A Retrospective Study on the Efficacy of Conservative Chiropractic Care in the treatment of Cervical Radiculopathy and Carpal Tunnel Syndrome

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ABSTRACT

Objective: Utilization of conservative methods to treat Cervical Radiculopathy and Carpal Tunnel Syndrome.

Methods: PROM/Traction of cervical spine, ART, PIR, Cold laser, Anti-inflammation diet, Stabilization exercises, Stretches.

Discussion: The methods above help to correct the mechanical joint dysfunction, biomechanical alterations, central sensitization, and psychosocial factors in a patient diagnosed with Cervical Radiculopathy and Carpal Tunnel Syndrome.

Conclusion: Chiropractic conservative management of Cervical Radiculopathy and Carpal Tunnel Syndrome is multifaceted and provides successful outcomes for the patient.

Key Indexing Terms: Case Report, Carpal Tunnel Syndrome, Cervical Radiculopathy, Cervical Traction, Anti-inflammation, Degenerative Disease, Spondylosis.

INTRODUCTION

The 2 most common causes of radiculopathy are lateral canal stenosis and herniated disk.(1) Lateral canal stenosis occurs due to the formation of osteophytes, or hypertrophied facet joints, and/or ligamentum flavum causing narrowing of the area of the canal where the nerve roots exit.(1) Research concerning the pathology of cervical spondylosis showed that some pathologic changes happened in the cervical nerve roots when they are compressed and

irritated by an osteophyte at the uncovertebral joint, at the posterior aspect of the vertebral body on the facet joints, or at the nucleus pulposus leading to edema around the nerve roots.(2) During cervical spine movement there is coupled motion between the vertebra causing a change in the sagittal diameter of the spinal canal.(2) One study suggests that lateral bending led to stretching and displacement of the anatomical structures in the vertebral canal, especially at C5, C6, and C7 nerve roots.(2) Compressive forces placed on the disk cause the nucleus pulposus to shift, placing added stress on the annular fibers. The mechanical stress creates laxity in the annular fibers which leads to the bulging disks.(4)

"Radiculopathy" is not synonymous with "radicular pain" or "nerve root pain". Radiculopathy is the whole complex of symptoms that arise from spinal nerve root pathology, symptoms including parasthesia, hyposthesia, anesthesia, motor loss and pain."(1) Typically, statements such as "radiculopathy, or nerve root compression, and therefore pain and neurologic symptoms should follow a dermatomal distribution" and "radicular pain... cause irritation, which causes ectopic nerve impulses perceived as pain in the distribution of the axon."(1) However, there is no universal diagnostic criteria for diagnosing cervical radiculopathy.(5) The annual rate of incidence of cervical radiculopathy is 85 per 100,000 patients, and is greater in the fifth decade of

life.(6,7) "The sixth and seventh roots are among the most common roots involved in cervical radiculopathy."(14)

Clinical evidence suggests that extremity pain often coexists with spinal dysfunction.(3) The typical patient will present with neck and arm pain, also may include referred pain to the medial border of the scapula or the upper and lower arms down to the hands.(6) Patients who present with both neck and upper extremity pain have been found to have greater functional impairments and disability.

Dr. Gunn proposed treatment of myofascial pain by relating it to it's neuropathic origin.(9) In cases of spondylosis they have accumulated an "injury pool" from repetitive injuries. One major manifestation of neuropathy is the motor sign of the shortened muscles due to spasm causing ropey bands in the muscles which become fibrotic areas of tenderness called trigger points.(9) These spasmed muscles lead to mechanical dysfunction causing increased pressure on the disks which irritate the nerve root.(9)

Korr proposed that the facilitated segment as a possible mechanism that abnormal sensory input due to spinal dysfunction would result in inhibition in the extremity muscle supplied by the same spinal segment.(3) In the facilitated segment, the neurons that moderate sensory, motor, and autonomic functions are in a constant state of hyperexcitability.(3) It is also known that intense and/or persistent nociceptive input can produce an expansion in the size of the

receptive fields of those dorsal horn cells that receive and project nociceptive signals from the periphery.(1) As a result, these cells are capable of responding to input from a greater number of incoming afferent fibers, leading to referral of pain that is perceived in a wider area than would occur without this expansion.(1) Another theory suggests that an increase in sympathetic activity may lead to increased sensitivity and tenderness in spinal muscles that are innervated by the same spinal segment.(3)

Carpal Tunnel Syndrome is one of the fastest growing repetitive injuries in this country. "It is known from clinical investigation that there is an over representation of carpal tunnel syndrome in patients suffering from cervical radiculopathy".(10) The theory of double crush syndrome suggests that proximal nerve root irritation may contribute to the expression of symptoms distally.(10) Leahy "states that the more frequent site of median nerve entrapment is at the level of the pronator teres duplicating the symptoms of carpal tunnel symptoms."(25) "Osterman found that with a more proximal root compression less involvement or compression of the median nerve across the carpal tunnel was required to produce the symptoms."(10) "Hurst et al. studied 1,000 cases of carpal tunnel syndrome and found a significant incidence of bilateral carpal tunnel syndrome in patients with cervical arthritis."(10) "Thus a cervical radiculopathy manifesting as little more than neck pain and stiffness could still precipitate a distal focal entrapment neuropathy."(16)

PATIENT DESCRIPTION

The patients vitals were as follows: Blood pressure 105/65 bilaterally, respiratory rate of 14, pulse 75, height 5'6'', weight 170, temperature 98.5 degrees. The examination of the head, face, eyes, ears, nose, heart, lungs, abdominal, lower extremities, skin, and cranial nerves were unremarkable. Patient regularly consumes 2-3 caffeinated beverages per day and 5-6 alcoholic drinks per week. In the past she smoked a half pack of cigarettes a day until she got pregnant with her son two years ago. The patient takes skelaxin and hydrocodone to treat her neck pain and stiffness. The patient takes Zoloft for depression. Patient denies any recreational drug use.

