# CASE SERIES

# Improved Health Outcomes in Parkinson's Disease Utilizing Specific Upper Cervical Chiropractic Protocol: A Case Series

*Tron Malachowski D.C.[1] & Ruvayn Rubinstein D.C.[2]*

## ABSTRACT

**Objective:** To report reductions in the Unified Parkinson's Disease Rating Scale (UPDRS) in three patients diagnosed with Parkinson's disease (PD) utilizing Kale Upper Cervical Specific Chiropractic protocol over 3 years.

**Clinical Features**: Patient one is a 63-year-old male who presented to the office diagnosed with PD with a UPDRS rating of 25. Using knee chest upper cervical specific protocol, it was established that the patient had a subluxation with a combination listing of ASL-PL. Patient two is a 65-year-old male who presented with PD and a UPDRS rating of 27. Using knee chest upper cervical specific protocol, it was established that the patient had a subluxation with a combination listing of ASRA-PLI. Patient three is a 66-year-old male who presented with PD and a UPDRS rating of 39. Using knee chest upper cervical specific protocol, it was established that the patient had a subluxation with a listing of PL.

**Interventions and Outcome:** Using Upper Cervical Specific Protocol, x-rays, bilateral NeuroCaloGraph (NCG) readings, orthopedic, neurological testing, and UPDRS scoring, the patient's outcomes demonstrated significantly reduced UPDRS scores. Orthopedic findings, neurological findings and NCG readings were also improved significantly.

**Conclusion:** Upper Cervical Specific chiropractic care utilized on three patients with a diagnosis of PD, rated using the UPDRS test at 2 months, 6 months and 36 months. Results associated with PD included better overall health, improved ambulation, a reduced UPDRS score and a reduction in upper cervical subluxations were all obtained.

**Key Words:** *Parkinson's, Specific Chiropractic, vertebral subluxation, upper cervical, Kale Technique, UPDRS*

### Introduction

More than 1.5 million Americans are diagnosed with Parkinson's disease (PD), which is more than are afflicted with multiple sclerosis and muscular dystrophy combined[1]. It is estimated that there are 100,000 new cases of PD reported annually in the United States[2]. Malachowski et al., states that PD which is also known as paralysis agitans is a progressive disorder that affects the central nervous system, characterized by tremor and impaired co-ordination[3]. PD results from obliteration of the substantia nigra, the area of the brain which is responsible for signaling the basal ganglia to secrete

1. Private Practice of Chiropractic, Summerville, SC
2. Private Practice of Chiropractic, Troy, MI

dopamine and filter sensory signals to the motor cortex[4]. PD is considered a multi-factorial disease ensuing from the effects of environmental factors and genetic susceptibility[5].

According to the National Parkinson's Foundation, "In clinical practice a diagnosis of PD is considered when a patient exhibits two of the four key symptoms: resting tremors, akinesia, rigidity, and in-coordination or poor balance[6]." The allopathic model of treating a patient with PD is with a group of medications including *Levodopa*, which is considered the most effective PD medication. *Levodopa* is a chemical that passes through the patient's blood brain barrier and is converted to dopamine. It is usually combined with *Carbidopa*, a medication which protects *Levodopa* from early conversion to dopamine[7]. The combination of the two drugs is sold using the brand name *Sinemet*.

According to the practice parameters of how to treat PD, it is stated that patients who took *Levodopa* scored considerably better on the Unified Parkinson's Disease Rating Scale (UPDRS) with the greatest improvement seen on the highest dosage of *Levodopa* when compared to a placebo in a double-blinded study compared to a controlled trial[8]. Dopamine agonists such as *Mirapex and Requip* mimic dopamine effects in the brain and these two drugs are usually taken with *Levodopa*.

MAO B inhibitors, such as *Azilect*, are used to help prevent the breakdown of brain dopamine by inhibiting the brain enzyme monoamine oxidase B (MAO B). This enzyme metabolized brain dopamine[7]. Even with the great deal of medications that are offered to help PD, it is stated by Bello et al., that "all the current drugs and surgical therapies are not curative, but focused on temporary symptomatic relief of the patient to improve quality of life for as long as possible until more permanent solutions are uncovered[2]."

There are multiple tests used to track PD, such as, the Hoehn/Yahr test, the Schwab/England test, but the Unified Parkinson's Disease Rating Scale (UPDRS) is the most commonly used and is widely considered the gold standard for evaluation of PD in both clinical and research settings[9]. The total UPDRS scores includes 42 items which contribute to three sub-categories: (1) Mentation, Behavior, and Mood; (2) Activities of Daily Living; and (3) Motor Examination[9]. (Table 1 illustrates the UPDRS) Each category is rated from 0 to 4 according to disability level; a score of 0 indicates absence of the symptom, whereas 4 represents complete disability[1].

For example, when evaluating tremors according to the UPDRS scale, "0" indicates absent, "1" represents slight and infrequently present, "2" indicates moderate; bothersome to patient, "3" equals severe; interferes with many activities, "4" is considered to be marked; interferes with most activities. In a study by Gerlach et al., it was determined that an increase of 2.5 points overall is to be considered a minimal change while an increase of 5.2 points overall is considered to be a moderate change in UPDRS scores[10]. Strengths of the UPDRS include its wide utilization, its application across the clinical spectrum of PD, and its nearly complete coverage of motor symptoms.

The UPDRS can be considered to be reliable and valid.[11] In this case series, Kale Upper Cervical Specific Chiropractic Protocol was administered to the 3 patients who entered the specific chiropractic office with an existing PD diagnosis. An upper cervical technique was chosen for the care in these cases because it was determined by Landry et al., "that an Atlas re-alignment was associated with the reduction of Parkinson's symptoms including various motor and non-motor conditions[12]." Numerous other authors have found similar symptomatic improvement to be the case.[1-4,22-,24]

## Case Report

*History*

*Patient One:* A 63-year-old disabled male who is single with four children, the patient presented to the office with a chief complaint of PD. The patient was diagnosed by his PCP for PD 5 years prior to coming into the office. The patient's health history revealed prior surgeries of both knees (1964, 1998), shoulder (1977), foot (2010), and spine (2010). In 1997, the patient was hit by a truck while riding his bike. He stated he was knocked unconscious during this accident. Patient stated that he has required a cane since his knee replacement as well as, his PD. The patient had been treated for spine/nerve disorders due to PD.

The patient stated that he had been hospitalized in the past for back pain and pneumonia. Patient presented to the office with a health history of: occasional allergies, chills, dizziness, fever, headaches, numbness, sweats, elbow, hand and feet pain, sciatica, gas, constipation, diarrhea, excessive hunger, nausea, colds, ear noises, failing vision, hoarseness, sinus infections, poor circulation, rapid heartbeat, chronic couch, difficult breathing, productive cough, and wheezing. Patient suffered frequent fatigue, sleep disturbances, weight loss, and degenerative joint disease.

The patient stated he suffered from pain in his shoulder, arms, hips, legs and knee, earaches, dryness of skin, and itching. Patient stated that without his medications, he suffered from constant tremors. The patient also stated he suffers from foot troubles, low back pain, neck pain, and stiffness, pain between shoulders, poor posture, spinal curvature problem, dental decay, and frequent night urination. Patient stated that he had the following conditions: cold sores, eczema, fever blisters, measles, and pneumonia. The patient's major complaint for coming into the office was due to spinal pain and Parkinson's disease.

Since diagnosis, patient number one's symptoms have been treated with the following medications: *Sinemet* (25/100mg) used to treat tremors, muscle stiffness, and weakness, *Requip* (3mg) used to treat PD symptoms, *Flexeril* (10mg) which is a muscle relaxant, *Lortab* (7.5/500) which is a combination narcotic analgesic to relieve moderate to severe pain, *Naproxen* (500mg) which is a non-steroidal anti-inflammatory drug (NSAID) used for pain relief, *Soma* (350mg) which is a muscle relaxant, *Azilect* (.5mg), *Lyrica* (75mg) which is a anticonvulsant drug used for partial seizures, and generalized anxiety (stopped taking *Lyrica* on 3/13), and *Klonopin* (.5mg) which is a benzodiazepine drug used for anxiolytic, anticonvulsant, muscle relaxant, sedative and hypnotic. Patient

also takes a calcium supplement (500mg + D 400u). At his initial chiropractic exam patient number one scored a 25 on the UPDRS.

*Patient Two:* A 65-year-old unemployed single man who presented to the office with a history of Type II Diabetes, heart disease, and Parkinson's disease. Patient stated that he had never been in an auto accident and his conditions were likely not related due to any type of accident, but patient was once knocked unconscious due to a seizure he experienced after he fell and hit the back of his head on the pavement. The patient presented to the office with occasional dizziness, fatigue, neck pain, leg and foot pain, colon trouble, diarrhea and rashes as well as frequent tremors and high blood pressure. Patient also stated that he has had tingling into his left arm for about one month, an MRI was ordered to evaluate the reasoning for the tingling it was confirmed that spinal canal stenosis was present in the cervical spine.

Patient's major complaints were poor posture, difficulty walking, and incontinence. He was diagnosed with Parkinson's disease in 2008 by his primary care physician (PCP). Patient stated that an increased amount of stress would cause his Parkinson's symptoms to increase. Patient was treated for symptoms using the following medications which were prescribed by his PCP: *Levetiracetam* for epilepsy, *Lisinopril* (an angiotensin-converting enzyme inhibitor) for hypertension, *Glipizide* for diabetes, and dopamine agonist *Mirapex*. According to the Mayo Clinic, the difference between *Mirapex* and *Levodopa* is that *Mirapex* does not change into dopamine but instead mimics the effects of dopamine in the brain[7]. In the patient's initial chiropractic exam he scored a 27 on the UPDRS.

*Patient Three:* A 63-year-old retired male who is married with one child, he presented to the office with a chief complaint of PD which was diagnosed by his PCP in 2000. Patient stated that he had experienced a "funny" walk with a shuffle, as well as shaking in his hands. He stated his conditions were not due to any type of accident. The patient's health history revealed that he had occasional allergies, chills, fatigue, sleep disturbances, weight loss, sweats, bursitis, foot troubles, neck pain and stiffness, pain between his shoulders. Patient also stated he has had previous pain and or numbness in his shoulders, elbows, and hips, he stated he had gastro-intestinal issues such as gas as well as the occasional cold and sore throat.

Patient stated he has had occasional chest pain that feels like pressure on his chest. The patient also had frequent tremors and low back pain; he also stated he had low blood pressure. The patient stated he has poor posture and a bad spinal curvature. It is also noted that the patient had frequent urination. The patients past medical history included influenza, pneumonia. Patient had bilateral knee surgery for torn cartilage 15 years prior to starting care. Due to the patient's PD he is taking the following medications: *Carbidopa (25mg/day) and Levadopa (100mg/day).* The patient also stated that he takes a melatonin supplement as needed. At his initial chiropractic exam, patient number three scored a 39 on the UPDRS.

*Examination*

*Patient One:* Upon first visit to the office he underwent an initial chiropractic examination which included the following diagnostic criteria; orthopedic, neurological, thermal and radiographic testing. Orthopedic testing revealed that the range of motion (ROM) in the patient's cervical spine was restricted in the following directions; flexion was noted as 40 degrees with pain (normal is 50°), extension was noted as 40° with pain° (normal is 60°), left / right rotation were noted as 45° on left and 40° on right with pain (normal 80°), left / right lateral flexion were noted as 30° on the left and 30° on the right with pain (normal 45°). Patient had a positive Jackson compression test. According to Sousa et al., Jackson compression is a test with an axially applied pressure to the patient's head in multiple directions; local pain felt more on extension and/or rotation indicated facet issue, while radiating pain down the arm may indicate nerve root involvement.[13] Neurological exam was administered as part of the UPDRS test (Table 1).

*Patient Two:* Upon first visit to the office he underwent an initial chiropractic examination which included the following diagnostic criteria; orthopedic, neurological, thermal and radiographic testing. Orthopedic testing revealed that the ROM in patient's cervical spine was restricted in the following directions; flexion was noted as 20° , extension was noted as 10 degrees (need degree symbol), left / right rotation were noted as 15° on left and 25° on right with pain, left / right lateral flexion were noted as 10° on the left and 10° on the right with pain. Patient had a positive shoulder depression test which according to Sousa et al., can cause nerve root or brachial plexus stretching on the side opposite of head deviation, or nerve root compression on the side of lateral flexion.[13] The Neurological examination was administered as part of the UPDRS test (Table 2).

*Patient Three:* Upon first visit to the office he underwent an initial chiropractic examination which included the following diagnostic criteria; orthopedic, neurological, thermal and radiographic testing. Orthopedic testing revealed that the ROM in the patient's cervical spine was restricted in the following directions; rotation was noted as 70° on the left and 45° on the right, the patient also had restrictions with lateral flexion on the right of 25°. Neurological exam was administered as part of the UPDRS test (Table 3).

*Instrumentation*

According to Amalu et al., "Digital infrared imaging is an extremely sensitive, non-invasive, risk-free, and accepted diagnostic procedure that images neurophysiology via cutaneous infrared emissions[14]." In present years infrared imaging has been verified to be a useful and insightful test for spinal nerve root irritation, articular facet syndromes, peripheral nerve injuries, sympathetic pain syndromes, and vertebral subluxation. According to Amalu et al., there have been several blinded retrospective and prospective studies comparing infrared imaging results to that of CT, MRI, EMG, myelography, and surgery, infrared imaging was shown to have a high degree of sensitivity (99.2%), specificity (up to 98%), predictive value, and reliability[14].

There are many factors that can influence skin temperature, such as room temperature, sunburn, and different substances such as, alcohol and tobacco. Thermal pattern analysis which was used in this case series is based upon the following concepts. First that skin temperature is fundamentally regulated by the autonomic nervous system and secondly, that dynamic skin temperatures imitate a dynamic healthy nervous system evoking adaptive responses to the environment[15]. Upon each of the patients first visits into the office a K4 NeuroCaloGraph (NCG) was utilized. The NCG is a thermocouple device which is used for measuring thermographic paraspinal temperature bilaterally. The K4 NCG is consistent to the technique that was utilized in this study. According to McCoy et al., It was determined that changes seen in correctly performed thermal scans are most likely due to actual physiological changes rather than equipment or technical error. Evidence shows that para-spinal thermal scanning is a dependable method of determining if dysautonomia secondary to a subluxation is present[16].

The results from these paraspinal thermographic scans are then compared to identify constants and variables. Kessinger et al. describe the process as, "Once the constants have been identified, the best representation of these 5 initial graphs is selected for future comparison and analysis. The example pattern graph is selected on the criteria of having all the constants and the best representation of the top constant or pattern angle (PA)." Using a pattern analysis assessment scale (PAAS) to determine progress or regression in patient status with regard to the established pattern, four different assessments can be made for each constant.

