

Case Study

Improvement in Symptoms and Spinal Alignment Following the Pierce Results System in a Patient with Cervical Radiculopathy & Intervertebral Disc Derangement: A Case Study & Review of the Literature

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Abstract

Objective: The purpose of this paper is to report on positive health outcomes in a patient with cervical radiculopathy from intervertebral disc derangement undergoing chiropractic care with the Pierce Results System.

Clinical Features: The patient began experiencing radicular symptoms in the form of pain, weakness, numbness, and tingling to the median nerve distribution site on her right arm two months prior to starting chiropractic care. During that time, the patient had an MRI taken, impressions indicating multilevel cervical protrusions, spondylosis and multilevel foraminal stenosis. The patient was considered for a surgical evaluation.

Intervention and Outcomes: A combination of Pierce care and traction were used. A total of seven Pierce Results System protocol adjustments, 13 manual traction adjustments, and 23 decompression maneuvers were given over 26 visits, in a 100-day time frame. Structural changes were observed on both X-ray and MRI along with a reduction in symptoms.

Conclusions: The use of the Pierce Results System and traction improved the patient's subjective symptoms, as well as improved objective findings related to the structural spinal shifts noted on imaging.

Key Words: *Chiropractic, MRI, Pierce Results System, cervical radiculopathy, vertebral subluxation complex, adjustment, disc herniation, disc derangement*

Introduction

Epidemiology

Radiculopathy is a clinical syndrome resulting from damage to either the dorsal or ventral nerve root, or both.¹ By definition, cervical radiculopathy is a disease of the cervical nerve root.² This indicates that a radicular pain or paresthesia may occur distal to the site of impingement if the dorsal root is affected.

A muscle weakness may occur distally to the site of impingement if the ventral root is affected. Cervical spinal nerves C6 (25%)³ and C7 (60%)³ are most common.⁴ In many cases, the cause of radiculopathy is not split into either a) disc protrusion, or b) degenerative changes, but both are plausible on their own.^{5,6} This will be explained in greater detail in the

anatomy and pathophysiology section below. The incidence of cervical radiculopathy has been estimated to be approximately 85 per 100,000 people,⁷ however, chronic neck syndrome was identified in 9.5-10% of the men and 13.5-15% of them women.^{1,7} Men and women in the age bracket of 50-54 are most likely to suffer.⁵

Etiology

The cause of cervical radiculopathy is commonly attributed to mechanical compression, neuropraxia, or chemical irritation of the nerve roots.⁸ Bone growth, such as spondylosis, tumor,

osteophyte, or sclerosis can all lead to compression of the nerve root. Soft tissues, such as the intervertebral discs, can lose height via loss of imbibition of water, or disc protrusion, also causing mechanical compression. Trauma, infection, or non-osseous tumors can also cause compression to the nerve root.⁹

Diagnosis may include positive neurological tests, such as Spurling's or Valsalva's maneuver, in association with MRI findings, and when consistent with the history and other physical findings.¹⁰

Anatomy

The term radiculopathy is defined as having radicular pain like sensation, numbness, weakness, or difficulty controlling the body, stemming from an injury to the nerve root.⁸ This pain typically presents along dermatome patterns, the sensory mapping of a particular area of skin, innervated by said nerve root. For example, the nerve root exiting the intervertebral foramina (the space in which the nerve root exits the spinal column,) between the fifth and sixth vertebrae (the C5 nerve root,) controls, (but is not limited to,) deltoid strength and control, sensation to the lateral arm, and the biceps reflex.

Having a C5 radiculopathy may present as having deltoid weakness, pain or numbness to the lateral half of the arm, or an irregular biceps reflex. A radiculopathy is distinct from a neuropathy, based on the origination from the nerve root and not the nerve distal to the root. The cervical spine includes the spinal bones of the neck. This includes the occiput, (base of skull,) the atlas (C1,) axis (C2,) and cervical bones C3 to C7.

The cervical curve is a kyphotic curve, which includes the first two thoracic vertebrae as well, T1 and T2.¹¹ The cervical spine has 7 discs, one between each cervical vertebra from C2 to T2. There are eight pairs of cervical nerve roots, rostrally starting at C1, which exits the spinal column between the occiput and C1. The most caudal cervical nerve root, C8, exits the spinal column between vertebrae C7 and T1. T1 spinal nerve root exits the spinal column between T1 and T2.