The examination of the upper extremity revealed hyporeflexia +1 for bicep and brachioradialis reflex on the right, +2 for the triceps on the right. The reflexes on the left were all normal, +2. The breast and rectal exams were not performed, but the patient does receive routine checkups for these systems.

Examination of Chief Complaint

The patient presented to the clinic with complaints of neck pain with radiation to the right and left arm and wrist, which she states the symptoms started on 4/10/10. The pain started after she was loading her car with suitcases. However, after further probing the patient recalls a water skiing

incident 08/2009 where she whipped her head/neck and her shoulders were jerked. Her pain is usually dull and achy, but often the pain can be sharp and shooting. The severity of the pain varies throughout the day but is typically worse at the end of the day. Prolonged sitting exacerbates the pain, VAS is a 5 or 6. When the pain radiates it goes up the neck and down the arms the patients says VAS 9. Usually the pain radiates down the left arm, but she presented to the clinic with pain radiating down the right arm. Both hands are numb in the first 3 digits, which is the C6 nerve distribution.

The neck pain wakes the patient around 3 or 4 A.M. most nights and it takes her 30-60 minutes to fall back to sleep. This is contributing to the patients fatigue, depression and irritability. The patient finds relief from pain by using muscle relaxers, hydrocodone, at home traction, physical therapy treatments, and biofreeze. The patient wears wrist guards at night which she thinks helps the symptoms. However, the patient is not able to perform all of her daily activities without some level of discomfort. These activities include writing, typing, carrying her child and sitting for extended periods of time.

Related Past Medical History

The patient had a fall in 1997 on outstretched arms from a second story building. She had multiple fractures in the left wrist which required surgery to stabilize. At the time of the fall the patient had a black eye and a bruised shoulder but denies receiving care for either injury. Patient recalled noticing

pain in her neck after having her first child in 2004, and after the second in 2008. She also said that she had an MRI in 2004 and 2008 which showed a disk bulge at C5/6 and C6/7.

Orthopedic Examination

The cervical spine regional was performed on initial examination of the patient. The patient presented with anterior head carriage and a right head tilt. The SCM, trapezius, and scalenes were hypertonic bilaterally, trigger points also present in the muscles. AROM was limited due to pain and muscle tension. She had 20 degrees of lateral flexion bilat., 60 degrees of rotation bilat., 60 degrees of extension, and 50 degrees of flexion which caused pain down the thoracic spine. The sensory exam of the cervical nerve roots revealed a decrease in sensation at the C6 distribution, but all other levels were unremarkable. Deep tendon reflexes of the biceps and brachioradialis were decreased on the right +1, all DTR's on the left +2, Hoffman sign negative. The muscle test reveals decreased biceps, wrist extension, and triceps strength on the right, and decreased strength in the left bicep and finger adduction grade +4. All of the other muscles were graded +5 within normal limits.

The orthopedic examinations which reproduced the chief complaint are Foraminal Compression, Maximal Foraminal Compression (MFC), Jacksons, Spurlings, spinal percussion. Foraminal Compression caused pain on the left anterior aspect of the neck. MFC pain was worse turning to the left side.

Jackson's produced pain to the opposite side being tested. Spurlings caused shooting pain down both arms that lasted a couple of minutes. Soto-Hall, Edens and Lhermitte caused bilateral pain. Soto-Hall caused more intense pain on the left than the right. Spinal Percussion caused pain down to the mid t-spine, more on the right side. Cervical distraction alleviated her pain.

The elbow wrist hand examination was performed for the wrist ache on the left and median nerve distribution numbness in both hands. Visual inspection reveals wrists in flexion suggesting tight wrist flexors. Palpation confirmed tightness of the flexors bilaterally. Upon palpation of the wrists clicking and crepitus of the carpals was noted. Sensory exam revealed improvement, C2-T1 dermatomes within normal limits bilaterally, spinothalamic and dorsal columns intact. DTR's of C5 and C6 on the right display hyporeflexia +1, and C5 C6 C7 on the left normal +2. Elbow range of motion (active, passive and resisted) full and non-painful. All the ranges of motion on the left wrist were decreased but not painful, and on the right the ROM was full and non-painful. The motor examination was the same as above for the c-spine exam. The orthopedic exams that reproduced the chief complaint Allen's on the left, Finkelstein's bilaterally, Reverse Phalen's bilaterally, Bracelet Test on the left, Fromet's paper sign on the left, and Tinels sign on the right.