A constant can either be present (P), present reduced (PR), opposite pull (OP), or clear (C). The PAAS gives the highest weight to the PA, with a lesser value for each subsequent constant. Similarly, P rates higher than PR, with OP having an even smaller value, and C having a value of zero. Reductions in PAAS score was documented with concurrent improvement in heart rate variability (HRV) and subjective measures[17].

It has been debated that if the chiropractic profession is going to continue to stand on its core principles that the subluxation, and its adjustment, does affect the neurophysiology of the body, it becomes absolutely essential, as a responsible specific chiropractor, to monitor its function using the best equipment the world has to offer. Through the use of para-spinal temperature readings, we as a profession, have the distinctive opportunity to establish neurophysiologic responses as the major factor within the subluxation, therefore expanding the limitations of the chiropractic practice beyond abnormal spinal biomechanics to the never-ending confines of the nervous system itself[18].

*Radiographs*

Precise upper cervical x-rays were used to analyze the patients and to evaluate for subluxation.. Each case showed significant cause for utilization of x-ray including: decreased cervical range of motion, cervical region pain, cervical region tenderness and taut fibers throughout the cervical region.

The first x-ray utilized is a cervical lateral film. The x-ray is taken at a distance of 70 inches with the patient covered using a lead shield and sitting up straight in an x-ray chair. The hard palate is set parallel to the ground to account for improper position which would result in too much flexion / extension in the film. Rotation and head tilt is also taken out of the required film by viewing the patient from anterior to posterior and rotating the x-ray chair. Head tilt is also removed by tilting the patient at the hips either left or right so that the top of the ear lobes are at the same height. The central ray is placed at the patient's mastoid fossa. Collimation is taken into an 8x10 film and factors are set according to the patient's thickness and compared to an up to date x-ray calibration chart. The x-ray was then taken.

An anterior to posterior open mouth (APOM) was the second film taken. The patient was given a lead shield to wear and was sitting up straight in an x-ray chair. Patient head rotation was taken out by rotating the chair in order to create equal space between the lateral edge of the patient's eyebrow to the edge of their medial hairline. Head tilt was removed by titling at the patient's hips which ensured that the top of their ear lobes were parallel to each other. X-ray tube was placed at 40".

A lanyard was utilized by raising it to pass through the lower 1/3 of the patient's open mouth and the patient's transverse process of C1. Once this location was achieved, the height of the x-ray tube was set, and the central ray was rotated to rest at the center of the film. Collimation is taken into an 8x10 film and factors are set according to the patient's thickness and compared to an up to date x-ray calibration chart. The x-ray was then taken.

A base posterior (BP) was the final film that was taken. A lead shield was placed on the patient, the patient was instructed to sit up straight and their hard palate level was set level to the floor. The film bucky was tilted to 45 degrees and the middle of the bucky was set at the crown of the patient's head. The patient was sitting in an x-ray chair. Patient head rotation was taken out by rotating the chair in order to create equal space between the lateral edge of the patient's eyebrow to the edge of their medial hairline.

Head tilt was removed as well by titling at the patient's hips to ensure the top of their ear lobes were parallel to each other. A lanyard was utilized and straightened in order to pass through both the middle of the mandible, and also ½" anterior to the external auditory meatus. The lanyard is 40" which allows for correct distance of the x-ray tube, and also proper tilt of the x-ray tube. Once this location is set, the x-ray tube is rotated and placed at the middle of the bucky. Collimation is taken into an 8x10 film and factors are set according to the patient's thickness and compared to an up to date x-ray calibration chart. The x-ray was then taken.

This series of x-rays is the same series of x-rays that were utilized by the Dr. BJ Palmer Research center is Davenport IA[19]. An in depth analysis of the films was done to see if misalignments were occurring in the cervical region. The lateral cervical x-ray was analyzed using several points according to Volume 21. The first point was marked at the center of the anterior tubercle of C1. The second point was marked at the center of posterior arch of C1. A parallel line was drawn in reference to the top of the film and drawn

through the anterior tubercle point. The next line was connecting the point made at the anterior tubercle and the posterior arch. By drawing these two lines an angle will be visible. This angle is where C1 is currently at; 8-10 degrees marks an average angle.

The APOM was analyzed using several points according to Volume 21. A line will be marked horizontally across the foramen magnum. This line will then be bisected. And a line will be dropped perpendicular to the foramen magnum line. Four more points are marked. Both the left and right lateral edge of lateral mass of C1, the middle of the dens of C2, and also the C2 spinous process. A compass is utilized to mark the laterality of C1. The compass is opened with the sharp end placed on the vertical line that is dropped through the foramen magnum line near the middle of the dens, and the compass is rotated and fixed to scribe an arc line on the edge of lateral inferior edge of the left lateral mass of C1.

The compass is kept at that fixed width, and then rotated drawing an arc line either inside or outside of the lateral inferior edge of right C1 lateral mass. In general, the scribed line will dictate whether the atlas has shifted to the left or right.

The BP was analyzed using several key points according to volume 21. Points were made in the middle of right and left C1 transverse process foramen. A line is drawn through these points. Two points are scribed on either side of the basilar process and a horizontal line is drawn. The last point is made on the external occipital protuberance (EOP). A line is drawn through the EOP and the middle of the basilar process line. The intersection of these two lines makes an angle. This angle represents any rotation in C1.

This thorough analysis allows for accurate directional misalignments in the upper cervical spine. This same analysis was utilized in all three cases.

*Intervention*

Each of the three patients received a specific chiropractic listing based upon their x-ray findings. According to Kale protocol the first cervical vertebrae (Atlas-C1) or the second cervical vertebrae (Axis-C2) were adjusted depending on the misalignment. The adjustment takes place with the patient in a kneeling posture called "Knee Chest Posture." In the knee-chest posture; the patient kneels upon a pad or carpet and, bending forward, places the head and top of the shoulders on the upper portion of the table. The patient's thighs are at a 90 degree angle to the floor, which serves to give the lower end of the spine a fixed support. This, combined with the forward bench, gives the spine the necessary "bridge."

With the patient in this posture, the doctor can use the body drop toggle-torque recoil[20].According to Stephenson's in the Art of Chiropractic, "a body drop toggle-torque recoil is a method whereby the weight of the body is used to support the adjustic thrust[21]."

*Patient One:* Analysis of x-rays revealed a combination listing of atlas-superior-left (ASL) and an axis listing of posterior-left (PL). When the patient was found to have neurological dysfunction based on pattern analysis and it was determined that atlas and axis were subluxated, they would be adjusted as a combination listing of (ASL-PL). This subluxation was adjusted using the body drop toggle-torque recoil with the patient in knee chest posture with his head turned to the left. The adjustment was performed by contacting the lateral inferior aspect of C2 spinous process with the doctor's left pisiform with a line of drive (LOD) of lateral to medial (L-M). Immediately following the adjustment, the adjusted was administered using the body drop toggle-torque recoil adjustment. Positioning for this adjustment occurred in the knee chest posture with the patient's head rotated to the left, the left posterior arch was contacted by the fleshy pisiform of the left hand using a LOD of L-M, and anterior to posterior (A-P) with counter-clockwise torque.

*Patient Two:* Analysis of x-rays revealed an atlas listing of atlas-superior-right-anterior (ASRA) with an axis listing of posterior-left-inferior (PLI). When the patient was found to have neurological dysfunction based on pattern analysis and it was determined that atlas and axis were subluxated, they would be adjusted as a combination listing of (ASRA-PLI) using the body drop toggle-torque with recoil. The placement of the patient during the adjustment was in knee chest posture with his head turned to the left at first, his C2 inferior lateral spinous process would be adjusted with the fleshy pisiform of the left hand and the thrust would be given with a LOD of L-M, inferior to superior (I-S), with counter-clockwise torque.

Immediately following, a listing of ASRA would be utilized. The patient would be in the knee chest posture, which his head would be turned to the right. The doctor would contact the right posterior arch of C1 with the fleshy pisiform of the right hand using a LOD of L-M, and A-P with clockwise torque.

*Patient Three:* Analysis of x-rays revealed an atlas listing of atlas-superior-left-anterior (ASLA) and an axis listing of PL. When the patient was found to have neurological dysfunction based on pattern analysis and it was determined that C2 would be adjusted. The body drop toggle-torque recoil adjustment would be performed with the patient in the knee chest posture. Using the body drop toggle-torque with recoil, the placement of the patient would be in knee chest posture with his head turned to the left, the patient's C2 inferior lateral spinous process would be contacted with the pisiform of the left hand and the thrust would be given with a line of LOD of lateral to medial L-M.

Following every adjustment the three patients would be told to rest on a flat bench for 30-35 minutes. After the resting period the patients would be re-evaluated using the K4 NCG to inquire if the heat pattern was symmetrical or had changed. A straight line or change in the graph would indicate that the patient's subluxation was corrected, therefore expressing full neurological function.

The patient's would then be scheduled for their next appointment. There were instances for all three patients in which they would come into the office with no neurological deficit and therefore not receive a specific chiropractic adjustment. They would therefore be scheduled according to their visit plan.

*Outcome*

Patient number one received upper cervical specific chiropractic Kale protocol for a period of 3 months. The patient was re-evaluated after 2 months using the UPDRS rating scale showing a reduction of the initial test from 25 to 15 (Table 1). The changes at re-evaluation show a decrease in mentation issues, swallowing issues, handwriting issues, temperature issues, walking issues, speech problems, facial expression problems, right hand grip weakness, right hand pronation/supination issues, posture abnormalities, gait problems, dyskinesia (duration), dyskinesia (disability), dyskinesia (pain), and sleep disturbances. Patient also showed a significantly improved ROM without pain; Jackson compression test was now negative. (Initial ROM: cervical flexion = 40° with pain, extension = 40° with pain, left rotation = 45° with pain, right rotation = 40° with pain, left lateral flexion = 30° with pain, right lateral flexion = 30° with pain. Post ROM: cervical flexion were within normal limits (WNL), extension was WNL, left rotation = 80° without pain, right rotation = 60° without pain, left lateral flexion = 25° stiff neck but no pain, right lateral flexion = 25° without pain.)

Patient number two received upper cervical specific chiropractic Kale protocol for a period of 6 months. The patient was re-evaluated after 5 months using the UPDRS rating scale showing a reduction of the initial test from 27 to 15 (Table 2). The changes of the re-evaluation show a decrease in thought disorder, depression, excessive salivation, handwriting issues, dressing issues, walking issues, hand tremors, finger taps, grip strength, and dyskinesia (disability). ROM was significantly improved and now the patient was not experiencing pain. (Initial ROM: cervical flexion =20°, extension =10°, left rotation = 15°, right rotation = 25° with pain, left lateral flexion = 10°, right lateral flexion = 10° with pain. Post ROM: cervical flexion = 40°, extension =40°, left rotation = 30°, right rotation = 30° without pain, left lateral flexion = 35°, right lateral flexion = 35° without pain.)

Patient number three received upper cervical specific chiropractic Kale protocol for a period of 3 years. The patient was re-evaluated after 36 months using the UPDRS rating scale showing a reduction of the initial test from a 39 to a 15 (Table 3). The changes of the re-evaluation show a decrease in excessive saliva, right hand tremors, right finger taps, and dyskinesia (duration). Physical exam revealed increased ROM. (Initial ROM: right rotation = 45°, Post ROM: right rotation = 70°)

**Discussion**

Parkinson's disease is a progressive neurodegenerative disease characterized by resting tremors, bradykinesia, rigidity, and postural abnormalities, with an estimation of about 1 million Americans that have the disease there is still not a cure for it. It is shown that PD is a result of environmental factors as well as genetic susceptibility, increase in age and male gender appears to be in association with an increased risk of developing PD, and PD is well thought-out to be the most common movement disorder in the world[4-5,22].

The allopathic approach to PD is that of medication and surgery, but it is stated by Burton et al., that they neither stop nor reverse the degeneration; the objective of the drugs and surgery are to improve the quality of the patient's life[23].

It has been reported by Elster et al., that Dr. B.J. Palmer treated patients with PD with upper cervical chiropractic care in the early 1930s. Dr. B.J. Palmer would refer to the patients as having "Shaking Palsy" and listed improvements or corrections of symptoms such as "tremor, shaking, muscle cramps, muscle contracture, joint stiffness, fatigue, incoordination, trouble walking, numbness, pain, inability to walk, and muscle weakness," Dr.B.J. Palmer would use thermal scanning, cervical x-rays, and specific upper cervical adjustments performed by hand in the knee chest posture[1].

According to Shapiro et al., Upper cervical chiropractic technique can reduce subluxations and symptoms in PD patients, a history of head, neck or back trauma was recalled by 95% of the PD patients[22]. In a study by Elster it was shown that upper cervical chiropractic care resulted in an improvement of symptoms in 92% of the patients in the study, the results indicated a underlying link between trauma, upper cervical injury and the onset of PD. Elster hypothesized "that correcting cervical spine injuries with an upper cervical chiropractic technique may reduce the progression of PD[3-24]."

Elster's hypothesis is sufficient for the three patients' in this study, as there is noted trauma and misalignment based upon the x-rays that were taken in these cases. Vertebral subluxations were observed and the patients underwent specific Kale knee chest upper cervical chiropractic care to remove the vertebral subluxations. Improvement in all three of the patient's signs and symptoms as well as a decrease in all three patients UPDRS ratings were observed. Further research into vertebral subluxations and their correlation with PD should be considered.

**Conclusion**

This case series shows a positive outcome in all three patients suffering from Parkinson's disease after receiving Kale upper cervical specific chiropractic protocol. It is still unclear whether the vertebral subluxations were the cause of their signs and symptoms or their reduction in UPDRS scores. More research correlating subluxation, PD and chiropractic care are needed to further explore these hypotheses.