Pathophysiology

Cervical disc herniations are the second most common cause of cervical nerve root compression, after lateral canal stenosis leading to neuropraxia,¹² however 63% of asymptomatic male athletes over 40 were found to have herniations.¹³ This indicates that cervical protrusions do not always predict cervical radiculopathy. In both neuropraxia and compression injuries, ischemia occurs, meaning that the nerve root is unable to receive adequate oxygen.⁸ This ischemia leads to an altered firing rate of the neuron, altering motor and/or sensory output of the nerve.¹⁴ All forms of mechanical irritation can cause ischemia. According to Homewood,¹⁵ mechanical irritation includes all, but are not limited to: Falls, Strains, Postural stresses, Occupational distortions, Motor vehicle accidents

Medical Approach

When radiculopathy is caused by disc herniation, the inflammatory process occurs, causing ischemia. Anti-

inflammatory medications are given when this occurs, as a form of treatment.⁸ Another common treatment is transforaminal epidural injection when addressing radiculopathy, cervical or lumbar. Corticosteroids are injected in an area close to the nerve root. Typically, the patient is put under local anesthesia, and with the use of videofluoroscopy, a needle is inserted. The level of the needle coincides with the level of radicular sensation, as well as location determined by MRI.¹⁶ The common injection material includes 50mg of corticosteroids, 2ml of prednisolone and hydrocortancyl.¹⁷ In one study, the use of preganglionic injection compared to the conventional post dorsal root ganglion injection worked better at relieving pain symptoms, however, the medical community uses both approaches.¹⁶ In a study by Vallee, using 34 subjects, 14 days after injection, 62% showed great improvement, while 38% reported only fair to poor improvement.¹⁷

Since the 1970's spine surgeons have commonly required six weeks of failed conservative treatment prior to considering surgical intervention for various spinal pathologies.¹⁸ Discectomy or arthrodesis is a surgical intervention that has been deemed safe, and removes a very high percentage of subjects' radicular symptoms.¹⁹

Complementary and Alternative Approach

Acupotomy, acupuncture, Juingfukang granule, and manual therapies, have all been published with respect to cervical radiculopathy, and showed minimal adverse reactions. However, each has been inadequately studied, therefore the efficacy of each is still undetermined.²⁰

A large body of research is based towards traction. Much of the chiropractic studies recorded for radicular cases involve some form of traction. There is evidence showing that intermittent versus continuous traction yields similar results. However, using randomized control trials, it was also found that placebo can have similar effects as traction.²¹ There is also weak evidence, according to Graham, that acupuncture may be more beneficial.²¹

Economics

There are many costs associated with treatment for radiculopathy. One figure assessed radiculopathy based on disc herniation. According to the Surgery Center of Oklahoma, a cervical injection costs US\$1,100 per injection. The cost of a discectomy at one level costs approximately US\$18,960.²² With the addition of rehabilitation post care for up to 12 weeks, the costs can increase by US\$2,832.¹⁸

The average cost of a visit to the chiropractor is between \$20 and \$80 per adjustment or per office visit.²³ Using the higher end office visit cost, (\$80,) at a visit total that the patient in our study received, (26 visits), the total cost would be US\$2,080. While, at the highest cost, this is more expensive than one cervical injection, it is less than the cost of two injections, which is a very real possibility. It is also substantially cheaper than opting for surgery.

As this case details, there is the possibility of specific chiropractic care making beneficial changes visible on MRI,

which would not be received via cervical injection, and only by an extreme approach in surgical intervention.

Review of Literature

Using key words “cervical radiculopathy” and “chiropractic” on PMC, 410 results were found. Using EbSCOhost, using key words “cervical radiculopathy” and “chiropractic” 4 results were found. Three were used. Using Science Direct, using key words “cervical radiculopathy” and “chiropractic” 462 results were found. Using McCoy Press, using key words “cervical radiculopathy” and “chiropractic” five results were found. Three were used.

A systematic review of the literature by Bono²⁴ yielded no studies to adequately address the role of manipulation/chiropractic in the management of cervical radiculopathy from degenerative disorders. The review did identify several case reports and series describing serious vascular and nonvascular complications and adverse outcomes associated with manipulation including radiculopathy, myelopathy, disc herniation, and vertebral artery compression.

This is an important article to begin this review of literature, as it clearly expresses a call for more and better research on said field of study.

In an article by Schliesser,¹ using flexion distraction manipulation, 22 subjects were studied. A Visual Analogue Scale (VAS) was used to measure progress. An average of 13.2 treatments were administered, which constituted applying increasing pressure to the T1 thoracic vertebrae while administering traction. This showed statistically significant changes in all 22 subjects.

The VAS is a subjective test based on the subjects’ perception of their pain. The article concludes by stating that each patient was diagnosed with cervical radiculopathy, independent of MRI or EMG testing. This may have led to fallacies in the condition presenting in each patient.

In an article by Whalen,⁷ a 40-year-old woman with a 2-level disc herniation was treated using high velocity low amplitude manipulation, meaning diversified technique. This presented in the form of radiculopathy as right finger paresthesia, right elbow and shoulder pain. MRI studies showed that the subject had a right posterolateral disc protrusion, and right neuroforaminal stenosis at C5-6 and C6-7. Manipulations were given at T1 and C5, in correspondence with home traction exercises. Within 15 adjustments, the finger paresthesia and shoulder pain subsided. The patient remained out of pain at the final visit, one-year post symptoms. No follow up MRI was taken.

Of critical importance, two neurosurgeons performed examinations on the subject, pre-and post-chiropractic care. The subject was advised to have surgery involving spinal decompression, as neurological findings were present during MRI and physical exam. Once all neurological findings were gone, spinal decompression surgery was still insisted upon.