The thoracic regional exam was preformed to evaluate pain between the shoulders especially on the medial border of the scapula. Winging of both scapula, right head tilt, and elevated left shoulder were noted. On palpation the trapezius and the levator on the left hypertonic and tender to the touch. The sensory exam and DTR's were all within normal limits. the motor exam reveals all lower extremity musculature +5. Gross range of motion (active, passive, and resisted) are full and non-painful. On palpation of t-spine segmental areas of tenderness and decreased motion were palpated at T1/T2 and at T6/T7. The orthopedic examinations that reproduced the chief complaint were Schepelmans, Valsalva, Amoss on the left. All of these tests reproduced the complaint of left scapula pain and left neck pain.

Radiographic Examination

The radiographic examination revealed mild discogenic spondylosis at C5/6 and more significantly at C6/7 with moderate neuroforaminal narrowing on the right and mild neuroforaminal narrowing on the left. There is a reversal of the sagittal curve extending cephalad from C5.

MRI Examination

The patient had an MRI performed in 2008 which showed degenerative disk changes at C5/6 and C6/7 with some right sided paracentral disk

osteophyte bulging causing some moderate foraminal stenosis. Mild impingement of the thecal sac with partial obscuration of the lateral recess.

Diagnostic Ultrasound Examination

The ultrasound demonstrates cross-sectional measurement of C5 nerve root was 5 mm2 bilaterally. The C6 measures 11 mm2 bilaterally. The right C7 root measurement of 16 mm2 and the left 12 mm2. This is outside of the normal range and this may suggest mild swelling secondary to radiculopathy. The left ulnar nerve measures 8 mm2 within the cubital tunnel. Which is the upper end of normal, and may indicate mild ulnar neuropathy at the elbow. The median nerve measures 11 mm2 at the carpal tunnel.

EMG and NCV Examination

Evaluation of the median motor nerve bilaterally showed a decreased nerve conduction velocity. The left ulnar motor nerve demonstrated a decreased conduction velocity. The right ulnar motor and the right ulnar sensory nerves showed reduced amplitude and decreased conduction velocity. The right median sensory nerve showed prolonged distal peak latency and decreased conduction velocity.

Nerve Conduction Studies

Anti Sensory Summary Table

Site	NR	Peak (ms)	Norm Peak (ms)	P-T Amp (µV)	Norm P-T Amp	Site1	Site2	Delta-P (ms)	Dist (cm)	Vel (m/s)	Norm Vel (m/s)
Left Median Anti Sensory (2nd Digit)											
Wrist		2.9	<3.6	43.3	>10	Wrist	2nd Digit	2.9	14.0	48	>39
Elbow		6.7		13.2		Elbow	Wrist	3.8	22.0	58	>48
Axilla		8.6		20.2		Axilla	Elbow	1.9	18.0	95	
Right Median Anti Sensory (2nd Digit)											
Wrist		**6.8**	<3.6	24.6	>10	Wrist	2nd Digit	6.8	14.0	**21**	>39
Elbow		8.8		18.4		Elbow	Wrist	2.0	16.0	80	>48
Left Ulnar Anti Sensory (5th Digit)											
Wrist		3.1	<3.7	35.1	>15.0	Wrist	5th Digit	3.1	14.0	45	>38
B Elbow		6.9		23.7		B Elbow	Wrist	3.8	23.0	61	>47
A Elbow		8.5		19.9		A Elbow	B Elbow	1.6	14.0	88	
Axilla		2.6		40.1		Axilla	A Elbow	5.9	0.0		
Right Ulnar Anti Sensory (5th Digit)											
Wrist		0.8	<3.7	**7.6**	>15.0	Wrist	5th Digit	0.8	12.0	150	>38
B Elbow		6.0		38.6		B Elbow	Wrist	5.2	23.0	**44**	>47
A Elbow		8.2		31.4		A Elbow	B Elbow	2.2	11.5	52	

Motor Summary Table

Site	NR	Onset (ms)	Norm Onset (ms)	O-P Amp (mV)	Norm O-P Amp	Site1	Site2	Delta-0 (ms)	Dist (cm)	Vel (m/s)	Norm Vel (m/s)
Left Median Motor (Abd Poll Brev)											
Wrist		3.9	<4.2	5.6	>5	Elbow	Wrist	3.0	8.0	**27**	>50
Elbow		6.9		5.0		Axilla	Elbow	1.6	18.0	113	
Axilla		8.5		9.4							
Right Median Motor (Abd Poll Brev)											
Wrist		4.0	<4.2	5.9	>5	Elbow	Wrist	3.3	8.0	**24**	>50
Elbow		7.3		3.0		Axilla	Elbow	1.8	18.0	100	
Axilla		9.1		6.0							
Left Ulnar Motor (Abd Dig Minimi)											
Wrist		2.7	<4.2	5.9	>3	B Elbow	Wrist	3.6	8.0	**22**	>53
B Elbow		6.3		5.5		A Elbow	B Elbow	2.1	21.0	100	>53
A Elbow		8.4		5.4							
Right Ulnar Motor (Abd Dig Minimi)											
Wrist		2.8	<4.2	**1.5**	>3	B Elbow	Wrist	6.0	8.0	**13**	>53
B Elbow		8.8		2.1		A Elbow	B Elbow	0.8	19.0	237	>53
A Elbow		8.0		2.6							