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| | Table 1:Patient One UPDRS Results | Initial | Final Exam |
|---|---|---|---|
| | | | |
| 1 | Mentation | 0 | 0 |
| 2 | Thought disorder | 0 | 0 |
| 3 | Depression | 0 | 1 |
| 4 | Motivation/Initiative | 0 | 0 |
| | **Subtotal 1-4 (Max=16)** | | |
| 5 | Speech | 0 | 1 |
| 6 | Salivation | 0 | 0 |
| 7 | Swallowing | 0 | 0 |
| 8 | Handwriting | 2 | 0 |
| 9 | Cutting food | 0 | 0 |
| 10 | Dressing | 0 | 0 |
| 11 | Hygiene | 0 | 0 |
| 12 | Turning in Bed | 0 | 0 |
| 13 | Falling | 0 | 0 |
| 14 | Freezing | 0 | 0 |
| 15 | Walking | 1 | 0 |
| 16 | Tremor | 0 | 1 |
| 17 | Sensory symptoms | 0 | 0 |
| | **Subtotal 5-17 (Max=52)** | | |
| 18 | Speech | 0 | 0 |
| 19 | Facial expression | 0 | 0 |
| 20 | Tremor at rest: face, lips, chin | | |
| | Hands: Right | 0 | 0 |
| | Left | 0 | 0 |
| | Feet: Right | 0 | 0 |
| | Left | 0 | 0 |
| 21 | Action tremor: Right | 0 | 0 |
| | Left | 0 | 0 |
| 22 | Rigidity: neck | 0 | 1 |
| | Upper Extremity: Right | 0 | 0 |
| | Left | 0 | 0 |
| | Lower Extremity: Right | 0 | 0 |
| | Left | 0 | 0 |
| 23 | Finger taps: Right | 0 | 0 |
| | Left | 0 | 0 |
| 24 | Hand grips: Right | 1 | 0 |
| | Left | 0 | 0 |
| 25 | Hand pronate/supinate: Right | 1 | 0 |
| | Left | 0 | 0 |
| 26 | Leg agility: Right | 1 | 0 |
| | Left | 0 | 0 |
| 27 | Arise from chair | - | 1 |
| 28 | Posture | 4 | 3 |
| 29 | Gait | 2 | 1 |
| 30 | Postural stability | 0 | 0 |
| 31 | Body bradykinesia | 1 | 1 |
| | **Sub-total: 18-31 (max=108) Total Points: 1-31 (Max=176)** | | |
| 32 | Dyskinesia (Duration) | 2 | 1 |
| 33 | Dyskinesia (Disability) | 3 | 2 |
| 34 | Dyskinesia (Pain) | 3 | 0 |
| 35 | Early morning dystonia | 0 | 0 |
| 36 | "Offs" (predictable) | 1 | 1 |
| 37 | "Offs" (unpredictable) | 0 | 0 |
| 38 | "Offs" (sudden) | 1 | 0 |
| 39 | "Offs" (duration) | 1 | 1 |
| 40 | Anorexia, Nausea, vomiting | 0 | 0 |
| 41 | Sleep disturbance | 1 | 0 |
| 42 | Symptomatic orthostasis | 0 | 0 |
| | | Total=25 | Total = 15 |

| | Table 2: Patient Two UPDRS Results | Initial | 6 Month Later |
|---|---|---|---|
| 1 | Mentation | 2 | 0 |
| 2 | Thought disorder | 1 | 0 |
| 3 | Depression | 2 | 1 |
| 4 | Motivation/Initiative | 0 | 0 |
| | **Subtotal 1-4 (Max=16)** | | |
| 5 | Speech | 1 | 0 |
| 6 | Salivation | 2 | 1 |
| 7 | Swallowing | 0 | 0 |
| 8 | Handwriting | 2 | 0 |
| 9 | Cutting food | 1 | 1 |
| 10 | Dressing | 1 | 0 |
| 11 | Hygiene | 1 | 0 |
| 12 | Turning in Bed | 0 | 0 |
| 13 | Falling | 0 | 0 |
| 14 | Freezing | 0 | 1 |
| 15 | Walking | 2 | 1 |
| 16 | Tremor | 1 | 0 |
| 17 | Sensory symptoms | 0 | 0 |
| | **Subtotal 5-17 (Max=52)** | | |
| 18 | Speech | 0 | 1 |
| 19 | Facial expression | 0 | 1 |
| 20 | Tremor at rest: face, lips, chin | | |
| | Hands: Right | 1 | 0 |
| | Left | 1 | 0 |
| | Feet: Right | 0 | 0 |
| | Left | 0 | 0 |
| 21 | Action tremor: Right | 0 | 0 |
| | Left | 0 | 0 |
| 22 | Rigidity: neck | 0 | 0 |
| | Upper Extremity: Right | 0 | 0 |
| | Left | 0 | 0 |
| | Lower Extremity: Right | 0 | 0 |
| | Left | 0 | 0 |
| 23 | Finger taps: Right | 0 | 0 |
| | Left | 0 | 0 |
| 24 | Hand grips: Right | 1 | 0 |
| | Left | 0 | 0 |
| 25 | Hand pronate/supinate: Right | 1 | 0 |
| | Left | 0 | 1 |
| 26 | Leg agility: Right | 1 | 1 |
| | Left | 1 | 1 |
| 27 | Arise from chair | 0 | 0 |
| 28 | Posture | 1 | 2 |
| 29 | Gait | 1 | 1 |
| 30 | Postural stability | 0 | 0 |
| 31 | Body bradykinesia | 1 | 1 |
| | **Sub-total: 18-31 (max=108) Total Points: 1-31 (Max=176)** | | |
| 32 | Dyskinesia (Duration) | 1 | 1 |
| 33 | Dyskinesia (Disability) | 1 | 0 |
| 34 | Dyskinesia (Pain) | 0 | 0 |
| 35 | Early morning dystonia | 0 | 0 |
| 36 | "Offs" (predictable) | 0 | 0 |
| 37 | "Offs" (unpredictable) | 0 | 0 |
| 38 | "Offs" (sudden) | 0 | 0 |
| 39 | "Offs" (duration) | 0 | 0 |
| 40 | Anorexia, Nausea, vomiting | 0 | 0 |
| 41 | Sleep disturbance | 0 | 0 |
| 42 | Symptomatic orthostasis | | |
| | | Total=27 | Total = 15 |

| | Table 3:Patient Three UPDRS Results | Initial | Final Exam |
|---|---|---|---|
| 1 | Mentation | 0 | 0 |
| 2 | Thought disorder | 0 | 0 |
| 3 | Depression | 2 | 1 |
| 4 | Motivation/Initiative | 1 | 0 |
| | **Subtotal 1-4 (Max=16)** | | |
| 5 | Speech | 0 | 0 |
| 6 | Salivation | 1 | 1 |
| 7 | Swallowing | 0 | 0 |
| 8 | Handwriting | 2 | 0 |
| 9 | Cutting food | 0 | 1 |
| 10 | Dressing | 0 | 0 |
| 11 | Hygiene | 0 | 0 |
| 12 | Turning in Bed | 0 | 0 |
| 13 | Falling | 0 | 0 |
| 14 | Freezing | 2 | 1 |
| 15 | Walking | 1 | 1 |
| 16 | Tremor | 1 | 0 |
| 17 | Sensory symptoms | 0 | 0 |
| | **Subtotal 5-17 (Max=52)** | | |
| 18 | Speech | 0 | 1 |
| 19 | Facial expression | 0 | 1 |
| 20 | Tremor at rest: face, lips, chin | | |
| | Hands: Right | 1 | 0 |
| | Left | 2 | 0 |
| | Feet: Right | 0 | 0 |
| | Left | 0 | 0 |
| 21 | Action tremor: Right | 0 | 0 |
| | Left | 0 | 0 |
| 22 | Rigidity: neck | 3 | 0 |
| | Upper Extremity: Right | 0 | 0 |
| | Left | 0 | 0 |
| | Lower Extremity: Right | 0 | 0 |
| | Left | 0 | 0 |
| 23 | Finger taps: Right | 1 | 0 |
| | Left | 0 | 0 |
| 24 | Hand grips: Right | 2 | 0 |
| | Left | 2 | 0 |
| 25 | Hand pronate/supinate: Right | 1 | 0 |
| | Left | 1 | 1 |
| 26 | Leg agility: Right | 2 | 1 |
| | Left | 1 | 1 |
| 27 | Arise from chain | 0 | 0 |
| 28 | Posture | 1 | 2 |
| 29 | Gait | 1 | 1 |
| 30 | Postural stability | 1 | 0 |
| 31 | Body bradykinesia | 0 | 1 |
| | **Sub-total: 18-31 (max=108)** | | |
| | **Total Points: 1-31 (Max=176)** | | |
| 32 | Dyskinesia (Duration) | 3 | 2 |
| 33 | Dyskinesia (Disability) | 2 | 0 |
| 34 | Dyskinesia (Pain) | 0 | 0 |
| 35 | Early morning dystonia | 0 | 0 |
| 36 | "Offs" (predictable) | 1 | 0 |
| 37 | "Offs" (unpredictable) | 1 | 0 |
| 38 | "Offs" (sudden) | 1 | 0 |
| 39 | "Offs" (duration) | 1 | 0 |
| 40 | Anorexia, Nausea, vomiting | 0 | 0 |
| 41 | Sleep disturbance | 1 | 0 |
| 42 | Symptomatic orthostasis | | |
| | | Total=39 | Total = 16 |

# CASE STUDY

# Upper Cervical Chiropractic Management of a Patient Diagnosed with Idiopathic Parkinson's Disease: A Case Report

*Steve Landry TRP, DC*[1]

## ABSTRACT

**Objective:** To demonstrate the effectiveness of upper cervical chiropractic care in managing a single patient with idiopathic Parkinson's disease and to describe the clinical findings.

**Clinical Features:** A 63-year-old man was diagnosed with Idiopathic Parkinson's disease after a twitch developed in his right hand at rest. Other findings included loss of energy, anxiety and localized middle back pain.

**Intervention and Outcomes:** Hole-In-One (HIO) Knee Chest protocol was used over a 4 week period using x-ray procedures, and analysis, skin temperature differential (pattern) analysis and Knee Chest adjusting technique. Contact-specific, low amplitude, high-velocity, moderate-force adjustments were delivered to the Atlas vertebra. The patient experienced significant improvements in his quality of life using SF-36, PDQ-39 and subjective intake during upper cervical care. The patient also showed considerable improvements in overall bodily pain, active and passive cervical range of motion, postural correction and better quality of sleep following the cessation of restless leg syndrome.

**Conclusions:** We conclude that improvement of the Atlas alignment was associated with reduction of most of his Parkinson's symptoms including decrease in frequency and intensity of his middle back pain, improvement in his quality of life and improvement in his motor function.

**Keywords:** *Idiopathic Parkinson's disease, upper cervical care, middle back pain, subluxation, chiropractic, Knee Chest, HIO.*

### Introduction

In the United States, 50,000-60,000 new cases of Parkinson's disease (PD) are diagnosed each year, adding to the one million people who currently have PD.[1] Parkinson's disease is considered a chronic and progressive disorder of the central nervous system and characterized by gradual loss of dopaminergic neurons in the substantia nigra.[2] Because dopamine is considered as an inhibitory neurotransmitter, it is thought that the lack of dopamine allows the basal ganglia to send continuous excitatory signals to the corticospinal motor control system.[3] Therefore over excitation of the motor cortex (caused by lack of inhibition) creates typical Parkinson's symptoms such as bradykinesia, rigidity, resting tremor (initially unilaterally and usually of the hands), postural instability and good response to levodopa.[4] However, the clinical recognition among the various Parkinsonian syndromes cannot always be made with accuracy.

Some characteristic clinical features are useful in the differential diagnosis.[5] Growing evidence suggests that PD and

1. Private Practice of Chiropractic, Marietta, GA

depression are linked. Patients with PD often present depressive symptoms during the course of their disease.[6]

Several prospective studies have reported a higher risk of developing PD among individuals with depressive symptoms or taking antidepressants.[7-11] Depression, anxiety, sleep disorders and other cognitive changes are part of the non-motor symptoms of this disease. Few studies have also shown increase in prevalence of restless leg syndrome (RLS) in patients with PD.[12,13]

In this particular case, we evaluated and managed an idiopathic case of Parkinson's disease which is the most common form of Parkinsonism. It is a group of movement disorders that have similar features and symptoms than PD with unknown etiology.[14]

The initial conventional therapy is the prescription of drugs such as Azilect, Levadopa and Artane. Controlled studies related with idiopathic Parkinson's medication such as Azilect noted that the most commonly observed adverse reactions were ≥ 3 % greater than the incidence in the placebo-treated patients and included flu syndrome, arthralgia, depression, and dyspepsia.[15]

Other medications such as Artane have side effects, such as dryness of the mouth, blurred vision, dizziness, mild nausea or nervousness, that will be experienced by 30 to 50 percent of all patients.[16] In conclusion, the use of the medication seems to be at an experimental stage and do not represent a cure for this particular condition.

## Case Report

*Patient History*

The patient is a 63-year-old male Pastoral Counselor complaining of resting tremors of the right hand, anxiety and middle back pain. Both of his complaints started about a year and a half prior following a severe case of the flu that lasted 2-3 weeks where he lost 15 pounds and never sought care for it. He presents as a frail white male with low tone of voice and reduced facial expressions.

He describes his middle back pain (T11-12 area) as a stabbing pain of 5/10 when bending forward, driving and/or standing for more than 20 minutes. The chief complaint of right hand tremor associated with middle back pain and anxiety was diagnosed by a neurologist as Idiopathic Parkinson's disease following an MRI study of the brain presenting as normal. The neurologist prescribed Azilect 1 mg/day (Rasagiline mesylate) and Artane (trihexyphenidyl HCl, USP) which are indicated for the initial treatment of idiopathic Parkinson's disease.

The Pastoral Counselor stated that he also works as a marriage counselor which increases his daily stress level to 8/10 on a daily stress level scale. He also has been experiencing restless leg syndrome at least twice a week for the past two years with poor quality of sleep. Various previous conditions have been noted in his past medical history such as recurrent sinus infections since 1960, melanoma on the back of his right shoulder in 1975, IBS in 1981, neck and right shoulder pain in 1990, lower back pain in 2000, took lexapro, (escitalopram oxalate) antidepressant medication in 2005 for a year period, and left inguinal hernia surgery in February 2010.

*Chiropractic Examination*

Significant findings during the patient's physical examination are reported as follows. In a prone position, patient presented with postural imbalance of left short leg discrepancy at ½ inch and in a supine position a right short leg at ½ inch. The weight bearing postural assessment of the patient revealed an abnormal severe anterior head translation at 2 inches (using external auditory meatus and middle of the deltoid as reference points), right head rotation at ½ inch and right head tilt at ¼ inch.

The patient also presented with a left high shoulder at ¼ inch and left high Ilium at ¼ inch. Active range of motion of the cervical spine showed severe restriction on left lateral flexion at 10/40 degrees and right lateral flexion at 20/40 degrees using an inclinometer. Passive range of motion revealed similar restrictions upon left and right lateral flexion of the head without pain. Upon palpation, taut and tender fibers were found at C1, C2, C4, T7, and at the sacrum area.

Lumbar paraspinal and left quadratus lumborum muscles also presented with taut fibers and tenderness. Visceral examination revealed abnormal "finger rub" test with no hearing past two feet. Orthopedic and neurological examinations showed normal reflexes, normal dorsal column examination such as Romberg's test and normal cerebellar motor functions. Upon testing, no pain was found from the area of middle back pain (T11-12).

The presence of vertebral misalignment in the upper cervical spine regions was confirmed by the findings on digital cervical X-ray, motion palpation, range of motion, and static palpation. Instrumentation using Tytron thermography determined severe temperature asymmetry at the level of the C-1 (Left paraspinal region > Right by 0.83 Celsius), C-2 (Left paraspinal region > Right by 0.75 Celsius) and left mastoid fossa greater by 0.72 Celsius on December 04, 2010.