The patient refused. The limitation to this study is that there are too many variables. It is undetermined if it was the

adjustment, the traction, or both, that reduced neurological findings.

In a case study by Pollard,²⁵ a 30-year-old male rugby athlete suffered a hyperflexion injury that led to findings of cervical radiculopathy. Decreased disc height was noted at C5-6 and C6-7, with associated posterolateral disc protrusion at C6-7. The intervertebral foramina looked healthy on the oblique projection x-rays. The patient exhibited signs of right trapezius weakness and pain following a radicular pattern, and decreased range of motion (ROM). Treatment included high velocity low amplitude adjustments, as well as proprioceptive neuromuscular facilitation stretching, ultrasound, ice, and trigger point therapy. Two months post-care, the patient reported no neck pain, and normal ROM.

The subject was constantly reinjuring himself through continued rugby play. Furthermore, the chiropractic adjustment cannot take full credit for the relief of symptoms, as many modalities were used in combination.

In a study by Radecki,²⁶ a 63-year-old male presented with ulnar distribution paresthesia, after a day of lifting heavy boxes. The subject underwent chiropractic adjustments and rest for six weeks but found little relief. MRI showed a right posterolateral T1 disc protrusion. EMG was useful in isolating the location of the radiculopathy.

This article did not go into detail as to the type of chiropractic technique utilized. The focus was on the efficacy using EMG.

In a systemic review of spinal manipulation and the treatment of cervical radiculopathy by Rodine,²⁷ it was found that scientific support, for both outcome measures and the treatment using manipulation, is lacking. In this review, a Neck Disability Index (NDI) was the outcome measurement being tested. It was found that NDI is a good indicator for measuring progress for chiropractic care and cervical radiculopathy.

As stated in the article, there is a large discrepancy when comparing HVLA adjustments to other techniques.

In a study by Murphy,²⁸ a 43-year-old nurse complained of right-sided neck and arm pain. The pain began two years prior to seeking treatment. The subject tried physical therapy with no benefit, before trying chiropractic care. EMG showed right C7-8 radiculopathy. Cervical compression test was positive on the right side. MRI showed right lateral canal stenosis. Using the Bournemouth Neck Disability Questionnaire (BDQ), the subject ranked at 31 for disability, 0 being no disability, 100 being fully disabled. Chiropractic adjustments were given at the level of C5-6 utilizing a supine anterior to posterior muscle energy technique. Neural gliding was also utilized. The patient reported improvements of 80% by week 15.

It is interesting to note that while the patient reported an 80% improvement, the BDQ score lowered to 17. These are both interesting as the pain intensity consistently stayed at 5/10. This indicates that there is a lack of empirical data when using subjective measures. It is also important to note the patient returned to work after a two-year absence due to the radiculopathy. It would have been beneficial to know what

type of chiropractic adjustment was delivered.

Emary⁴ reported a study on the use of post-isometric relaxation and chiropractic management in a 55-year-old male. The symptoms were present on his right upper extremity. The arm presented with a burning sensation, as well as weakness and numbness in the right hand. The patient had used muscle relaxants prior to seeking care. Upper extremity neurological diagnosis revealed no positives, except for a weak right deltoid. X-ray revealed foraminal narrowing of the C6-7 IVF bilaterally. The subject underwent cervical manipulation technique, soft tissue trigger-point therapy, ice, and isometric stretching exercises. The patient was seen three times a week for the first two weeks. Objective measures used to track changes were “visual estimation of ROM” and orthopedic and neurologic examination. The patient’s symptoms disappeared and were not present after a post three-year follow-up.

Visual estimation of ROM is in no way an objective measure. While the patient got symptomatic relief, there is little evidence of changes to objective measures. A post x-ray would be an example of an objective measure. The patient was subject to multiple techniques, diminishing the ability to detect which caused the majority of the impact.

In a study by Dufton,⁵ two cases were addressed. In the first case, a 55-year-old man presented with right neck and arm pain for five weeks. Uncovertebral joint spurs encroached C5-6 IVF bilaterally. Disc narrowing was present from C4-7. Radiculopathy involved C6 nerve root. Spinal manipulation and retraction head position was used at each treatment.

Eighteen treatments were done over three months. Reduction of symptoms occurred after the third treatment. Nine-month follow-up showed no neurological symptoms. The second case was a 56-year-old female with right-sided arm pain, with numbness to the medial two fingers of the right hand. X-ray revealed decreased disc height from C4-T1 and anterior head carriage. Multiple neurologic findings showed up on examination. The patient also underwent spinal manipulation and retraction exercises. The patient was seen 26 times in three months. No dermatomal patterns were present post care.

This article is beneficial for research, as the only two factors that were changed in the subjects were spinal manipulation, and a self-induced retraction exercise of the head relative to the shoulders. While this interferes with the clinical relevance of the manipulations, it is less compound than the many studies where traction, trigger point work, etc., were used.