F Wave Studies

Min-F	Max-F	Dispersion	Mean-F	F-Norm	L-R Mean-F	L-R Mean-F Norm	F/M Ratio
Left Median (Curs) (Abd Poll Brev)							
17.66	27.81	10.15	20.2	<33	**6.4**	<2.2	1.58
Right Median (Curs) (Abd Poll Brev)							
22.50	33.20	10.70	26.6	<33	**6.4**	<2.2	1.55
Left Ulnar (Curs) (Abd Dig Min)							
24.38	29.53	5.15	26.2	<36	**4.3**	<2.5	18.56
Right Ulnar (Curs) (Abd Dig Min)							
19.38	24.45	5.07	21.9	<36	**4.3**	<2.5	4.01

Nerve Conduction Studies

Anti Sensory Left/Right Comparison

Site	L Lat (ms)	R Lat (ms)	L-R Lat (ms)	L Amp (µV)	R Amp (µV)	L-R Amp (%)	Site1	Site2	L Vel (m/s)	R Vel (m/s)	L-R Vel (m/s)
Median Anti Sensory (2nd Digit)											
Wrist	2.9	**6.8**	**3.9**	43.3	24.6	43.2	Wrist	2nd Digit	48	**21**	27
Elbow	6.7	8.8	2.1	13.2	18.4	28.3	Elbow	Wrist	58	80	22
Axilla	8.6			20.2			Axilla	Elbow	95		
Ulnar Anti Sensory (5th Digit)											
Wrist	3.1	0.8	**2.3**	35.1	**7.6**	**78.3**	Wrist	5th Digit	45	150	105
B Elbow	6.9	6.0	0.9	23.7	38.6	38.6	B Elbow	Wrist	61	**44**	17
A Elbow	8.5	8.2	0.3	19.9	31.4	36.6	A Elbow	B Elbow	88	52	36
Axilla	2.6			40.1			Axilla	A Elbow			

Motor Left/Right Comparison

Site	L Lat (ms)	R Lat (ms)	L-R Lat (ms)	L Amp (mV)	R Amp (mV)	L-R Amp (%)	Site1	Site2	L Vel (m/s)	R Vel (m/s)	L-R Vel (m/s)
Median Motor (Abd Poll Brev)											
Wrist	3.9	4.0	0.1	5.6	5.9	5.1	Elbow	Wrist	**27**	**24**	3
Elbow	6.9	7.3	0.4	5.0	3.0	40.0	Axilla	Elbow	113	100	13
Axilla	8.5	9.1	0.6	9.4	6.0	36.2					
Ulnar Motor (Abd Dig Minimi)											
Wrist	2.7	2.8	0.1	5.9	**1.5**	**74.6**	B Elbow	Wrist	**22**	**13**	9
B Elbow	6.3	8.8	2.5	5.5	2.1	61.8	A Elbow	B Elbow	100	237	**137**
A Elbow	8.4	8.0	0.4	5.4	2.6	51.9					

METHODS

Interventions

Three phases of care were implemented for this patient relief, rehabilitation, and stabilization. In the relief phase of care the main treatment goals were to decrease the patients pain, which was measured by the Numeric Pain Rating Scale, to increase the active range of motion (AROM), to decrease inflammation, and to decrease the Oswestry Disability Index. The plan included cervical spine manual treatment, Sacral Occipital Stair-step maneuver 3x a week with PROM and joint play trial of care, cervical decompression, cold laser and ART/PIR/ischemic compression soft tissue work on neck musculature. Also, to adjust the wrists 3x a week using diversified and soft tissue work on the wrist flexors and extensors. Thoracic spine diversified adjusting for subluxations.

Initial posture education for patient to correct postural habits contributing to her pain, for example anterior head carriage and rounded shoulders. Taught the patient to walk with palms facing forward to help bring shoulders back, using shoulder retraction. PIR of the levator scapula, trapezius, and SCM to help with the hypertonicity of the musculature. Home care suggestions were to keep using the biofreeze, to sleep with a cervical pillow, and to continue using the wrist braces at night. Taught the patient the importance of regular stretching every hour while working to decrease her neck

and shoulder pain. Taught patient self PIR for cervical range of motion, and home stretch for the levator scapula. Encourage the patient to maintain her current cardio schedule of 3-5 times a week which will help with weight loss, depression and irritability. Provided the patient with information about the anti-inflammation diet and recommended that she take Bromaline. This phase of care was 17 visits with 2 re-evaluations to assess the progress of the patient under the treatment plan.

The second phase of care was the rehabilitation phase. The primary treatment goals for this phase of care were to reduce pain, strengthen the cervical spine musculature and core, to decrease the Oswestry Disability Index, and to improve proprioception and muscle function thru exercise. The plan included cervical spine manual treatment, Sacral Occipital Stair-step maneuver 2x a week with PROM and joint play trial of care, SOT pelvic blocking, cervical decompression, cold laser (for the first 8 visits), kinesiotaping (for the last 9 visits) and ART/PIR/ischemic compression soft tissue work on neck musculature. Also, to adjust the wrists 2x a week using diversified and soft tissue work on the wrist flexors and extensors. Thoracic spine diversified adjusting for subluxations. Strengthening of the deep neck flexors with Breuggers exercise which helps with the activation of the muscles that help to decrease the patients anterior head carriage. Strengthening the core musculature using the curl up to improve posture. This phase of care lasted 17

visits with two re-evaluation exams, after the 8th and the 16th visit to check the progress of the patient under the treatment plan.