Temperature asymmetry suggests aberrant function of the sympathetic nervous system innervating the skin vascular beds when temperature asymmetry is greater than 0.5 Celsius.[17] As described by Brown et al., all thermographic data were obtained using the TyTron C-3000. Thermographic data were recorded on each visit prior to any handling or other clinical data taking. Thermographs were done with the patient seated. The instrument was used to scan from C-7 to base of the skull and taking right and left mastoid fossa temperatures. (Brief light contact directly on the skin in the mastoid fossa holding the instrument at a slightly anterior-inferior angle to the fossa.)[18]

Digital x-ray films were taken of the patient's lumbar spine, including T-11 and T-12 area, of antero-posterior and lateral views. Lateral L-5 spot shot and pelvis views were also taken to rule out any pathology. Cervical views were also used including antero-posterior, antero-posterior with open mouth (APOM) and lateral films. A vertex view using head clamps to maintain head in proper alignment was also included in the

series. X-ray films were taken after establishing a similar pattern of paraspinal thermography (pattern with greater than 0.5 Celsius asymmetries at C-1 level) recorded on computer over a 2 week period. Osseous and soft tissues of the lumbar spine and pelvis were unremarkable. X-ray examination of the cervical spine showed secondary intervertebral (osteo) chondrosis including osteophytosis at C-5 and C-7. Uncovertebral arthrosis (degenerative joint disease of the uncovertebral joint) was observed at C-5 to C-7. Between C-4 and C-5, an intercalary bone was seen which corresponds to ossification of the intervertebral disc interposed between two intervertebral bodies.

Using HIO Knee Chest protocol, all cervical views were then analyzed. The lateral film showed a military neck at 0 degrees between C-2 and C-7, which is usually represented as a smooth lordotic curvature. We noticed an adaptative change in the curvature at the level of C-1 vertebra to allow neck extension. A line was drawn on the digital film, originating from the center of the Atlas' (C-1) anterior arch, to the midline of the posterior arch at its most narrow portion. We then drew a horizontal line intersecting with the center of the Atlas' anterior arch and measured an angle of 19.5 degrees.

A cervical gravity line was added through the apex of the odontoid process, showing anterior head translation. On the APOM view, we drew a dot at the base of the odontoid process of the Axis (C-2), corresponding to the center of the foramen magnum. Using computerized technology, we drew a circle using the above dot as the center of rotation. To determine the diameter, we used the left most-lateral aspect of the Atlas' lateral mass, where the junction of its posterior arch superimposes its lateral mass.

Left Atlas translation was indicated by a 3.46 mm gap between that circle and the right most-lateral aspect of the right Atlas' lateral mass. On the vertex view, we measured the amount of C-1 rotation by drawing a line crossing the center of both transverse foramen at the level of atlas, and another line intersecting it that passes in the center of the clivus and the nasal septum cartilage. This resulted in 5.8 degrees of anterior rotation of the Atlas' left lateral mass.

The above measurements give us a three dimensional description of an Atlas misalignment, known as AS+LA. Normally the superiority of the Atlas' anterior arch relative to its posterior arch is maintained between 8 to 10 degrees, but with this patient, it was 19.5 degrees. The third letter of this listing, L, represents left laterality of the Atlas on the APOM view, and the fourth letter, A, represents left lateral mass anteriority of the Atlas vertebra on the vertex view.

*Chiropractic Care*

The patient was examined and cared for utilizing Knee Chest protocol based on the original upper cervical chiropractic research performed by Dr. B.J. Palmer seventy years ago and a recent description of the technique's application conducted by Dr. Micheal U. Kale.[19,20] It includes the use of pre and post paraspinal thermal imaging following adjustment, (paraspinal repetitive scans contained static thermal asymmetry of 0.5°C or higher at the level of C1-C2, which indicates neuropathophysiology originating from the upper cervical spine), upper cervical radiographic analysis (Left C-1 translation is hypothesized that the medulla and spine are disfigured and/or torque such that it creates distortion of the spinal cord.)[20] Knee chest adjusting procedures (only done if the patient presented with a pattern of temperature asymmetry showing a warmer left side at C-1 greater than 0.5 Celsius), and post-adjustment recuperation (10-15 minutes to allow the body to assimilate new biomechanical information sent by mechanoreceptors).

The adjustment positioning requires the use of a special table, where the patient is on his knees and bends forward to apply his chest on the table. To accomplish a three dimensional correction of the subluxation, we have the patient's head rotated to the left in order to contact the posterior, inferior and lateral aspect of Atlas' posterior arch. By inducing a high velocity, low amplitude force in a clockwise manner, we theorize the reduction of Atlas' inclination of 19.5 degrees.

At the same time, we induced a vector coming from anterior-posterior and from left to right taking care of the other component of the initial misalignment. He presented initially with a right short leg at ½ inch in a supine position and a warmer left mastoid fossa at 0.96 Celsius compared to his right side. After the manual adjustment, his leg balanced in a supine position. Following this adjustment, the patient noted a decrease in resting tremor amplitude for a day period and a few episodes of epigastric pain with no known cause. After a week under care, the patient came in with subjective increase in energy following his previous adjustment. By the end of the second week of care, he reported greater range of motion in his neck and higher level of energy, allowing him to complete his week of work and participating in extra activities on that weekend.

About a week or so later the patient noted the absence of middle back pain for 3-4 days. The following week, he presented with middle back pain only if direct pressure. Temperature asymmetry lowered at the left mastoid fossa to 0.58 Celsius. A week later he was reassessed and noted significant changes concerning his thermographic analysis, posture, active range of motion (aROM) and quality of life.

After a month of corrective care two visits per week, his right short leg of ½ inch reduced to ¼ inch and absence of middle back pain since 2 weeks while bending forward, sitting and/or standing for at least an hour period. Postural analysis revealed improvement from 2 inches of anterior head carriage to one inch, right head tilt from ½ inch to ¼ inch, balanced hips and shoulders in a standing position.

Also his aROM of right lateral flexion went from 20 degrees to 30 degrees and left lateral flexion from 10 degrees to 20 degrees, using an inclinometer. QVAS of middle back pain improved from 3,5,0,8 to 0,6,0,8 (50%) on one and a half months later and to 0,2,0,2 (80%) about 2 ½ months later., see Table 1. SF-36 went from 36 PCS, 47 MCS initially to 47 PCS, 52 MCS about a month and a half later, see Table 2. We also requested the patient to fill out at home with his wife two PDQ-39 questionnaires, one describing perception of his condition after care and one describing it at the beginning, see Table 3.

## Discussion

Parkinson's symptoms have important adverse impacts on patient's lives. With PD, patients not only experience functional impairment, but the disease also affects their emotional and social life.[22,23] There are some instruments available that measure the severity of PD, but they do not focus on the patient's subjective experience of the illness.[22-24] In order to quantify and qualify the profile of this patient we assessed the patient's subjective experience with SF-36 and PDQ-39.

We found great support for the responsiveness following 4 weeks of care from those questionnaires, on both external criterion variables, including the variable on difficulties of day-to-day activities. There were significant improvements after 4 weeks of care, indicating a role for upper cervical alignment in patients with Parkinson symptoms, including depression, quality of life and/or bodily function, see Tables 1-3. More than a million Americans suffer from this chronic and progressive disease and not only does it affect the person, but their entire family.

The medical and chiropractic literature is expanding to demonstrate the relationship between proper bony alignment of the cervical spine and proper nervous system communication with the body. Atlas subluxation (meaning a misalignment affecting the nervous system) can be associated with infection, trauma and unguarded movement[25-28] Various theories have been proposed to explain the effects of specific chiropractic adjustment; a combination of those theories seems to explain the major changes seen in this patient after receiving care.

The upper cervical region is uniquely developed with poor biomechanical stability to allow great range of motion in the cervical spine along with the greatest concentration of spinal mechanoreceptors. The Atlas relies solely upon soft tissue (muscles and ligaments) to maintain alignment; therefore, the Atlas is uniquely vulnerable to displacement.[28] Other studies have shown a correlation between improper cervical spine alignments causing decrease in cerebral blood flow. Anatomical abnormalities of the cervical spine at the level of the Atlas vertebra have been shown to be associated with relative ischemia of the brainstem circulation.[28]

Unlike other vertebrae, which interlock one to the next, displacement of C-1 may be pain free and thus, remain undiagnosed and untreated, whereas health-related consequences are attributed to other aetiologies.[28] This relative ischemia of the brainstem has been associated with various types of health concerns, but never specifically to one condition in particular. We theorize that the misalignments found in this case study could induce over time Parkinson related symptoms.

An additional theory concerning the nourishment of the brain is related to cerebrospinal fluid.[29] Johanson et al. describe the cerebrospinal fluid (CSF) production, flow and importance in great detail. It is called the third circulation of the brain and it is the least understood. CSF production and flow is critical to brain nourishment, cushioning and protection. In terms of protection CSF is important to brain support to prevent the brain from sinking in the cranial vault. Conversely, excess CSF volume compresses the brain. It comes from arterial blood that has been filtered through the blood brain barrier (BBB) to the point where it is mostly water and glucose to feed the nerve cells. About sixty percent of the CSF produced in the brain ends up in the spinal cord. Eventually most of the CSF in the spinal cord makes its way back up through the subarachnoid space of the cord and into the subarchnoid space of the brain.

From there it travels up to the superior sagittal sinus and arachnoid granulations to exit the brain along with venous blood. The CSF that leaves the brain on its way down to the cord, however, must first pass through the upper cervical spine. The subarachnoid space is delimited by the arachnoid mater, which is firmly attached by the denticulate ligaments to the dura mater in the spinal cord, and to the pia mater that covers the spinal cord.[30] Likewise, on its return trip back to the brain, it must again pass through the neural canal of the upper cervical spine. Therefore, the upper cervical spine is an important link in the flow of CSF between the subarachnoid space of the brain and the cord.

The Journal of Bone and Joint Surgery has reported that at the extreme of physiological axial rotation (47°) the spinal canal is reduced to 61% and also stated that any rotation is likely to cause cord compression.[31] Even though it is considered safe to rotate the Atlas to 47 degrees, the study did not mention its effect on the CSF flow or the effect of upper cervical misalignment to the spinal cord over an extended period of time. In this case study, the patient presented with severe anterior head carriage, atlas rotational misalignment and lateral displacement. We propose that further MRI study in a standing position should be done on these patients to determine the arterial blood flow and CSF flow, demonstrating the irrigation to the brainstem area and to the substantia nigra, pre and post chiropractic adjustment.

## Conclusion

We conclude that Atlas re-alignment was associated with the reduction of Parkinsonian symptoms including various motor and non-motor conditions. We also recognize the correlation between proper bodily functions and overall health improvement.

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**Table 1 -** Quadruple Visual Analogue Scale -- (QVAS) : Results from middle back pain

| QVAS | Initial | 1.5 months later | 2.5 months later |
|---|---|---|---|
| | | | |
| Current pain | 5 | 0 | 0 |
| Average pain | 5 | 6 | 2 |
| Pain level at its best | 0 | 0 | 0 |
| Percentage of awake hours is your pain at its best | | 50% | 80% |
| Pain level at its worst | 8 | 8 | 2 |
| | | | |

*Source :* Provided by the patient during the initial visit and reassessments

**Table 2 -** Health Survey Questionnaire -- (SF-36) : Scales and results for each item

| SF-36 | Initial 12/4/2010 | Follow-up After 2 Months |
|---|---|---|
| | | |
| PCS | 36 | 47 |
| MCS | 47 | 52 |
| General health | 37% | 37% |
| Bodily Pain | 41% | 62% |
| Physical functioning | 90% | 95% |
| Mental health | 64% | 72% |

The higher the percentage, the better the domain score.

**Table 3 -** Parkinson's Disease Questionnaire -- (PDQ-39): Raw Score and Percent Rating of Disease Progression

| PDQ-39 | Pre | Post |
|---|---|---|
| | | |
| Mobility | 7 (5%) | 2 (5%) |
| Activities of daily living | 4 (17%) | 8 (33%) |
| Emotional well-being | 54 (17%) | 20 (83%) |
| Stigma | 37 (5%) | 18 (75%) |
| Social support | 0% | 0% |
| Cognitive impairment | 18 (75%) | 6 (25%) |
| Communication | 0% | 0% |
| Bodily discomfort | 58 (33%) | 41 (67%) |