In a case by Costello,²⁹ thoracic spine thrust manipulation, soft tissue mobilization, and exercise, were all used on a 41 year old male subject with left sided radicular pain in his elbow. High velocity thrusts were used during the first seven treatments along with soft tissue mobilization and neck flexor exercises. This was followed by two weeks of neck strengthening exercises. As measured using Patient Specific Function Specific scale (PSFS,) the patient improved from 5/10 to 10/10 after the first week of treatments. Using the Numeric Pain Rating (NPRS) scale, the patient lowered pain levels from a 4.66 to a 0. Both of these improvements are considered significant.

This study was not done by a chiropractor, therefore the type of manipulation can jeopardize the validity of chiropractic adjustments and cervical radiculopathy.

In a study by Radpasand,³⁰ a 40-year-old male presented with left sided arm, forearm, and hand pain. EMG was irregular. MRI revealed disc protrusion at the level of C5-6, with spurring at the posterior margin. Diversified HVLA adjusting was used in conjunction with ice, electro therapy, and exercise. Using the NDI, the patient improved by 89.65% from his initial score. A cervical pillow was used as well.

While this study uses EMG and MRI as initial objective measures, the study bases its outcomes on the NDI, a subjective pain questionnaire. There are also many variables as to which truly improved the radicular neurological findings.

In a case study on cadavers done by Gadavalli,³¹ it was found that using a manual cervical distraction technique, interdiscal pressure was decreased by 168.7 kPa. It was found that of the four chiropractors in the study, two had high inter-examiner reliability.

While this does not directly involve cervical radiculopathy, it gives insight as to why many chiropractors give patients symptomatic relief, when using distraction. The disc can be a direct cause of cervical radiculopathy when a protrusion is present.

In a retrospective review by Christensen,³² 162 patient cases were researched. Each patient met the criteria for having radiculopathy. It was found that in all but 23 cases, chiropractic treatment fully resolved the patients’ symptoms. The chiropractic treatment included a HVLA, and chiropractic manipulation, exercise stability, and neuromuscular mobilization, meaning traction. Interestingly, this study also stated that the average visit time for resolution was nine treatment sessions.

While some patients had advanced imaging studies performed, it was not a part of the inclusion criteria. A pain scale was used to compare pre post outcomes. While this study has a large body of participants, the objective measures are still very much lacking.

In a randomized control trial by Moustafa,³³ two traction techniques were compared. A total of 189 subjects were followed for one year. Patients were placed in one of three groups. One used a multimodal approach, one used ventroflexion traction in addition that same approach, and another used H-reflex based traction. It was found that the H-reflex based traction approach was the best approach. The multimodal approach consisted of heat, interferential electrotherapy, soft tissue mobilization, and HVLA thoracic manipulation. The study also found that the angle best utilized for traction is 5° of extension.

This is a great article when comparing different techniques in an attempt to conclude which may be the most beneficial. It was concluded that one measure was better, however the chiropractic indicated in the study was not specific, or used objective measures as to where to adjust. The multiple modalities also discredit each individual technique used, as

many may not have had any influence on the outcomes.

In a case study by Manison,³⁴ a 64-year-old male presented with left sided arm and elbow pain, which later evolved to hypoesthesia of the left medial forearm and hand. Physical therapy, acupuncture, and herbal therapy were used before chiropractic care was initiated, with no resolve. MRI revealed degenerative findings consistent with cervical radiculopathy. Orthopedic tests Shoulder Depressor and Cervical Distraction were both positive on the left side. Cox Flexion Distraction technique was utilized. Ten treatments were administered, using both protocol II and I. Active Release Technique (ART) was used post-individual treatment. Diversified technique followed ART. After ten visits the patient had no complaints, which was consistent after nine months at the follow up.

While this article is titled with regards to Cox technique, the use of multiple techniques makes it difficult to give all credit solely to Cox. Another study should be done comparing just Cox to the plethora of techniques used.

In a case report by Apfelbeck,³⁵ a 54-year-old male patient experienced left sided cervical radiculopathy. The study used instrument adjusting, interferential treatment, and intermittent traction treatment. Ten treatments were used, while eight sessions of interferential treatment were integrated. Traction was used for 15 minutes following an activator instrument adjustment. X-ray revealed osteoarthritis at the C6-7 level. MRI was not recommended due to improvements after three treatments. In conclusion, the NDI score improved and the patient no longer experienced radicular symptoms.

The lack of post objective outcomes does little more than state that the combination of all three of the techniques plays a role in reducing symptoms. The article even states that the use of all three does not rule in or out which method was of greater importance.

In a case study by Kruse,³⁶ a 51-year-old female patient suffered from median nerve root pins and needles sensation stemming from neck pain that began occurring two years prior to seeking out treatment. The MRI revealed a large disc protrusion at the level of C5-6. The patient underwent a treatment of cervical traction. Her symptoms were alleviated within the first treatment, and she was able to remain pain free with treatment approximately every two weeks. Pain would return if treatment was not administered.

It is interesting to note that a key word tagged in this study was "chiropractic." The use of a chiropractor was not stated anywhere in the study. Furthermore, no use of the word adjustment or manipulation was used. This shows another study that is based purely off of the control of symptoms and not function.