The last phase of care is the supportive phase. The main treatment goals for this phase of care was to increase the time between visits without an increase in the pain symptoms, to increase strength/endurance during activities of daily living and to decrease the Oswestry Disability Index. The plan included cervical spine manual treatment, Sacral Occipital Stair-step maneuver 1x a week with PROM and joint play trial of care, cervical decompression, and ART/PIR/ ischemic compression soft tissue work on neck musculature. Also, to adjust the wrists 1x a week using diversified and soft tissue work on the wrist flexors and extensors. Thoracic spine diversified adjusting for subluxations.

Outcome Measurements

The Neck Disability Index (NDI) is the assessment tool used most often to measure for self reported disability in neck pain patients.(7) The NDI measure contains seven activities of daily living, two pain components, and one aspect related to concentration.(7) These features are scored from 0-5 for each question, and it is calculated as a percentage, the higher the percentage score the greater the disability.(7) The test-retest reliability in patients with cervical radiculopathy has been reported to be moderate (ICC=0.68).(7)

Numeric Pain Rating Scale (NPRS) is a rating scale where the patient rates their current level of pain from 0-10.(7) With the 0 meaning no pain and the 10 being the worst pain of their life.(7) “The test re-test reliability has been recently reported to be moderate (ICC = 0.63) in cervical radiculopathy patients.”(7)

Spurling’s test is an orthopedic test that induces lateral flexion and extends the neck, then the Dr. induces axial pressure on the spine.(8) Spurlings test is not very sensitive, but it is specific for cervical radiculopathy and it is clinically useful to confirm cervical radiculopathy.(8) In one study Spurling’s test had a sensitivity of 6/20 (30%) and a specificity of 160/172 (93%).(8)

Discussion

“Physicians who have the highest level of success treating upper extremity conditions are armed with a wide array of treatment options that take into account the multiple causes including treatments aimed at muscular, bony, fibrotic, nervous, edemonus tissues and systemic systems.”(10) “Treatment options include: spinal manipulation, joint mobilization, deep tissue/cross friction massage, therapeutic stretching, and rehabilitation programs as well as modification of postures and contributing activities.”(10) BenEliyahu specifically states: ”Patients with and without nerve root compression secondary to cervical disk herniation can and do respond well to chiropractic care. Chiropractic

management of this condition can and should be employed prior to more invasive treatment."(12) "Outpatient nonsurgical conservative management with careful patient education and monitoring of a coordinated conservative regimen can be successful for the majority of patients with cervical disk radiculopathy."(15) The majority of cases of cervical radiculopathy, 80 to 90 percent, resolve with conservative care.(26)

The use of cervical traction could be considered the therapy of choice for treating cervical radiculopathy caused by herniated/bulging disks or spondylosis.(11,19) Distractive forms of manipulation, intermittent axial traction and at home traction should be employed to treat patients suffering from cervical radiculopathy.(13) Cervical traction used for treatment of cervical spine pain dates back to 4000 B.C., the Hippocratic traction bench was used in ancient Greece.(19) It has been shown that the distractive forces of cervical traction help to open up the facets and increase the intervertebral foraminal space which the nerve travels.(19) Statements by Caillet still pertain to todays literature," only personal experience determines the method, amount of weight applied, the duration, and the frequency of traction since unfortunately, no scientific documentation is available."(19)

"In a study by Giles and Muller a comparison of manipulation versus acupuncture versus NSAIDS indicated a significant improvements in pain and disability for the manipulated patients as compared with patients undergoing

other approaches."(22) Their is moderate to high quality evidence to support the efficacy of spinal manipulation or mobilization for chronic neck pain sufferers.(26)

"Ischemic compression of trigger points is one of the most popular treatment methods used by chiropractors to treat myofascial pain."(17) Fernandez-de-las-Penas et al "found a relationship between the presence of myofascial trigger points in the upper fibers of the trapezius muscle and the presence of cervical impairment."(18) "An abnormal sensory input from the joint dysfunction may reflexively activate the trigger points."(18) Simon and Travell suggest that trigger point in the upper trapezius muscle may often be misdiagnosed as a cervical radiculopathy. Due to the overlap of symptoms like constant posterior lateral neck/shoulder pain and stiffness, burning pain at the medial scapular border and a deep ache over the scapular area which often leads to the patient constantly rubbing the area.(20) Simon and Travel have documented that trigger points in the lower trapezius are contributing factors for trigger points in the upper trapezius, levator scapula and the posterior cervical musculature.(20)

Post isometric relaxation technique (PIR) is a method which uses a contraction of the muscle and then relaxation of the muscle with a stretch, it helps to correct restrictions in the muscles and more importantly reeducates the muscles.(20) "PIR allows the practitioner to gently lengthen the shortened

sarcomeres in the fascicle of the muscle fibers that contain trigger points in a way that avoids over stretching, which can aggravate the trigger point."(24)