*The lower the percentage, the better the outcome

**Figure 1.** Lateral cervical view -- AS+; 19,5 degrees angulation

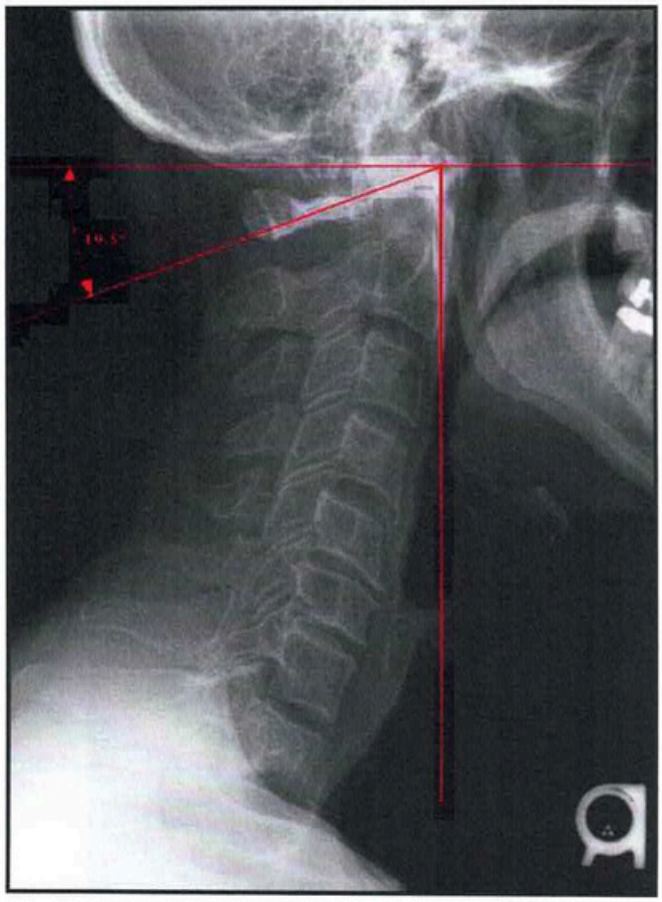


**Figure 2.** APOM View Initial -- Left Atlas translation by 3.46 mm

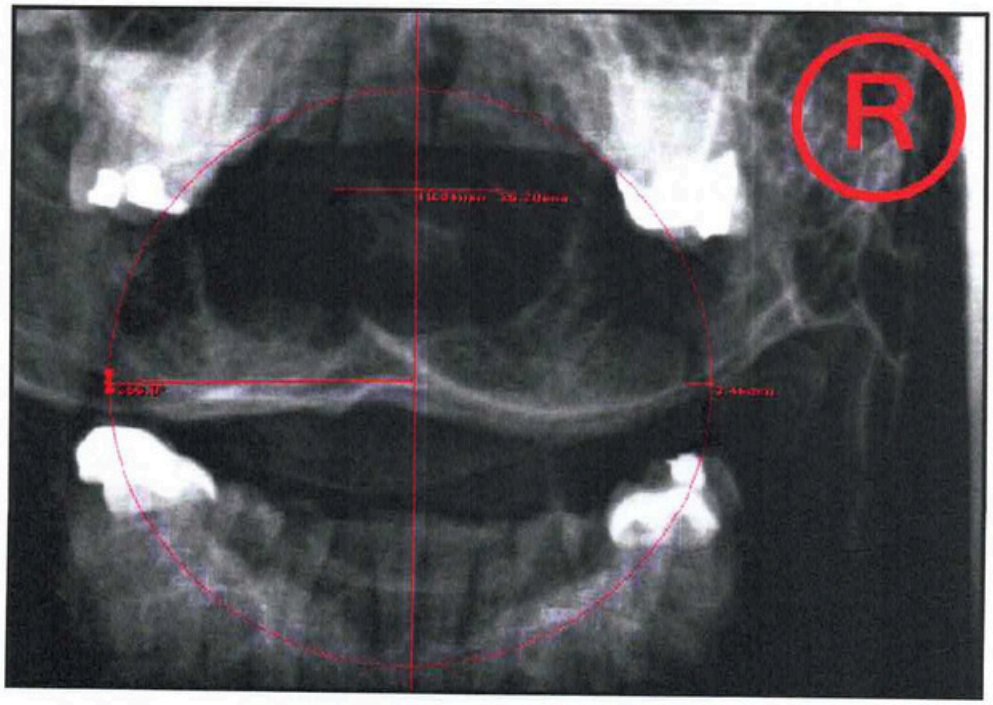


**Figure 3.** APOM view Post – 2 Months Later -- Left Atlas translation by 2.1 mm

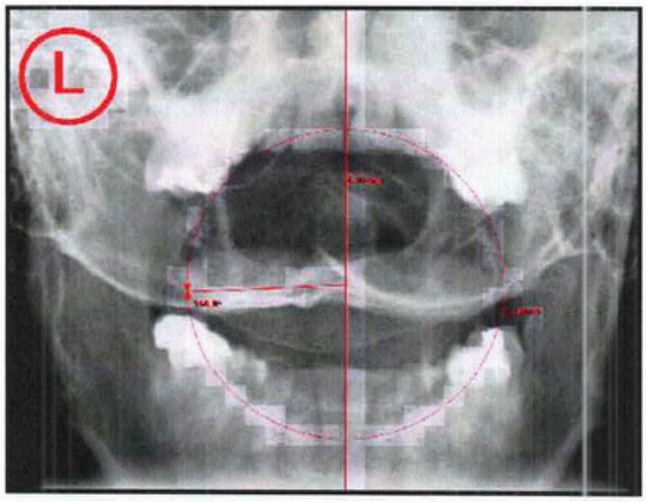



**Figure 4.** Vertex View Initial -- Anteriority of left C-1 lateral mass by 5.8 degrees

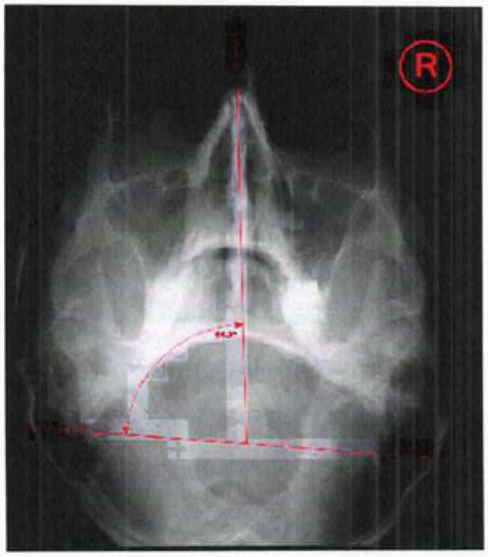
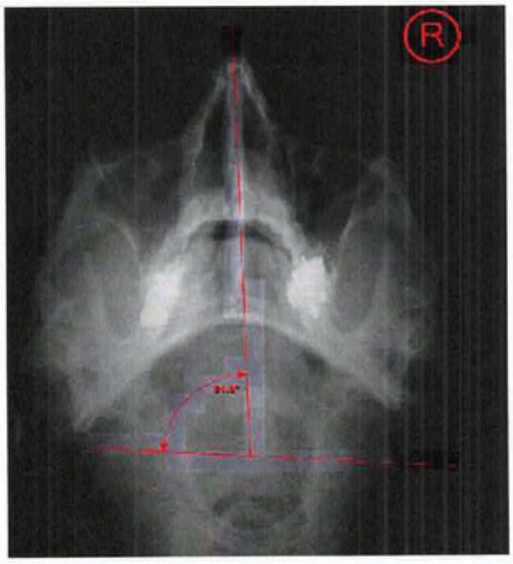



**Figure 5.** Vertex View Post – 2 Months later -- Anteriority of left C-1 lateral mass by 5.2 degrees



# Case Study

# Reduction of Essential Tremors in a 38 Year Old Male Undergoing Chiropractic Care for the Reduction of Vertebral Subluxation: A Case Report

*Nathan Berner, D.C.*[1]
*Kevin Kustarz, D.C.*[2]

1. *Private Practice, Marietta, GA*
2. *Private Practice, Jupiter, FL*

## Abstract

**Objective:** The objective of this case report is to detail improvement of a patient with essential tremors while undergoing chiropractic care.

**Clinical Features:** A 38 year old male who was diagnosed with essential tremors presented with complaints of uncontrollable bilateral arm and head tremors that started in 1997.

**Intervention and Outcome:** The patient was assessed for vertebral subluxations using instrumentation, radiographs, and video fluoroscopy following the Pierce Results System ™ of analysis. An adjustment was made using a toggle set, high-velocity, low-amplitude force on the site of subluxation. The patient reported a decrease in the severity of tremors immediately following the adjustment. After 21 visits during a span of over 5 months the patient reported an improvement of 99% for the head tremors, 75% for his arm tremors and 60% increase in quality of life.

**Conclusion:** The chiropractic care for a patient diagnosed with essential tremors is presented. Chiropractic care resulted in a dramatic decrease of symptoms and increase in quality of life for the patient. More research on the benefits of chiropractic care on people with essential tremors is needed.

***Key Terms:*** *Essential Tremors, vertebral subluxation, Pierce Results System, video fluoroscopy*

### Introduction

Essential tremor (ET) is the most the most common tremor disorder in the world. Previously known as benign tremors, essential tremors are estimated to occur in 3 to 4 people per 1000 with people over the age of 60 being at a higher risk.[1] The disease is as much as 20 times more prevalent than Parkinson's disease.[1] Although there is such a high prevalence, the medical system has limited means of controlling the problem. As of 2009 there was only 1 FDA approved drug for the problem.[2]

ET is characterized by postural and /or kinetic tremors in the frequency range of 4 to 12 Hz. The amplitude of the tremors usually decrease as time goes on while increasing in frequency. ET is considered to be a heterogeneous genetic condition.[2] It is estimated that ET is misdiagnosed up to 50% of the time.[3]

According to the Movement Disorder Society the following criteria are used for diagnosis of the condition. The inclusion criteria is bilateral postural tremor with or without kinetic tremor, involving hands and forearms, that is visible and persistent and a duration lasting over 5 years.

The exclusion criteria include: other abnormal neurological signs (except Froment's sign), presence of known causes of increased physiological tremor, concurrent or recent exposure to tremorogenic drugs or the presence of a drug withdrawal state, direct or indirect trauma to the nervous system within 3 months before the onset of tremor, historical or clinical evidence of psychogenic origins, convincing evidence of sudden onset or evidence of stepwise deterioration.[4]

The verdict is still out on the pathogenesis of ET. There is evidence to suggest the problem being either a neurodegenerative disorder or a non-degenerative disease. The disease may be caused by a central oscillator originating in the Gullain Mollaret triangle in the brainstem while other evidence has found Inferior Olivary nucleus and cerebellar involvement.[5]

Although there are multiple case studies showing the benefits of chiropractic on patients with tremors related to Parkinson's disease and seizures, there is very little research on the benefits of chiropractic care on persons suffering from ET. The purpose of this paper is to show the benefits of reducing vertebral subluxations in a patient suffering from ET.

**Case Report**

*Clinical Features*

A 38 year old male presented for chiropractic care with a chief complaint of tremors in his upper extremity that started 15 years ago and had no known mechanism related to the onset. He stated that he was diagnosed with Essential (benign) Tremors. The patient stated that he had tremors in both his head and his arms. He stated the tremors averaged a 5/10 and were a 10/10 at their worst. The assessment used to rate symptoms is based on a 0-10 scale, with 0 being no symptoms, and 10 being unbearable symptoms.

He stated that his right arm was worse than his left, and he rated his right arm spasm as a 10/10. At the same time he also complained of 10/10 head tremors. He stated the tremors happen every day and last all day. Relaxing was said to help decrease the frequency of tremors while stress and not eating increased the frequency of tremors. The patient was unable to write with his right hand due to the tremors and stated he was unable to lift a drink to his mouth because he would spill the drink everywhere. He stated that all of his activities of daily living are interrupted by the tremors. He also has a family history of ET with his sister being diagnosed with the problem as well.

The patient also presented with 8/10 low back pain that was a 10/10 at worst. He stated the pain was all day every day and has been going on for three weeks. He stated that any type of movement makes the pain worse while sitting with good posture makes the pain better. He said he has had the low back pain before and that is has been going off and on for the last 10 years.

*Chiropractic Examination*

The chiropractic examination was performed following the Pierce Results System (PRS) of analysis. The first step in the PRS is to establish a full spine pattern using infrared thermography.[6] The Tytron C-5000 instrument was used along with the Platinum System infrared thermography camera. The initial reading showed a severe hypothermic zone of greater than 0.8° C in the cervical region. There was also a severe hyperthermic zone of greater than 0.8° C in the mid thoracic area (Figure 1).

Infrared thermography was used to check for a pattern on the patient. Kent and Gentempo explain pattern analysis as follows:[7]

"In the 'pattern system,' the chiropractor compares consecutive readings acquired prior to the administration of an adjustment. If the readings demonstrate a consistent pattern, nerve interference is suggested. Miller stated, 'Persons free of neurological interference tend to display skin temperature readings which continually change, but when the vertebral subluxation and interference to normal neurological function appear on the scene, these changing differentials become static. They no longer display normal adaptability, and at this time the patient is said to be 'in pattern.'"

Thermal instrumentation is used to give a reliable objective analysis of the neuropathological component of the vertebral subluxation complex (VSC).[8] Owens et al. studied the inter-examiner and intra-examiner reliability of 2 examiners using a Tytron C-3000. They reported an intra-class coefficient between 0.91 and 0.9. They concluded that changes in thermal scans are due to physiological phenomena rather than equipment error.[9]

Spector also did a study on inter-examiner and intra-examiner reliability and found that reliability ranged from 0.940 to 0.995.[9] While McCoy states that the existing literature on reliability of paraspinal thermal scanning shows good to excellent reliability for the technique and issues related to interpreter reliability, and computerized analysis are being addressed.[10]

The goals of instrumentation in the PRS is: to change any type of pattern or consistent reading, cold areas, and make your readings as straight as possible (within 1 degree F from top to bottom).[6] Instrumentation is used to objectify the neuropathology of the VSC.[7]

Radiographs taken included a lateral a cervical x-ray that showed a slightly kyphotic neck. The measurements were done using an AcuArc ruler. Initial analysis measured the cervical curve as -35 cm (Figure 3). While an A-P lumbopelvic view was taken, no listings were found on the x-ray. The AcuArc ruler measures the radius of an arc that measures a range from 17 cm (representing the smallest arc) to 500 cm (representing the largest arc or a straight line).

When a number is positive it indicates a lordotic measurement, while a negative number indicates a kyphotic measurement. A + 17 cm curve indicates a normal cervical curve, a +/- 500 cm curve indicates a straight or military neck, while a -17 cm curve indicates a perfectly reversed cervical kyphosis.[6,11]

Along with plain film radiographs video fluoroscopy was used. Fluoroscopy is used to objectively analyze for the kinesiopathological component of the VSC.[7] The patient was found to have multiple vertebral locks present. Vertebral locking is used to describe a vertebral segment that does not move in a specific plane of motion.

If the segment does not move into flexion it is called a flexion lock, while an extension lock is described as the vertebra

above not dropping fully into extension. In the thoracic area and the lumbar area if the spinous process does not move to the right it is described as a right lock; if the spinous does not move to the left under fluoroscopy it is called a left lock. The fluoroscopy study found a C6 flexion lock along with C6, C7, T1, and T2 extension locks in the cervical spine (Figure 5). The thoracic spine showed right rotation locks at T1, T2, and T3, while the lumbar spine showed left rotation locks at L5 and L4.

*Intervention*

Using the PRS guidelines - hand, instrument, and pressures, were all used to reduce and correct the vertebral subluxations, The patient was seen 21 times in an approximately five and a half month time period. The patient is still under care at the time that this article is being written.

The first adjustment was performed by hand and was intended to correct the C6 flexion lock. The maneuver which was performed is called a "toggle set." Unlike the toggle recoil adjustment, the "toggle set" does not have a recoil. For the adjustment the patient was placed prone on Zenith 230 Hilo drop table with the Pierce 3-D head piece in flexion and the cervical and thoracic drop pieces were elevated.

The doctor used the medial aspect of the base of the 5$^{th}$ digit to contact the most posterior inferior aspect of the C6 spinous process. The doctor's supporting hand was placed over the lateral aspect of the contact hand and a posterior to anterior (P-A) and (I-S) high velocity, low amplitude thrust was performed in the line of the facet joints, allowing the table to drop.

In the 21 visit timeline, the toggle set adjustment was performed on C6 four times. There were only two other uses of the toggle set adjustment used during the care. They were both performed on a C5 flexion lock. The rest of the visits consisted of only low force techniques and instrument adjustments using the Variable Frequency Adjuster $^{TM}$ (VFA), as decided by observing the changes in thermal instrumentation.

Throughout care, pressure adjustments were used on every listing found on video fluoroscopy. Pressure adjusting is based on the Nimmo-Receptor Tonus technique and utilizes ischemic compression to remove myofascial trigger points that may be exacerbating the VSC.[11]

The VFA is a low force pulsating tool. It has the ability to set force, frequency, and pre-load, which allows a very precise adjustment to be made at the proper level of VSC. All listings can be adjusted with the instrument while the patient is either sitting or prone on the table.