In a study by Lorigan,³⁷ a 61-year-old female patient had burning sensation into her arm for two months prior to seeking care. The examination revealed a C6 radiculopathy. Using only diversified technique, after 12 visits the patient no longer had dermatome sensation issues, and a greater range of motion. Subjectively, her RAND36 scores improved.

This is the first study that has used solely chiropractic, and not

chiropractic along with some other form of treatment. It is of importance to note that the patient did receive benefits from chiropractic alone.

In a cohort by Murphy,¹² 20 people with cervical radiculopathy were studied. The median age of the subjects was 48. In each case, motion palpation was used to determine if there was a need for chiropractic manipulation. If there was no need, then a manipulation was not delivered. On average, the subjects were seen three times a week for the first three weeks, and then tapered in care. Using a BDQ and a patient self-assessment form, it was found that the non-invasive treatments used in the cohort were beneficial to the subjects.

While the study showed benefit of chiropractic care and CR, it clearly states that randomized control studies are needed to determine the exact efficacy of each treatment. Also, later in the article it was stated that an energy technique was used in addition to chiropractic. This alters the studies. No objective studies were stated as used by any subjects.

In a case study by Roffers,³ a 23-year-old female patient presented with a C8 radiculopathy. X-rays taken were within normal limits. The patient was assessed and adjusted using full spine technique. After eight adjustments the patient had a noticeably marked reduction in symptoms. The radicular symptoms were entirely gone, while trapezius pain was almost entirely gone.

This is an excellent case of using chiropractic care solely in the treatment of radiculopathy. It is interesting to note that the patient injured herself while jumping out of a second story building in avoidance with bullets being fired at her in a home invasion.

In a case study by Gudavalli,³⁸ a 33-year-old male patient presented with C6 radiculopathy, as tingling sensation down his left arm into the median nerve distribution area. MRI revealed a left posterolateral disc herniation at C6/C7 causing foraminal stenosis. A combination of ultrasound and cox flexion distraction was utilized. After 15 treatments, the patient noted a substantial decrease in sensation.

It appears that Cox flexion distraction, like other traction modalities, works well with this condition. However, the lack of post examination MRI, and the compound use of ultrasound negate the exact outcome based on the chiropractic treatment alone.

In a cohort study by Peterson,¹³ MRI confirmed herniation caused radiculopathy was explored. Fifty subjects were used, with an average age of 44.38 years. In this study, one adjustment was given on the side of radicular symptoms for 3-5 times per week until the symptoms alleviated. It was found that there were significant improvements to all of the patient's symptoms after the first and third months, when reassessments were taken.

This was an excellent study where the doctors had controlled situations. All adjustments were administered on the side of symptomatology, and all adjustments had an attempt number of three to create a cavitation. This was the most controlled study in the entire paper based on these parameters. No

physical therapy modalities were utilized.

A cohort study done by Leemann³⁹ was done a year post care with a group of radiculopathy patients with disc herniation. Patients were assessed as having radiculopathy, using MRI. Using high velocity low amplitude adjusting 148 patients were assessed. Using Oswestry questionnaire 90% of patients reported improvements at three months, while 88% reported complete improvement by one year.

This study is evident that the use of HVLA manipulation has been associated with prolonged improvement for patients with radicular symptoms due to herniation. This study was done on patients with lumbar radiculopathy, so there needs to be further study to validate for cervical radiculopathy.

In a study by Murphy,⁴⁰ a patient experienced radiculopathy-like symptoms after six visits to a chiropractic office. The patient was a 38-year-old male. The technique used was diversified, which left him with radicular pain. MRI was ordered, showing three herniations in the cervical area. The primary care physician referred the patient to another chiropractor. A muscle energy technique was used at this time, the symptoms fully resolved.

The article explains that while the diversified did not cause the herniations, it possibly exacerbated the condition. This is an interesting article, as it brings the importance of objective measures to the forefront. This patient should have known about the discs before seeing a chiropractor that just manipulated at free will.

In a case study by Brouillette,⁴¹ a 60-year-old female suffered from left sided deep burning arm pain. An MRI indicated that the patient had a posterior lateral herniated disc at the level of C6-7. After three weeks of daily chiropractic manipulative therapy, manual traction, and interferential treatment, the patient reported no more symptoms.

The cross use of modalities makes it difficult to decipher which lead to the utmost benefits, or if it was the combination of all three. The lack of post care objective examination fails to detect any objective changes made to the disc herniation.

Under Anesthesia

In a case series by Dougherty,⁴² 20 patients with cervical radiculopathy, the patients were followed using chiropractic adjustments post injection. The injection was given under video fluoroscopy, using lidocaine and Depo-medrol. It was found that using high velocity- low amplitude adjustments in tandem with injections were deemed safe to do on the patient.

It was interesting to note that there were three complications when inserting the injection. There were no complications with the chiropractic adjustment. It is interesting to note that the study refers to the manipulation used, as one done by either chiropractor or osteopath.

In a study by Herzog,⁴³ adjustments under anesthesia were administered. A 29-year-old female patient suffered from a disc herniation caused right sided radiculopathy, after a rear-end car accident, proven by MRI. It was found that after just

the first treatment, the patient noticed that her symptoms were greatly reduced. Her long-term check-up showed an improvement of 95%.