"Common muscle imbalances at or affecting the cervical spine include tightness of the SCM's, short deep neck extensors, upper trapezius, levator scapula, and the pectoralis major and minor. Muscles that tend to be inhibited are the deep neck flexors and the lower stabilizers of the scapula including the lower and middle trapezius and the rhomboids."(21) The common postures found in conjunction with cervical dysfunction are anterior head carriage and rounded shoulders. "The demands on the posterior musculature are dramatically increased by the weight of the head as it moves forward of the body."(21) Simon and Travell stress the importance of correcting the postural abnormalities which contribute to the articular dysfunctions occurring in the spine. They suggest using wall angels, Bruggers, doorway stretches to release the pectoralis muscles, strengthening the lower trapezius muscles.(20) Bruggers exercise is used to facilitate the mid and lower trapezius muscles, while inhibiting the upper trapezius, levator scapula, pectoralis major and minor.(24) "Recent research indicates that both exercise and chiropractic care involving spinal manipulation may also be able to improve these impaired neuromuscular patterns."(27)

Dr. Seaman has extensively documented the systemic benefits of an anti-inflammatory diet. He suggests nutritional supplementation or a diet rich in

Bromelain, Magnesium, CoQ10, Ginger, Fish oil, Glucosamine and Chondriton, Vitamin E to decrease the pro-inflammatory potentials of our tissues.(23) "Clinical trials have demonstrated the efficacy of Bromelain supplementation in the reduction of inflammation and pain associated with musculoskeletal injuries, surgery, and rheumatoid arthritis."(23) To achieve the anti-inflammatory effects of enzymes like Bromelain it should be taken on an empty stomach up to 4 times per day. It should be noted that the long term use of proteolytic enzymes effects has not be well documented.(23) Bromelain's action is similar to that of NSAIDS like Advil or Ibuprofen, it causes a decrease/ inhibition in the prostaglandin E-2 leading to a decrease in inflammation.(23)

Results

EMG and NCV Examination

Evaluation of the median nerve showed that only the median sensory nerve on the right showed reduced amplitude. All remaining nerves were within normal limits. All F Wave latencies were within normal limits. All examined muscles showed no evidence of electrical instability.

Nerve Conduction Studies

Anti Sensory Summary Table

Site	NR	Peak (ms)	Norm Peak (ms)	P-T Amp (µV)	Norm P-T Amp	Site1	Site2	Delta-P (ms)	Dist (cm)	Vel (m/s)	Norm Vel (m/s)
Left Median Anti Sensory (2nd Digit)											
Wrist		3.1	<3.6	78.0	>10	Wrist	2nd Digit	3.1	14.0	45	>39
Elbow		6.4		42.0		Elbow	Wrist	3.3	0.0		>48
Axilla		8.2		25.2		Axilla	Elbow	1.8	0.0		
Right Median Anti Sensory (2nd Digit)											
Wrist		3.5	<3.6	**7.0**	>10	Wrist	2nd Digit	3.5	14.0	40	>39
Elbow		6.8		41.1		Elbow	Wrist	3.3	0.0		>48
Axilla		3.3		12.5		Axilla	Elbow	3.5	0.0		
Left Ulnar Anti Sensory (5th Digit)											
Wrist		3.1	<3.7	43.3	>15.0	Wrist	5th Digit	3.1	14.0	45	>38
B Elbow		1.3		9.5		B Elbow	Wrist	1.8	0.0		>47
A Elbow		2.8		9.5		A Elbow	B Elbow	1.5	0.0		

Motor Summary Table

Site	NR	Onset (ms)	Norm Onset (ms)	O-P Amp (mV)	Norm O-P Amp	Site1	Site2	Delta-0 (ms)	Dist (cm)	Vel (m/s)	Norm Vel (m/s)
Left Median Motor (Abd Poll Brev)											
Wrist		3.3	<4.2	11.5	>5	Elbow	Wrist	3.8	0.0		>50
Elbow		7.1		1.8		Axilla	Elbow	6.7	0.0		
Axilla		13.8		0.6							
Right Median Motor (Abd Poll Brev)											
Wrist		3.8	<4.2	7.2	>5	Elbow	Wrist	3.4	0.0		>50
Elbow		7.2		7.2		Axilla	Elbow	2.0	0.0		
Axilla		9.2		4.7							
Left Ulnar Motor (Abd Dig Minimi)											
Wrist		2.7	<4.2	7.5	>3	B Elbow	Wrist	11.1	0.0		>53
B Elbow		13.8		0.0		A Elbow	B Elbow	5.7	0.0		>53
A Elbow		8.1		7.9							
Right Ulnar Motor (Abd Dig Minimi)											
Wrist		2.7	<4.2	11.6	>3	B Elbow	Wrist	11.1	0.0		>53
B Elbow		13.8		0.3		A Elbow	B Elbow	5.6	0.0		>53
A Elbow		8.2		10.2							

F Wave Studies

Min-F	Max-F	Dispersion	Mean-F	F-Norm	L-R Mean-F	L-R Mean-F Norm	F/M Ratio
Right Median (Curs) (Abd Poll Brev)							
26.17	27.58	1.41	26.9	<33		<2.2	2.81
Right Ulnar (Curs) (Abd Dig Min)							
25.94	33.28	7.34	29.6	<36		<2.5	0.45

EMG

Side	Muscle	Nerve	Root	Ins Act	Fibs	Psw	Amp	Dur	Poly	Recrt	Int Pat	Comment
Right	Abd Poll Brev	Median	C8-T1	Nml	Nml	Nml	Nml	Nml	0	Nml	Nml	