The general guideline for the tool is to use low force (5-15 lbs) and high frequency (16 Hz) when addressing the upper cervical region, and to increase the force (20-30 lbs) and decrease the frequency (5-12 Hz) while moving to lower areas of the spine.[11] Every listing found on fluoroscopy was adjusted using the VFA at least 1 time during the 21 visits.

*Outcome*

Immediately after the patient's first adjustment there was an improvement in his symptoms. He was able to lift his right hand to his mouth with minimal tremors. The patient came in nine more times in the next 2 weeks, showing consistent improvement of symptoms. One other hand toggle drop adjustment was performed during the course of the two weeks while the pressures and the VFA were used on multiple segments.

After two toggle set adjustments on C6 in nine visits over the course of 15 days, the patient's improvement prompted the taking of another x-ray and another video fluoroscopy of the cervical area. He noted an improvement from a -35 cm kyphotic curve to a +500 cm curve, also known as a military neck (Figure 4). This is a 49% improvement, moving towards the goal of a + 17 cm cervical lordosis.

Though research is limited on curve restoration without the use of traction, Galgano et al. published a retrospective case study of 51 patients and the reduction of kyphosis using the PRS of analysis. They found that over an average of 12 weeks and 10 visits there was an average of a 56% correction towards the normal cervical curve.[12]

The fluoroscopy flexion and extension study also showed a dramatic improvement. All of the locked vertebral segments in extension were eliminated (Figure 6) and the only locking left was a C5 flexion lock.

The patient was seen a total of 21 times over a four and a half month period. On his last visit a re-examination was done. The patient reported improvements of 75% for the tremors in both of his arms, 99% for the tremors in his head, 90% for his low back pain, 90% in overall stiffness, and felt that his overall quality of life has improved by 60%.

Thermography on the 21$^{st}$ visit revealed improvements. Although there is still one severe hyperthermic swing in the thoracic area and one hypothermic swing in the cervical area, the swings cover a smaller area (Figure2). Due to the improvements seen in the patient, he was put on a care plan that consisted of two visits per month to maximize his progress.

**Discussion**

*Medical Intervention*

Medical treatment on ET is considered when tremors interfere with activities of daily living. Having a proper diagnosis is essential when using medicine. The medications used to treat ET are used to treat other medical conditions, such as hypertension and seizures. It is estimated that 30% to 50% of patients with ET do not respond to medical therapy, while those who do, experience an improvement of tremor magnitude, estimated to be about 50% reduction.[1]

*Chiropractic Care*

There is very little research that has been done on the effects of subluxation reduction and non-Parkinson's disease related

tremors. Alcantara et al published a case showing elimination of tremors in a pediatric patient with a medical diagnosis of conversion disorder. The patient's spine and cranial bones were adjusted and tremors were completely eliminated after 12 chiropractic visits.[13] Though there is a lack of research on essential tremors, research is found to demonstrate the benefits of subluxation reduction in patients suffering from Parkinson's disease and seizures.

When it comes to Parkinson's disease, there are studies published showing the benefits of vertebral subluxation reduction and symptomatic improvement. Shapiro et al.[14] published a case study showing that reduction of vertebral subluxations and curve restoration in the cervical spine, along with other postural changes, led to a decrease in Parkinson's symptoms in a 67 year old male.

Elster[15] published a case describing the reduction of Parkinsons symptoms in a 60 year old male patient with the use of International Upper Cervical Association upper cervical technique. Bello[16] documented a reduction in symptoms in a 66 year old female patient using National Upper Cervical Chiropractic Association (NUCCA) technique. Lastly, Malachowski et al[17] published a case showing a decrease in neurological signs of Parkinson's in a 77 year old male using Kale Upper Cervical Specific Protocol.

Sweat published two case studies showing improvement of patients with seizures using Atlas Orthogonal technique. The first patient was a 76 year old female suffering from post-concussion seizures that had a complete recovery from seizures while under care for two months.[18] The second patient was a 75 year old female who was suffering from seizures, ataxia, fatigue, strabismus, and migraines. All of her symptoms were resolved with the correction of her atlas subluxation.[19]

Although the causes of ET are largely unknown we can theorize how the correction of the VSC along with curve restoration can lead to a decrease in the symptoms of ET. According to Harrision et al.[14, 20-22] abnormal postural loads on the nervous system can result in progressive neuronal dysfunction and degenerative changes, including abnormal spinal stress on the spinal cord.

Abnormal spinal cord stress has been linked to many conditions such as epidural, and subarachnoid adhesions, amyotrophic lateral sclerosis, cerebral palsy, intermedullary neoplasms, syringomyelia, paraplegia, and urinary incontinence. The research has shown that restoring normal spinal curvature will reduce stress and strain on the central nervous system.[14, 20-22]

It can be theorized that the patient's symptoms were caused by abnormal stress on his spinal cord due to the kyphosis in his cervical spine. When the adjustment was given and the subluxations were reduced, the cervical curve improved. This led to a decreased amount of stress being placed on the spinal cord thus allowing for proper nervous system function, leading to a decrease in the patient's ET symptoms.

## Conclusion

We presented a case of a 38 year old male diagnosed with essential tremors. The patient's symptoms and quality of life were dramatically improved under chiropractic care when his vertebral subluxations were reduced. The medical community has experienced very little success with treating essential tremors, while the chiropractic community has limited research on the subject. This case is an example of the potential of chiropractic care in helping patients suffering from ET, and shows that there is more research needed on the effects of chiropractic and ET.

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## Figures

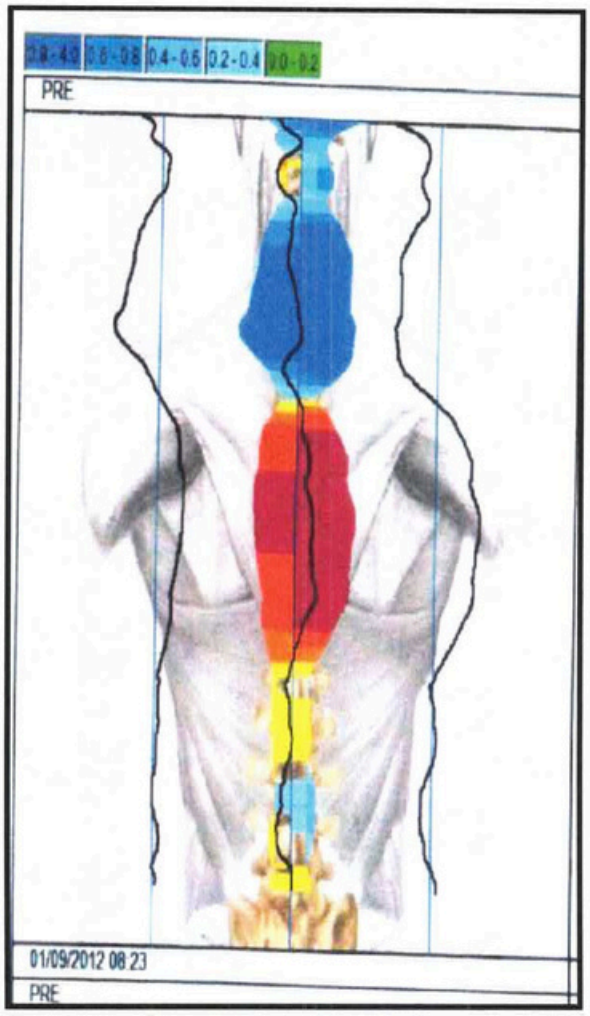


**Figure 1.** Pre full spine thermal pattern on the first adjustment.

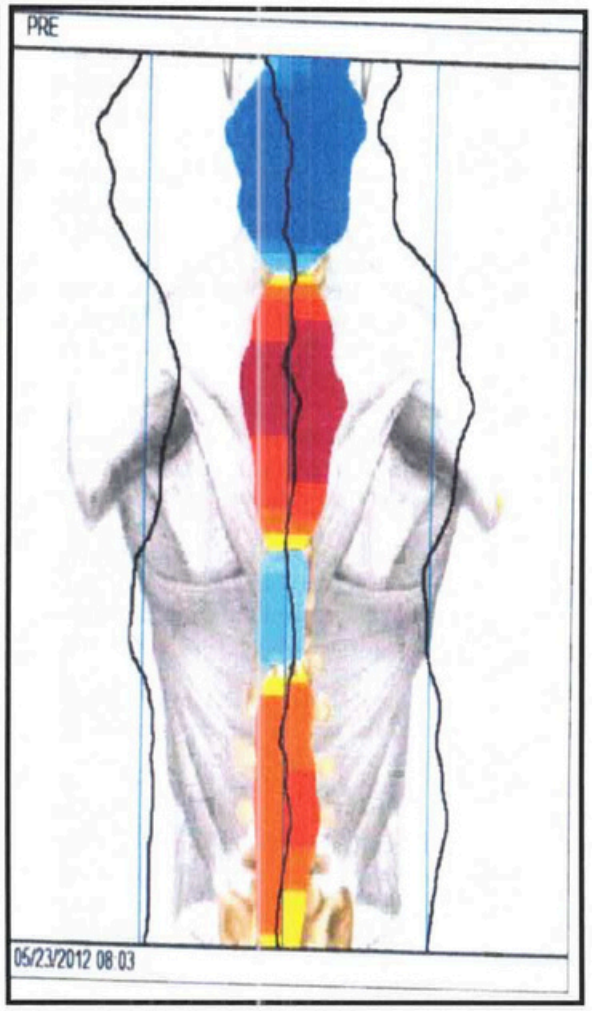


**Figure 2.** Pre full spine thermal pattern on the last visit, 5 months later.

ORIGINAL RESEARCH

# Eighty-One Patients with Multiple Sclerosis and Parkinson's Disease Undergoing Upper Cervical Chiropractic Care to Correct Vertebral Subluxation: A Retrospective Analysis

*Erin L. Elster, D.C.*


## ABSTRACT

**Objective**: The objective of this article is threefold: to examine the role of head and neck trauma as a contributing factor to the onset of Multiple Sclerosis (MS) and Parkinson's disease (PD); to explore the diagnosis and treatment of trauma-induced injury to the upper cervical spine through the use of protocol developed by the International Upper Cervical Chiropractic Association (IUCCA); and to investigate the potential for improving and arresting MS and PD through the correction of trauma-induced upper cervical injury. Data from 81 MS and PD patients who recalled prior trauma, presented with upper cervical injuries, and received care according to the above protocol are reviewed.

**Clinical Features**: Each patient was examined and cared for in the author's private practice in an uncontrolled, non-randomized environment over a five-year period. Of the 81 MS and PD patients, 78 recalled that they had experienced at least one head or neck trauma prior to the onset of the disease. In order of frequency, patients reported that they were involved in auto accidents (39 patients); sporting accidents, such as skiing, horseback riding, cycling, and football (29 patients); or falls on icy sidewalks or down stairs (16 patients). The duration between the traumatic event and disease onset varied from two months to 30 years.

**Intervention and Outcome**: Two diagnostic tests, paraspinal digital infrared imaging and laser-aligned radiography, were performed according to IUCCA protocol. These tests objectively identify trauma-induced upper cervical subluxations (misalignment of the upper cervical spine from the neural canal) and resulting neuropathophysiology. Upper cervical subluxations were found in all 81 cases. After administering treatment to correct their upper cervical injuries, 40 of 44 (91%) MS cases and 34 of 37 (92%) PD cases showed symptomatic improvement and no further disease progression during the care period.

**Conclusion**: A causal link between trauma-induced upper cervical injury and disease onset for both MS and PD appears to exist. Correcting the injury to the upper cervical spine through the use of IUCCA protocol may arrest and reverse the progression of both MS and PD. Further study in a controlled, experimental environment with a larger sample size is recommended.


**Key Indexing Terms:** *upper cervical spine, chiropractic, Parkinson's disease, Multiple Sclerosis, trauma*

## Introduction

While the link between head trauma and the later development of Parkinson's disease (PD) or Multiple Sclerosis (MS) remains controversial, many PD and MS researchers have confirmed the connection.[1-12] Several researchers have reported a strong association between head trauma and the subsequent development of PD in retrospective case-controlled studies and have found this association to be stronger than that of other environmental agents long suspected as risk factors for PD.[1-5] On average, these studies found that head trauma occurred two to three decades prior to PD onset.[1-2,5] One recently published study, performed at the Mayo Clinic and headed by Dr. J.H. Bower, investigated the association between head trauma and PD in more detail.[1] By reviewing the complete medical records of both cases and controls, the study team was able to objectively determine prior occurrence of head trauma without introducing recall bias. Study results suggest that head trauma is associated with the later development of PD, even when study limitations were taken into consideration.

In a discussion regarding the possible role of trauma in the development of MS, Dr. Charles Poser [9-11] notes that "in some patients with MS, certain kinds of trauma (to the brain and/or spinal cord, including whiplash injuries) may act as a trigger at

Erin L. Elster, D.C., Private Practice, Boulder, CO 80301

some time for the appearance of new or recurrent symptoms." Poser goes on to suggest that trauma to the central nervous system may alter the blood-brain-barrier (BBB), which many researchers consider to be a critical step in the formation of MS lesions. He cites research conducted on monkeys demonstrating that mild trauma inflicted on the central nervous system, including whiplash injury, results in a breakdown of the BBB. He also cites several researchers who observed the correlation between trauma and the formation or exacerbation of MS lesions. He further notes that the "relationship (between cervical spondylosis and MS) has been well documented by MRI in many patients with MS, revealing a close anatomical correspondence between compression of the cervical spinal cord by spondylosis or herniated discs ... and intraspinal plaques at the same level."

In 1996, a British court awarded damages to a plaintiff based on the rapid onset of MS closely following a motor vehicle accident.[12] The presiding judge stated that he was "satisfied that (the plaintiff) did sustain a whiplash injury....and that the symptoms he later displayed indicated that MS had developed in the very area which had been affected by the trauma." Experts testified that hundreds of MS cases diagnosed subsequent to auto accidents existed; too many, they claimed, to be caused by chance.

While links between trauma and the later development of MS and PD have been established, researchers have yet to define an exact mechanism to explain the onset of MS and PD following trauma, nor have they isolated an objective method for measuring and/or diagnosing the kind of trauma-induced injuries that appear to precipitate MS and PD. This paper serves to address the above issues through the summary of case histories, diagnostic test results, and treatment responses of 81 MS and PD patients, 78 of whom recalled head or neck trauma prior to disease onset. These patients were examined and cared for in the author's private practice over a five-year period in a non-experimental environment without control subjects. This paper does not purport to be a controlled research study, but rather serves to provide a foundation for future research.