The subject underwent PT, anti-inflammatory medication, and acupuncture, all while doing the treatment. Therefore, it is unknown if the manipulation under anesthesia was truly the cause for recovery. Furthermore, no post MRI studies were conducted.

Alternative CAM

In a study by Savva,⁴⁴ a 52-year-old female was treated for cervical radiculopathy using cervical traction, and slider neuro mobilization. During the physical, C5 dermatomal findings were present. An NDI was used to measure progress. It was found that the patient fully recovered within four weeks.

The patient did not have any objective measures to identify if there were any underlying structural anomalies causing the sensation. It is interesting to note that without the use of chiropractic adjustments, the patient recovered in a time frame similar to that of patients under chiropractic care, traction, and neuromuscular mobilization.

In a cohort study by Constantoyannis,⁴⁵ four subjects aged 31-41 were followed through care. Each had cervical radiculopathy symptoms associated with a herniated disc as shown on MRI. Traction was used on each patient. The study concludes that conservative treatment is beneficial for subjects with cervical radiculopathy, in this case, traction.

It is important to have studies such as these that compare similar scenarios between patients. It shows that from this sample, there are great symptomatic benefits to utilizing traction to alleviate radiculopathy sensation.

In a case study by Schenk,⁴⁶ a 39-year-old male presented with cervical radiculopathy-like symptoms. The patient improvement was measured using a NDI pain rating scale. Using Mechanical Diagnosis and Therapy (MDT,) in one of the treatment therapies, the patient was instructed in repeated cervical retraction with rotation to the left, with the left arm across the body to reduce adverse neural tension. Sets of these were performed. After five weeks the patient was discharged, and at the three-month follow up, NDI scores were still at 0.

This study was clinically relevant, using muscle activation to alleviate the neck pain, but also improve posture. I would be curious as to the perspective of a neurologist, in that this could be masking a neurological condition. Based on this study, the use of MDT is effective in alleviating symptoms.

In a cohort study by Cagnie,⁴⁷ trigger point work was used in the alleviation of cervical radiculopathy. Using the NDI as a measuring scale, the average subject found relief from neck and upper shoulder pain and tightness within eight visits.

While this article does not directly pertain to cervical radiculopathy, it does look at effect treatment for subjects with neck and shoulder pain, symptoms commonly associated with said condition.

In a study by Graham,²¹ placebo was compared to both intermittent traction and constant traction. The review found that there was little difference in efficacy of all three. They also did not show differences when compared to using heat. This was a study done using randomized control trials.

It is interesting to note that no benefits were observed from a pain standpoint when performing this study. Most other case reports noted diminished pain sensation. It would be beneficial to compare objective imaging studies before and after these treatments and repeat these randomized control studies.

In a case study by Tabatabai,⁴⁸ a 51-year-old female patient sought out chiropractic care for radicular symptoms in her right arm. An orthopedic specialist performed a chiropractic manipulation, which did not alleviate symptoms. The MRI showed that the patient appeared to have a vertebral artery dissection. Anti-coagulation and physical therapy relieved all radicular symptoms.

It is important to note that a chiropractor was not the one performing the “chiropractic manipulation.” This also shows that radicular symptoms can stem from issues such as a vertebral artery dissection.

In a study by Olivero,⁴⁹ Halter Cervical Traction was used with patients who had nerve compression radiculopathy. Eighty-one patients were observed over a four-year period. Sixty-three of the 81 patients had full recovery of pain when tested at 43 days from the beginning of treatment. Of the patients observed, 78 had imaging done, showing 71 with disc herniation, and seven with foraminal stenosis.

This shows that traction appears to reduce symptoms associated with radiculopathy. It is interesting to note that it worked at only 78% of all patients. This indicates that there is still work to be done on the efficacy of traction, especially in light of Graham’s study, indicating that it has no clinical value compared to placebo.

In a clinical trial study by Young,⁵⁰ manual traction was compared again as placebo traction. Eighty-one subjects were divided into two groups. Both groups did manual therapy and exercises, and then differed in their form of therapy. Subjects had pain scales measured using NDI, Numeric Pain Rating Scale, the Patient-Specific Functional Scale. When compared at both two and four weeks, there were no differences found between group one and group two. Therefore, the article concluded that there might not be a need for mechanical traction in a multimodal approach.

It is very interesting that the use of mechanical traction may not have any effect on a patient’s symptoms, and that it may in fact be the placebo effect. This is very important to note, as our subject in this study received traction along with chiropractic care.

Case Narrative

History

The patient presented to the clinic with right arm numbness and pain, as well as tingling that was felt in all the fingers of

the right hand. The patient was right handed. The symptoms occurred for two months, prior to being referred into the office. The sensation began at work, but there was no known mode of injury. One week post onset, and prior to seeing the chiropractor, a medical doctor was seen for x-rays, anti-inflammatory medication, steroids, and an injection. Prior to seeing the chiropractor, a physical therapist was seen three times per week to perform finger rehabilitation. Two weeks prior to starting care at the chiropractic office, an MRI was taken.

