damage.

Kraus et al. explains how secondary injuries come about through the following neurochemical mediators: excitatory amino acids, endogenous opioid peptides and increased intracranial pressure. Excitatory amino acids are responsible for cell swelling, vacuolization, and neuronal death. Opioid peptides modulate the presynaptic release of EAA (excitatory amino acid) neurotransmitters, thereby exacerbating neurological damage.⁴

Holder and Blum suggest that every level of the spine has an intimate relationship with the limbic system's ability to process and establish a balanced *Brain Reward Cascade*.⁵ Furthermore, vertebrates have an opiate receptor brain reward cascade mechanism and the brain reward cascade is dependant on the proper functioning of the dopaminergic and opioidergic reward pathways of the nervous system. These are critical in providing the pleasure drives for eating, love, and reproduction that are elemental in the survival of vertebrates. The "natural reward" of pleasurable sensations involves the release of dopamine, the primary neurotransmitter in the brain reward pathway. The proper functioning of the brain reward pathway and its proper sensations of pleasure are dependent on the genes that regulate the dopamine receptors and the synthesis, degradation, and transportation of dopamine.⁶ Opioid peptides cause the release of dopamine in the nucleus accumbens.^{7,8} Kyles et al. found that when dopaminergic and opioid systems process nociceptive information it is mediated spinally.⁹

According to D.D. Palmer in 1910, if the spinal column is free of interference from spinal subluxations then the body is able to adapt to its inner and outer environment to the best of its ability.¹⁰ A subluxation has been defined as a complex of functional and/or structural and/or pathological articular changes that compromise neural integrity and may influence organ system function and general health.¹¹ Mollendorf states:

"The vertebral subluxation also interferes with the function of the dopamine receptors in the nervous system, particularly in the dorsal roots of the spinal nerves and the dorsal horn of the spinal cord. This will lead to further altered function and incoordination. This is often seen when obsessive/compulsive or addictive behaviors are used by Educated Brain in response to Innate Intelligence's messages to increase the release of dopamine in the limbic system (including the dorsal roots of the spinal nerves and the dorsal horn of the spinal cord) until the vertebral subluxation can be reduced or corrected."¹²

This author's theory is that due to this patient receiving regular chiropractic adjustments effectively correcting her spine of multiple levels of subluxation, that this allowed her body to properly modulate the opiate receptors. Such restored function thereby reduced pain and decreased the release of EAAs—which would in turn decrease the effects of cellular damage, as well as moderating the release of dopamine and establishing a balanced brain reward cascade system. As a result, pain decreases and quality of life improves.

According to research out of the University of Michigan Health System's Department of Physical Medicine and Rehabilitation, more than 80 percent of individuals that suffered from traumatic brain injuries believed that the alternative approaches to health including chiropractic were effective, even though there has been little medical assessment in most cases.¹³

Conclusion

Based on the results of this case, chiropractic should be considered for patients recovering from traumatic brain injuries. There were three specific goals that the chiropractor and patient set out to achieve before chiropractic care commenced: subluxation reduction, reduction of symptoms, and increased quality of life for the patient. All three goals were accomplished within six months of beginning care. Initially, adjustments were being provided for up to six levels per visit. This author notes that Torque Release Technique protocol indicates the number of levels adjusted per visit should be a maximum of three. Over the course of this patient's care, there were occasional visits when more than three segments were adjusted, due to special circumstances. Keeping in mind the severity of injuries experienced through brain injury, the number of specific individual adjustments continued to be at three to six levels; however a change in subluxation pattern was noted.

A reduction of symptoms was also noted gradually within one month and continued throughout care. An increase in the quality of life was at first thought impossible by the patient but

was soon realized when she was able to perform daily tasks that at one point seemed impossible.

The potential for a chiropractic adjustment to make a change in someone's quality of life should never be underestimated. In this case, someone who had lost hope in life due to severe physical injuries and emotional trauma she had experienced once again discovered that she could enjoy life to her fullest capabilities. The patient continues under chiropractic care at this time.

Further studies showing the effects of chiropractic on the healing process of patients with traumatic brain injuries and studies encompassing a larger group are needed.

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