Case reports of two of the 81 cases (1 MS case and 1 PD case) were published in indexed, peer-reviewed journals.[13-14] Other reports documenting successful treatment of patients with similar diagnoses using upper cervical chiropractic care are limited primarily to Palmer's upper cervical research conducted seventy years ago, which was never published in a peer-reviewed, indexed fashion.[15-16] Patients with other neurological conditions such as Migraine headaches and Tourette Syndrome also responded favorably to IUCCA upper cervical chiropractic intervention.[17-18] In both cases, patients reported substantial traumas to the head or neck prior to the onset of symptoms and diagnoses.

## Clinical Features

Of 81 total cases of Multiple Sclerosis (MS) and Parkinson's disease (PD), 44 individuals with MS and 37 with PD consented to examination and treatment in the author's private practice. Patients began treatment at various intervals over a five-year period. Treatment duration varied from one to five years depending on the individual. Patient data for the 44 MS patients and for the 37 PD patients were compiled and listed in Tables 1 and 2 respectively.

MS patients ranged in age from 21 to 66 years old and presented with a one to thirty year history of MS, as diagnosed by their neurologists. PD patients ranged in age between 34 and 77 years and presented with a one to twenty year history of PD, as diagnosed by their neurologists. Most patients reported that they "had tried everything" to relieve their symptoms including prescription medications, chiropractic adjustments, osteopathic manipulation, physical therapy, massage therapy, rolfing, acupuncture, herbs, Chinese medicine, chelation, special diets, supplements, and removal of dental amalgams.

Patients were questioned as to whether they recalled a history of trauma (blow to the head, concussion, whiplash, accident, fall, etc.) prior to the onset of MS or PD. Of the 44 MS patients, 43 (98 %) recalled a history of trauma. (Table 1) Of the 37 PD patients, 35 (95%) recalled a history of trauma. (Table 2) Of the 78 patients who recalled traumas (many recalled more than one), 39 (21 PD patients and 18 MS patients) reported experiencing one or more auto accidents (many were minor rear-end collisions); 29 reported multiple blows to the head and/or neck during sporting activities including skiing, cycling, horse back riding, football, gymnastics, etc.; and 16 reported falls on icy sidewalks or down stairs. In other lesser-reported incidences, one man reported being kicked in the head by a cow; another man reported blows to the head as a result of heavy machinery accidents; and two female patients reported concussions from domestic abuse. The duration between the traumatic event and disease onset varied from two months to 30 years.

It should be noted that sixteen additional MS patients and seven additional PD patients were examined and accepted for care during the same period but chose to discontinue care during the early treatment weeks. Data from these patients were not included in this report.

## Intervention

Each patient was examined and cared for utilizing protocol developed by the International Upper Cervical Chiropractic Association (IUCCA), including the use of paraspinal digital infrared imaging, laser-aligned upper cervical radiography, knee-chest adjusting posture, and post-adjustment recuperation.[19] The care, described in detail in previous publications,[13-18] is based on the original upper cervical chiropractic research performed by Palmer seventy years ago.[15-16]

To diagnose spinal injury, a paraspinal thermal analysis was performed using the Tytron C-3000 (Titronics Research and Development) according to thermographic protocols.[20-23] (Figure 1) In all 81 cases, paraspinal scans contained static thermal asymmetry of 0.5°C or higher, which indicates neuropathophysiology originating from the upper cervical spine.[24-27] (Figure 2) (Table 1)

Based on the results of the thermal scans, a cervical x-ray series (lateral, anterior-to-posterior, open mouth, and base posterior) was taken utilizing a specially designed machine (American X-ray Corp.) that incorporates a laser-aligned frame, a laser mounted to the x-ray tube (Titronics Research and Development), a positioning chair, and head clamps.[28] (Figure 3) This configuration is designed to ensure accuracy when measuring

Figure 1: Tytron C3000.

the deviation of the upper cervical spine from the neural canal. Analysis of the upper cervical radiographs revealed deviation of the upper cervical spine from the neural canal, or upper cervical subluxations, in all 81 cases. On average, each patient's atlas and axis deviated from the foramen magnum (occiput) laterally (to the left or right) five millimeters or less and rotationally (anterior or posterior) five degrees or less. In Tables 1 and 2, atlas listings are depicted with laterality of left (L) or right (R) and rotation of anterior (A) or posterior (P). The lateral movement of axis is listed to the left (ESL) or right (ESR).

Because upper cervical subluxations were discovered in all 81 cases, it was recommended that these patients receive care to correct their cervical injuries. Before initiating care, patients were cautioned to continue medical treatment including medications unless otherwise advised by their physicians. After consent was obtained, care was administered according to IUCCA protocol to correct the lateral and rotational deviation of each patient's upper cervical spine. To administer the adjustment, each patient was placed on a knee-chest table with his or her head turned to the side of laterality (either left or right). (Figure 4) Using the posterior arch of atlas or lamina of axis as the contact point, an adjusting force was introduced by hand.[29]

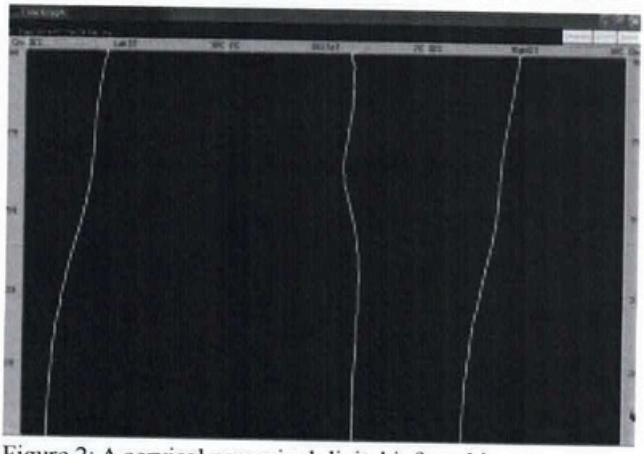

Figure 2: A cervical paraspinal digital infrared image performed with the Tytron C3000. The scan contains static thermal asymmetry of 0.5°C, which is indicative of neuropathophysiology originating from the upper cervical spine.

Following the adjustment, the patient was placed in a post-adjustment recuperation room for fifteen minutes as per thermographic protocol.[20-23] After the recuperation period, a post-adjustment thermal scan was performed to ensure restoration of normal neurophysiology. (Figure 5)

All subsequent office visits began with a thermal scan. An adjustment was administered only when the patient's presenting thermal asymmetry returned. If an adjustment was given, a second scan was performed after a recuperation period to determine whether restoration of normal thermal symmetry had occurred. On average, patients were seen two times per week during the first two weeks of care, one time per week during the following four weeks, two times per month during the following month, one time per month for the following three months, and once per quarter thereafter.

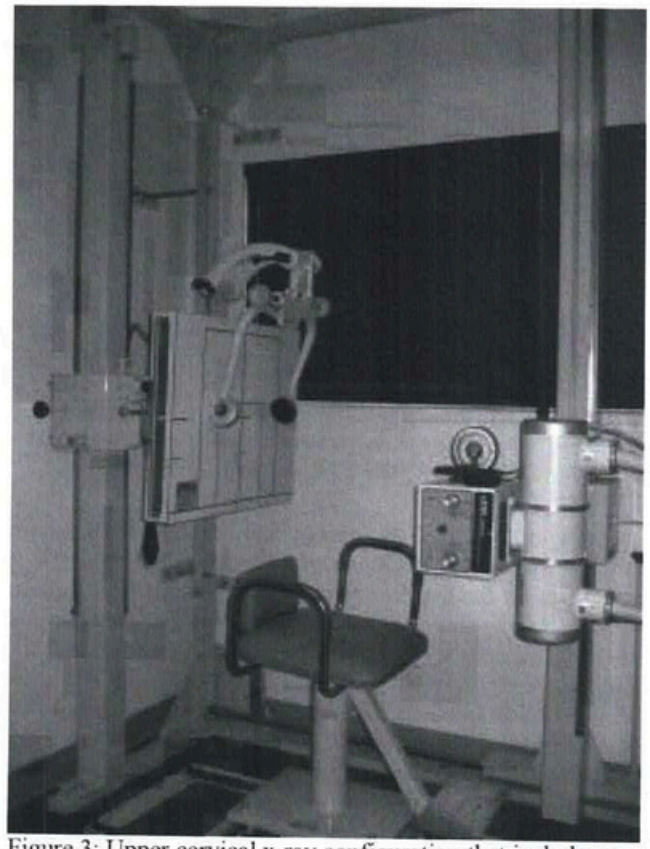

Figure 3: Upper cervical x-ray configuration that includes a laser-aligned frame, a laser mounted to the x-ray tube, positioning chair, and head clamps for accuracy in measuring upper cervical subluxation.

**Outcome**

Outcomes of the 44 Multiple Sclerosis (MS) patients and 37 Parkinson's disease (PD) patients are illustrated in Tables 3 and 4 respectively. The tables list gender, age, years since diagnosis, initial symptoms, improved symptoms, and category of improvement (minor, moderate, substantial or no change). If the patient's condition remained the same during the care period, "no change" was listed. Patients reporting improvement with, or absence of, less than half of their symptoms were indicated

Figure 4: Knee-chest adjusting posture. The adjustment, based on x-ray findings, is performed to correct lateral and rotational deviation of the upper cervical spine from the foramen magnum.

as showing "minor" improvement. Patients reported reporting improvement with, or absence of, half of their symptoms were identified as having "moderate" improvement. If patients showed improvement or with, or absence of, the majority of their symptoms, they were categorized as having "substantial" improvement.

Of the 44 MS cases, 40 (91%) reported improvement. Of these, 28 showed "substantial" improvement; 8 showed "moderate" improvement; and 5 showed "minor" improvement. No further progression of MS was noted in the improved cases during the care period, which ranged from one to five years depending on the patient. Four cases reported "no change" in their condition.

Of the 37 PD cases, 34 (92%) reported improvement. Of these, 16 showed "substantial" improvement; 8 showed "moderate" improvement; and 11 showed "minor" improvement. No further progression of PD was noted in the improved cases during the care period, which ranged from one to five years depending on the patient. Three cases reported "no change" in their condition.

## Hypotheses

Seventy-eight of the 81 Multiple Sclerosis (MS) and Parkinson's disease (PD) patients recalled head or neck trauma prior to the onset of the disease, including blows to the head, whiplash, or concussion sustained as a result of motor vehicle, sporting, or other accidents. These findings are consistent with published retrospective studies conducted with MS and PD patients regarding head trauma sustained prior to disease onset.

In this case, patients were examined to confirm trauma-induced spinal injuries. Two diagnostic tests - paraspinal digital infrared imaging and laser-aligned upper cervical radiography - were administered according to the protocol of the International Upper Cervical Chiropractic Association (IUCCA). In all 81 cases, trauma-induced upper cervical subluxations were discovered.

After administering IUCCA upper cervical chiropractic care, 91% of the MS patients and 92% of the PD patients improved, and no further progression of MS or PD was noted in the improved patients during the care period. Seventy percent of the improved MS patients and 47% of the improved PD patients showed "substantial" improvement, reporting the absence or significant improvement with the majority of symptoms.

Hypotheses: MS and PD both can be induced as a result of head and neck trauma and the resultant injury to the upper cervical spine. Further, this injury can be diagnosed and corrected through the administration of IUCCA upper cervical chiropractic care. Finally, it is the correction of this injury that may arrest and reverse the disease processes involved in MS and PD.

## Conclusion

Eighty-one patients with either Multiple Sclerosis (MS) or Parkinson's disease (PD) were evaluated and cared for using protocol developed by the International Upper Cervical Chiropractic Association (IUCCA). Histories of trauma to the head and/or neck were recalled in 78 cases; upper cervical subluxations were found in all 81 cases; and 91% of the cases responded to care, with symptoms improved and/or reversed and no further progression of either MS or PD detected. These results indicate a causal link between trauma, upper cervical injury, and disease onset for both MS and PD. Correcting the injury to the upper cervical spine through the use of IUCCA protocol may arrest and reverse the progression of both MS and PD. Further study in a controlled environment with a larger sample size is recommended.

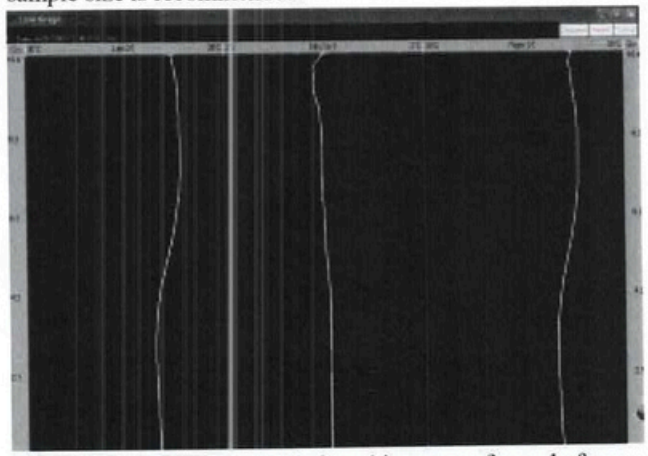

Figure 5: Paraspinal digital infrared image performed after an adjustment was administered. The scan contains normal thermal symmetry.