Pierce Results System

The Pierce Results System (PRS) is a chiropractic system of analysis created by Dr. Walter Vern Pierce. It is a system that utilizes videofluoroscopy, x-ray, and thermography, in an attempt to use as many objective measures as possible in care. X-rays are used for patient education and locating any pathologies present. Videofluoroscopy is a motion x-ray, granting the practitioner the ability to observe the spine while performing a specific motion. The subluxation listings are derived from this aspect of the technique. Infrared thermography is used as a means of knowing when to adjust. A pattern indicates that the patient’s nervous system is not adapting. This falls in line with Pierce’s definition of subluxation, which is as follows:

“a condition where a vertebra has lost normal juxtaposition with the one above or the one below or both, to the extent less than a luxation, occluding an opening, impinging nerves, and interfering with the normal flow of the mental impulses from the brain and tissue.”

Therefore, if a patient is not in pattern, the subluxation can be considered not present, and the need for an adjustment is not there. This is described in detail below.

Videofluoroscopy

Videofluoroscopy(VF) also sometimes referred to as cineradiography, is the gold standard in studying kinematics of the spine and allows a greater insight into spinal mechanics than static x-ray.⁵¹ Within PRS, inter examiner and intra examiner reliability has been shown to be reliable and reproducible, when locating subluxation.⁵² Videofluoroscopy can reliably demonstrate kinematic changes in spinal motion.⁵³ The amount of radiation used in a VF is considerably lower than a static x-ray, due to the low milliamperage. It was determined that 60 seconds of VF was at worst equivalent to radiation of two A-P cervical x-rays.⁵¹

The Pierce System follows an order of chronicity. In this order, the concept of peeling back layers is present. According to Dr. Pierce, the first subluxation in life is typically Atlas, followed by sacrum. This is followed by the first thoracic, third cervical, and finally, C4-6 and pelvis. Based on this order of chronicity, and the findings on videofluoroscopy, the order of adjustment in this case followed suit.

Thermography

Infrared thermography has been used in chiropractic for

almost a century. It is shown that abnormal thermal readings correlate with abnormal spinal kinematics consistent with subluxation, although it does not have to occur at the same level.⁵⁴ Thermography is typically charted using a device and a computer program, to track the infrared reading.

A device, (a Tytron in this case study,) is run up the back, from the sacrum to the occiput. Paraspinal thermocouples measure the temperature of skin, which is then recorded on a computer. The posterior division of the dorsal nerves innervate the skin of the paraspinal region.⁵⁵ However, when sympathetic tone is increased, the capillaries that control blood supply to the skin on the back vasoconstricts and leads to a cooled reading on the skin.⁵⁶ Therefore, a thermographic reading is measuring the level of sympathetic nervous system influence to that area of the spine. By comparing the skin temperature differentials between multiple scans, patterns in temperature readings may or may not develop.

Pattern analysis is a form of thermographic analysis that stems from the concept that in a healthy functioning nervous system, temperatures should be similar from left to right, top to bottom, and that skin temperature adapts and changes, as the body adapts and changes to its environment.⁵⁶ If it appears that a scan has a similar presentation to a scan previously done, or a similar pattern has emerged, then that person's nervous system is not adequately adapting to his or her environment. Chiropractors contend that this indicates the presence of a vertebral subluxation complex. However, pattern analysis does not present the location of the subluxation.

It has been found that to correctly identify the presence of a pattern, approximately 16 minutes should be given in between each scan, as a means of allowing for any acclimation.⁵⁷ As shown by Dr. Pierce, patients who receive less incorrectly placed adjustments, or periods of time where they are over adjusted, show significantly warmer thermography scans, indicating that the sympathetic nervous system is less activated compared to the parasympathetic system.⁵⁸

X-Ray Analysis

The x-ray analysis for PRS is used for listings in the pelvis, and patient education in the cervical spine. In the pelvis, by looking at size of the obturator foramen, the pelvic brim, height of the iliac crest, and rotation of the fifth lumbar, listings are found. These listings can include external yaw, internal yaw, anterior superior pitch, posterior inferior pitch, or a combination of these. Measurements are drawn using a program to remove human error. The cervical spine x-ray film is used to educate patients. According to Pierce, a cervical curve of +17cm radius is ideal. The head should not be anterior but balanced on the cervical spine.

The patient education line is drawn at a +17cm to show the patient where he/she should be. Another line is drawn to show where the patient is. The gravity weight line extends from the sella tursica inferiorly, to show where the head is in relation to the cervical spine. The line should be in the anterior 1/3rd of the 5th cervical vertebrae. The Whitehorn angle is an angle measured between the horizontal plane, and the inferior body of C2. According to Dr. Pierce, a healthy angle is +/- 2 degrees. A normal, (superior) atlas measures 17-24 degrees.

This angle is measured from a horizontal plane, and the midline of the atlas, from the anterior tubercle to the spinolaminar line. A superior+ angle measures 25-30, while a superior++ is anything above 30 degrees. Inferior angle is anything less than 18 degrees.