Nerve Conduction Studies

Anti Sensory Left/Right Comparison

Site	L Lat (ms)	R Lat (ms)	L-R Lat (ms)	L Amp (µV)	R Amp (µV)	L-R Amp (%)	Site1	Site2	L Vel (m/s)	R Vel (m/s)	L-R Vel (m/s)
Median Anti Sensory (2nd Digit)											
Wrist	3.1	3.5	0.4	78.0	**7.0**	**91.0**	Wrist	2nd Digit	45	40	5
Elbow	6.4	6.8	0.4	42.0	41.1	2.1	Elbow	Wrist			
Axilla	8.2	3.3	4.9	25.2	12.5	50.4	Axilla	Elbow			
Ulnar Anti Sensory (5th Digit)											
Wrist	3.1			43.3			Wrist	5th Digit	45		
B Elbow	1.3			9.5			B Elbow	Wrist			
A Elbow	2.8			25.8			A Elbow	B Elbow			

Motor Left/Right Comparison

Site	L Lat (ms)	R Lat (ms)	L-R Lat (ms)	L Amp (mV)	R Amp (mV)	L-R Amp (%)	Site1	Site2	L Vel (m/s)	R Vel (m/s)	L-R Vel (m/s)
Median Motor (Abd Poll Brev)											
Wrist	3.3	3.8	0.5	11.5	7.2	37.4	Elbow	Wrist			
Elbow	7.1	7.2	0.1	1.8	7.2	75.0	Axilla	Elbow			
Axilla	13.8	9.2	4.6	0.6	4.7	87.2					
Ulnar Motor (Abd Dig Minimi)											
Wrist	2.7	2.7	0.0	7.5	11.6	**35.3**	B Elbow	Wrist			
B Elbow	13.8	13.8	0.0	0.0	0.3	100.0	A Elbow	B Elbow			
A Elbow	8.1	8.2	0.1	7.9	10.2	22.5					

Diagnostic Ultrasound Examination

The ultrasound examination demonstrates the normal fasicular echogenic pattern of the distal cervical nerve roots and brachial plexus. There is no evidence of enlargement of the brachial plexus or entrapment by any fibrous structures. The median, ulnar, and radial nerves within the upper arms bilaterally are within normal limits. The right and left median nerves at the elbow measure 10 mm2 and 9 mm2. The right and left median nerves at the

distal forearm measure 8 mm2 and 9 mm2. The wrist to forearm ratio measures 1.0 on the right and 1.1 on the left, which are within normal limits. Compared to the previous ultrasound exam on the left upper extremity on 7/23/2010 there has been an interval decrease in the cross-sectional area of the left median nerve.

Myotome Test

	May 22 2010	Jun 25 2010	Jun 28 2010	Jul 28 2010	Aug 4 2010	Aug 30 2010	Sep 1 2010	Oct 11 2010	Oct 18 2010	Dec 18 2010	Feb 19 2011
C5 deltoid	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5
C6 bicep	R 4 L 4	R 4 L 4	R 4 L 4	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5
C6 wrist ext	R 4 L 5	R 4 L 5	R 4 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5
C7 triceps	R 4 L 5	R 4 L 5	R 4 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5
C7 finger ext	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5
C8 finger flexor	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5
T1 finger abd	R 5 L 4	R 5 L 4	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5	R 5 L 5

Reflexes

	5/22/10	6/28/10	7/28/10	8/4/10	9/1/10	10/11/10	12/18/10	2/19/11
Biceps C5	R 1 L 2	R 1 L2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2
Triceps C7	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2
Brachioradialis C6	R 1 L 2	R 1 L2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2	R 2 L 2

AROM Cervical Spine

AROM	5/22/10	6/28/10	7/28/10	9/1/10	10/11/10	12/18/10	2/19/11
Flexion	50	50	45	45	50	50	50
Extension	60	60	50	55	60	60	60
R. Lat. Flexion	60	70	70	65	70	80	65
L. Lat. Flexion	60	70	60	65	70	75	65
R. Rotation	20	30	40	35	45	40	40
L. Rotation	20	30	35	35	30	45	40

Orthopedic Tests

	5/22/10	6/28/10	7/28/10	9/1/10	10/11/10	12/18/10	2/19/11
Cervical exam							
Foraminal compression	+ pain	+ pain	+ pain	+ pain	+ pain	+ pain	+ pain
Max Foraminal compression	+ pain		+ pain	+ pain			
Jackson's compression	+ pain	+ pain		+ pain	+ pain	+ pain	
Spurlings	+ pain	+ pain	+ pain	+ pain			
Cervical Distraction	+	+	+	+	+		
Shoulder Depression							
Spinal Percussion	pain			+ pain			
Valsalva							
Dejerine's Triad							
Bakody		+			+		
Swallowing							
Soto-Hall	pain						
LHermitt's Sigh	pain			pain			
Wright's							
Allen's Test							
Adson's/ Modified							
Eden's	pain						

	5/22/10	6/25/10	8/4/10	8/30/10	10/18/10	12/18/10	2/19/10
Tinel's	R +	R +	WNL	WNL	WNL	WNL	WNL
Finkelstein's	R + L +	R + L +	WNL	WNL	WNL	WNL	WNL
Phalen's		R +	L+	L+	L+	WNL	WNL
Reverse Phalen's	R + L +	R + L +	R + L +	WNL	WNL	WNL	WNL
Bracelet test	L +	R + L +	L +	WNL	WNL	WNL	WNL
Carpal Lift	WNL	WNL	WNL	WNL	WNL	WNL	WNL
Froment's Paper	L +	R + L +	WNL	WNL	WNL	WNL	WNL