**Table 1. Case Histories and Examination Findings for 44 Multiple Sclerosis Patients**

| Patient | Gender | Age | Years Since MS Diagnosis | History of Trauma | Thermal Deviation | X-ray Listing |
|---|---|---|---|---|---|---|
| 1 | F | 43 | 7 | auto accident | 0.5°C | AR |
| 2 | M | 65 | 10 | auto accident | 0.5°C | ALP |
| 3 | F | 55 | 30 | bike | 1.2°C | ARP |
| 4 | F | 56 | 15 | auto accident | 0.6°C | ARA |
| 5 | M | 32 | 3 | skiing (multiple) | 0.8°C | ESL |
| 6 | F | 48 | 23 | skiing (multiple) | 0.7°C | ESL |
| 7 | F | 30 | 2 | fall | 0.5°C | ALA |
| 8 | F | 49 | 10 | ice fall | 0.5°C | ARP |
| 9 | F | 32 | 13 | auto & ice fall | 0.5°C | ARA |
| 10 | F | 59 | 1 | auto accident | 0.5°C | AL |
| 11 | F | 33 | 1 | roller skating | 0.7°C | ALA |
| 12 | M | 53 | 1 | horseback fall | 0.5°C | AL |
| 13 | F | 55 | 9 | stair fall | 0.5°C | ARP |
| 14 | F | 35 | 1 | bike | 0.5°C | ESR |
| 15 | F | 44 | 8 | auto & ski | 0.5°C | AR |
| 16 | M | 37 | 1 | fall | 0.5°C | ARP |
| 17 | M | 49 | 20 | horseback fall | 0.6°C | AL |
| 18 | F | 50 | 2 | auto accident | 0.5°C | AR |
| 19 | F | 41 | 2 | domestic abuse | 0.6°C | ARP |
| 20 | F | 34 | 1 | auto accident | 0.5°C | AL |
| 21 | F | 40 | 1 | auto accident | 0.5°C | ESR |
| 22 | F | 47 | 2 | auto accident | 0.5°C | ARP |
| 23 | F | 45 | 10 | auto accident | 0.5°C | AL |
| 24 | M | 40 | 5 | wrestling | 0.5°C | ESL |
| 25 | F | 41 | 2 | auto accident | 1.0°C | ALA |
| 26 | F | 41 | 6 | auto accident | 0.5°C | ESL |
| 27 | F | 45 | 4 | body surfing | 0.5°C | ESL |
| 28 | F | 42 | 6 | auto accident | 0.6°C | AR |
| 29 | M | 35 | 1 | none | 0.5°C | ALA |
| 30 | M | 50 | 2 | weight lifting | 0.5°C | ESR |
| 31 | F | 46 | 1 | ice fall | 0.6°C | ESR |
| 32 | F | 54 | 3 | physical therapy | 0.5°C | ESL |
| 33 | F | 39 | 20 | auto accident | 0.7°C | ALP |
| 34 | F | 48 | 15 | fall | 0.5°C | ESR |
| 35 | F | 53 | 9 | fall | 1.0°C | ALA |
| 36 | F | 53 | 5 | ice fall | 0.7°C | ESL |
| 37 | M | 57 | 12 | horseback fall | 0.5°C | ESL |
| 38 | F | 66 | 8 | auto accident | 0.5°C | AR |
| 39 | F | 39 | 15 | skiing (multiple) | 0.5°C | ALA |
| 40 | F | 46 | 20 | auto accident | 0.5°C | AL |
| 41 | F | 21 | 2 | auto accident | 0.5°C | ALP |
| 42 | F | 44 | 14 | fall | 0.5°C | ESR |
| 43 | F | 54 | 15 | stair fall | 0.5°C | ALP |
| 44 | F | 38 | 1 | ice fall | 1.0°C | ESL |

**Table 2. Case Histories and Examination Findings for 37 Parkinson's Disease Patients**

| Patient | Gender | Age | Years Since PD Diagnosis | History of Trauma | Thermal Deviation | X-ray Listing |
|---|---|---|---|---|---|---|
| 45 | M | 63 | 10 | football | 0.5°C | ALA |
| 46 | F | 70 | 2 | auto accident | 0.8°C | ALP |
| 47 | F | 60 | 3 | auto accident | 0.7°C | ESR |
| 48 | M | 74 | 10 | football & auto | 0.5°C | ESL |
| 49 | M | 60 | 7 | football, horseback, auto | 0.6°C | AR |
| 50 | M | 70 | 14 | heavy machinery traumas | 0.6°C | ALA |
| 51 | M | 62 | 2 | football, hockey, & auto | 0.5°C | ESR |
| 52 | M | 58 | 1 | auto accident | 0.5°C | ESL |
| 53 | M | 34 | 2 | heavy lifting | 0.5°C | ESR |
| 54 | F | 76 | 10 | motorcycle, fall on ice | 0.8°C | ALA |
| 55 | F | 56 | 5 | blow to the head | 0.5°C | ESL |
| 56 | M | 74 | 7 | kicked by cow, auto | 0.8°C | AL |
| 57 | F | 56 | 11 | auto accident | 0.8°C | ESR |
| 58 | M | 61 | 2 | skiing & auto | 0.5°C | ALP |
| 59 | F | 53 | 20 | gymnastics & auto | 0.6°C | AL |
| 60 | M | 53 | 2 | auto accident | 0.5°C | ESL |
| 61 | M | 67 | 8 | fall | 0.5°C | AR |
| 62 | M | 76 | 4 | none | 0.7°C | ARA |
| 63 | M | 54 | 15 | auto accident | 0.5°C | AR |
| 64 | F | 65 | 2 | auto accident | 0.5°C | ESL |
| 65 | M | 49 | 12 | headfirst fall | 0.7°C | ESR |
| 66 | F | 54 | 2 | none | 0.5°C | ESR |
| 67 | F | 64 | 9 | auto accident | 0.6°C | ALA |
| 68 | M | 66 | 7 | football & auto | 0.5°C | ESL |
| 69 | F | 66 | 8 | skiing (multiple) | 0.9°C | ESL |
| 70 | M | 69 | 11 | motorcycle accident | 0.5°C | ARP |
| 71 | M | 41 | 8 | cycling (multiple) | 0.5°C | ESR |
| 72 | M | 67 | 3 | football & skiing | 0.5°C | ESL |
| 73 | M | 60 | 12 | football & auto | 0.5°C | ESL |
| 74 | F | 59 | 13 | domestic abuse | 0.5°C | AR |
| 75 | F | 77 | 3 | falls on ice | 0.5°C | AL |
| 76 | M | 49 | 5 | waterskiing (multiple) | 0.5°C | ESR |
| 77 | M | 72 | 7 | football concussion & auto | 0.5°C | ESR |
| 78 | M | 59 | 1 | skiing (multiple) | 0.5°C | ESL |
| 79 | F | 64 | 2 | headfirst fall | 0.6°C | AL |
| 80 | M | 47 | 10 | football concussion & auto | 1.0°C | ESR |
| 81 | M | 60 | 3 | auto accident | 0.5°C | AL |

**Table 3. Outcome of 44 Multiple Sclerosis Patients**

| Patient | Gender | Age | Years Since Diagnosis | Initial Symptoms | Improved Symptoms | Category of Improvement |
|---|---|---|---|---|---|---|
| 1 | F | 43 | 7 | ENW, L | All improved/absent | substantial |
| 2 | M | 65 | 10 | ENW, NP, HA | All improved/absent | substantial |
| 3 | F | 55 | 30 | ENW, L, C, B, Walker | All improved/switched to cane | substantial |
| 7 | F | 30 | 2 | ENW, F, B, Cane | All absent /eliminated cane | substantial |
| 10 | F | 59 | 1 | ENW, F, V, NP | All improved/absent | substantial |
| 11 | F | 33 | 1 | ENW, F, HA | All improved/absent | substantial |
| 12 | M | 53 | 1 | ENW, F, V | All improved/absent | substantial |
| 13 | F | 55 | 9 | ENW, NP, L, F | ENW, NP, L | substantial |
| 14 | F | 35 | 1 | Right-sided paralysis, NP | All improved/absent | substantial |
| 15 | F | 44 | 8 | ENW, NP, LBP, L, C, B | ENW, NP, LBP, L | substantial |
| 16 | M | 37 | 1 | ENW, L, NP, LBP | All improved/absent | substantial |
| 19 | F | 41 | 2 | ENW, L, F, NP | All improved/absent | substantial |
| 20 | F | 34 | 1 | ENW, F, HA, NP, L | All improved/absent | substantial |
| 21 | F | 40 | 1 | ENW, F | All improved/absent | substantial |
| 22 | F | 47 | 2 | ENW, CA | All improved/absent | substantial |
| 24 | M | 40 | 5 | ENW, NP, B | All improved/absent | substantial |
| 25 | F | 41 | 2 | ENW, NP, L, C | All improved/absent | substantial |
| 27 | F | 45 | 4 | ENW, F, Cane | All absent /eliminated cane | substantial |
| 29 | M | 35 | 1 | ENW | All improved/absent | substantial |
| 30 | M | 50 | 2 | ENW, F, NP, SS | All improved/absent | substantial |
| 31 | F | 46 | 1 | ENW, NP, HA, B, C | All improved/absent | substantial |
| 32 | F | 54 | 3 | ENW, NP, LBP | All improved/absent | substantial |
| 34 | F | 48 | 15 | ENW, NP, HA | All improved/absent | substantial |
| 35 | F | 53 | 9 | ENW, L, V | All improved/absent | substantial |
| 36 | F | 53 | 5 | ENW, NP | All improved/absent | substantial |
| 41 | F | 21 | 2 | ENW, L, C, B, NP, LBP | All improved/absent | substantial |
| 44 | F | 38 | 1 | ENW, V | All improved/absent | substantial |
| 5 | M | 32 | 3 | ENW, L, V, B | ENW, L | moderate |
| 8 | F | 49 | 10 | ENW, L, B, NP, V, Cane | NP, L, V | moderate |
| 9 | F | 32 | 13 | ENW, F, Cane | ENW, F | moderate |
| 23 | F | 45 | 10 | ENW, NP, HA, F, B | ENW, NP, HA | moderate |
| 26 | F | 41 | 6 | ENW, LBP, HA, L, NP | L, NP, HA | moderate |
| 28 | F | 42 | 6 | ENW, F, HA, NP, LBP | ENW, NP, HA | moderate |
| 38 | F | 66 | 8 | ENW, LBP | ENW | moderate |
| 43 | F | 54 | 15 | C, S, B, Wheelchair | C, S, switched to walker | moderate |
| 6 | F | 48 | 23 | NP, LBP, HA, V, B, SS, Wheelchair | B, HA, NP, LBP | minor |
| 17 | M | 49 | 20 | ENW, NP, F, B, S, V, Wheelchair | ENW, NP | minor |
| 33 | F | 39 | 20 | ENW, B, C, Walker, HA | HA | minor |
| 39 | F | 39 | 15 | ENW, F, B, S, C, SS, Wheelchair | ENW, F | minor |
| 42 | F | 44 | 14 | ENW, NP, B, F, V | ENW, NP | minor |
| 4 | F | 56 | 15 | ENW, V, L, B | None | no change |
| 18 | F | 50 | 2 | ENW, NP, F | None | no change |
| 37 | M | 57 | 12 | CA,B,F,LN&W | None | no change |
| 40 | F | 46 | 20 | ENW, NP, SS, B, F, Wheelchair | None | no change |

**Table 4. Outcome of 37 Parkinson's Disease Patients**

| Patient | Gender | Age | Years Since Diagnosis | Initial Symptoms | Improved Symptoms | Category of Improvement |
|---|---|---|---|---|---|---|
| 46 | F | 70 | 2 | SD, F, T, NP | All improved / absent | substantial |
| 49 | M | 60 | 7 | C, D, SS, HW, FA, FR, T, R, SD, F | All improved / absent | substantial |
| 51 | M | 62 | 2 | D, LBP, NP, CO, SS, T, G, R | All improved / absent | substantial |
| 52 | M | 58 | 1 | NP, HA, T, LBP | All improved / absent | substantial |
| 57 | F | 56 | 11 | NP, HA, F, R, T, SS, SW, G, SD | All improved / absent | substantial |
| 58 | M | 61 | 2 | T, R, SA | All improved / absent | substantial |
| 59 | F | 53 | 20 | NP, HA, LBP, SD, F, FR, G, SS, T, R | All improved / absent | substantial |
| 63 | M | 54 | 15 | NP, LBP, HA, R, D, C, SD, F | All improved / absent | substantial |
| 64 | F | 65 | 2 | NP, R, T | All improved / absent | substantial |
| 69 | F | 66 | 8 | C, D, SS, SW, G, R | All improved / absent | substantial |
| 71 | M | 41 | 8 | T, R, NP, SD, F, C | All improved / absent | substantial |
| 78 | M | 59 | 1 | T, R, HW, NP | All improved / absent | substantial |
| 79 | F | 64 | 2 | T, SS, HA, F, SD, LBP | All improved / absent | substantial |
| 80 | M | 47 | 10 | C, D, SS, HW, T, R, G, NP, LBP | All improved / absent | substantial |
| 81 | M | 60 | 3 | C, D, SS, SA, HW, T, SD, R, FE | All improved / absent | substantial |
| 45 | M | 63 | 10 | D, HW, T, R, NP, LBP, FR, FE | NP, LBP, R, FE, D | moderate |
| 47 | F | 60 | 3 | SS, HW, G, T, R, NP, LBP, F, SD | G, T, SD, F, NP | moderate |
| 56 | M | 74 | 7 | SS, SW, T, G, B, R, F | F, G, R, SS | moderate |
| 72 | M | 67 | 3 | F, T, G, HW, NP | F, NP, T | moderate |
| 73 | M | 60 | 12 | NP, LBP, T, G, C, R, SD, F | SD, NP, LBP, F, G | moderate |
| 74 | F | 59 | 13 | SS, HW, G, T, FE, R, SD, F, NP, LBP | SD, F, NP, LBP, G | moderate |
| 75 | F | 77 | 3 | NP, R, HA, T, HW, F | NP, HA, F, R | moderate |
| 76 | M | 49 | 5 | FR, C, SS, HW, T, R, F | FR, R, F | moderate |
| 48 | M | 74 | 10 | D, SS, SA, HW, G, T, R, SD, F, HA | SD, F, T | minor |
| 50 | M | 70 | 14 | G, FR, FE, D, C, SD, SW, R, FA, LBP | C, D, G | minor |
| 53 | M | 34 | 2 | NP, T, G | NP | minor |
| 54 | F | 76 | 10 | NP, LBP, SD, F, FR, T | NP, LBP, T | minor |
| 55 | F | 56 | 5 | T, NP, HA, LBP, FR, G, D, R | NP, HA, F | minor |
| 61 | M | 67 | 8 | F, SD, LBP, FR, G, Cane | LBP, G | minor |
| 62 | M | 76 | 4 | C, SS, SA, SW, FE, T, G, R, F, NP | F, NP | minor |
| 65 | M | 49 | 12 | C, D, SS, HW, T, FE, R, LBP | LBP, T | minor |
| 66 | F | 54 | 2 | T, F, NP, LBP, C | NP, LBP, C | minor |
| 67 | F | 64 | 9 | C, SS, SA, SW, T, R, F, SD, HA | SD, F, HA, R | minor |
| 70 | M | 69 | 11 | SD, F, R, FA, CO, NP, LBP | SD, R | minor |
| 60 | M | 53 | 2 | C, D, SS, FA, G, FE | None | no change |
| 68 | M | 66 | 7 | C, SS, SA, HW, FA, G, T, R, NP, LBP | None | no change |
| 77 | M | 72 | 7 | D, SS, SA, SW, HW, FA, T, G, R | None | no change |

**Symptom Key for Figures 3 and 4**

| | |
|---|---|
| B | Bladder incontinence or urgency |
| C | Cognitive deficit |
| CO | Constipation |
| D | Depression / loss of motivation |
| ENW | Extremity numbness & weakness |
| F | Fatigue |
| FA | Falls |
| FE | Frozen facial expression |
| FR | Freezing |
| G | Shuffling gait / stutter steps |
| HA | Headache |
| HW | Handwriting difficulty |
| L | Lhermitte's Sign |
| LBP | Low Back pain |
| NP | Neck Pain |
| R | Rigidity |
| S | Spasticity |
| SA | Excess salivation |
| SD | Sleep disorder |
| SS | Slurred speech |
| SW | Swallowing difficulty |
| T | Tremor |
| V | Vision loss |