Oswestry Disability Index – Neck

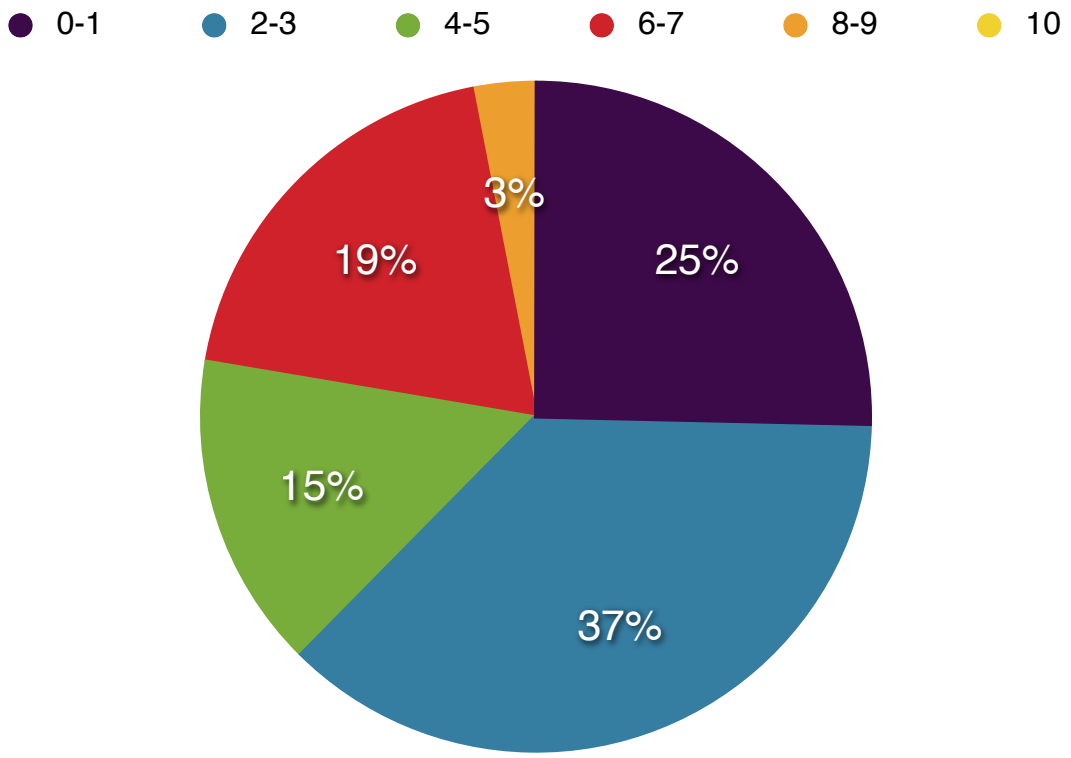
	5/10/10	6/28/10	7/28/10	8/11/10	8/30/10	10/18/10	1/29/10	2/19/10
% Disability	36%	22%	20%	28%	32%	24%	6%	6%

Carpal Tunnel Functional Disability

	6/28/10	7/28/10	8/11/10	9/1/10	10/18/10	1/29/10	2/19/10
% Disability	50%	34.38%	12.5%	22%	9.37%	9.37%	3.1%

Numeric Pain Rating Scale- Neck

These values represent the patients response over 52 treatment visits.



Conclusion

This was a limited study because there was only one patient participating in the study. Another limiting factor in this study was the use of multiple treatment modalities at the same time. This made it difficult to determine which treatments were more effective. However, over the course of treatment the patient made great progress utilizing a multifaceted chiropractic approach. In the future it would be beneficial for a larger scale study to be performed as a

research project. The project should have a more structured approach to the introduction of treatment modalities which would provide more specific outcome measures.

The patient is no longer suffering from symptoms of carpal tunnel syndrome in either hand as evidenced by the disability index score going from a score of 50% to a score of 3.1%. Objectively this is supported by the decrease in the diameter of the median nerve by diagnostic ultrasound and the improvement in sensory and motor nerve conduction speeds as documented by the NCV/EMG. The orthopedic tests also support that the patients carpal tunnel symptoms have improved.

The patient made improvements in her active range of motion, especially in rotation and lateral flexion. Objectively the patients progress can be evidenced by the overall improvement during cervical orthopedic testing and by the improvement on the disability index scores going from a 36% to a 6%. The improvement can also be demonstrated by the normalization of the patients C5, C6, C7 reflexes and T1, C7, C6, C5 myotome strength. Over the course of treatment the patient experienced a decrease in her level of pain as demonstrated by a reduction in her numeric pain scale reporting. In the beginning of treatment the patient experienced pain scores that were higher and with treatment she reported lower scores. The patient is now able to perform activities of daily living for extended periods of time with a much lower

level of pain or no pain a all. In conclusion, treatment of cervical radiculopathy and bilateral carpal tunnel syndrome with conservative multifaceted chiropractic treatment and education was effective in this study.

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