Physical Exam

The physical exam followed the Pierce Results System protocol, which was explained in greater detail above. Five x-rays were taken of the patient, an A-P pelvis, a lateral lumbar, an APOM, a lateral cervical, and a base posterior. The x-rays showed no abnormalities or pathology. The pelvis showed no subluxation. The lateral cervical film, used as an objective measure, showed a few interesting findings. Anterior head carriage was measured at 1.35cm. Atlas angle measured at 21.88°. Whitehorns angle measured at -12.79°. This was followed by a videofluoroscopy exam. From the videofluoroscopy exam, the subluxation listings were flexion locks at occiput, C4, and C6, extension locks at C3 and C7. It was also noted that the upper thoracic spine was not rotating when looking to the right. Thermography, using a Tytron was taken during the initial exam. A pattern was noted after the first visit.

Diagnosis

The MRI impression was multilevel cervical spondylosis, worst at the C4-5, C5-6, and C6-7 levels where there is mild canal narrowing. There is multilevel foraminal stenosis as well, worst at the C5-6 level. Surgical evaluation was suggested to the patient.

The chiropractic diagnosis was cervical radiculopathy to the median nerve distribution area, and multiple subluxations, located at occiput, C3, C4, C6, and C7.

Intervention

Each visit began with a thermography reading. If the patient was in pattern via the use of thermography, no adjustment was delivered that visit. The adjustments were done on a Zenith-60 Pierce Results System table. The patient lays face down. The doctor adjusted the headpiece and table settings to the direction of subluxation, and size of the patient. All adjustments were delivered with the doctor in a fencer stance. The lines of drive of all adjustments were done posterior to anterior, and slight inferior to superior, based on the inferior posterior alignment of the subluxated vertebrae. Any rotations or lateral flexions were addressed in the movement of the headpiece, removing some potential human error for line of drive.

The first adjustments delivered were C4 and C6. The headpiece was circumducted to the right based on the opposite direction of spinous process on film. The headpiece was also in slight flexion, as these were flexion locks. This adjustment did not break the pattern on thermography, so the following visit the doctor administered a C5 adjustment. The headpiece was circumducted to the right and laterally flexed to the right. The patient remained out of pattern after this adjustment until the ninth visit, when a new pattern emerged. At this time, a C7 adjustment was delivered. The patient remained out of pattern

until the original C4 pattern emerged at the 13th visit. A C4 adjustment, circumducting the head left, and laterally flexing to the right changed the pattern during the 13th visit, and the patient did not develop a new pattern until the 25th visit. At that time the C3 subluxation was adjusted. If care had continued, the following adjustment would have been occiput, before the re-exam using the videofluoroscopy would have been done.

On each of the 26 visits, the patient was given a head weighted therapeutic exercise, using the Halo Posture, to strengthen neck muscles. This device is a weighted headband that the patient wears. This device adds weight to the front of the head, causing the extensor muscles of the neck to engage. As it engages the neck extensor muscles, it lowers the chin. It is this motion that reduces the forward head posture while improving the lordotic curve.⁵⁹ This head weight device is specifically used to correct anterior head posture and return a lordotic curve to the cervical spine. Additionally, the patient stood on a vibration plate for five to ten minutes. This, in combination with the Halo Posture, creates proprioceptive neuromuscular re-education, according to the Halo Posture website. This has been shown to improve the cervical curve and reduce forward head posture.⁵⁹

The patient also lay on a Spinemed decompression table the final 24 visits of treatment. A decompression table treatment consists of the patient lying on a table that separates, allowing for distraction and repositioning of the spine. The purpose of decompression is to create negative intradiscal pressure, repositioning herniated or bulging disc material. This was performed for 30 minutes each time it was utilized.

Manual traction adjustments were given 14 of the visits, exclusively when the patient was not in pattern. This was performed using a CLEAR Scoliosis Treatment. Manual traction adjustments are not the same as the Pierce Results System adjustments. These adjustments consisted of upward traction on the cervical spine area.

The manual traction adjustment stretches ligaments of the neck with a gentle increase in traction to a harness that is placed under the patients chin and around the occiput.⁶⁰ The harness is connected to a weight on the other side of a pulley, which is pulled down by gravity, leading to traction. This device has similar characteristics to the decompression table in that a stretch is occurring.

Outcomes

Chiropractic Outcome

The reassessment lateral cervical x-ray showed anterior head carriage of 0.53cm, an improvement of 0.77cms. This equates to 0.3 inches, which, under the theory that 10lb of pressure per each inch of forward head posture, her neck muscles were relieved of 3 additional daily pounds.⁶¹ Reduction in head posture also shortens the potential constant stretch force on the spinal cord,⁶² which may further exacerbate radicular symptoms. The Whitehorn angle changed from -12.8 to -2.8. The atlas angle increased from 21.88 to 28.68.

No subjective measuring score was used with this patient.

Notes were taken at each visit stating subjective pain levels of that visit. Symptomatically, during the first visit, the patient had right arm and hand pain. By the eighth visit, the patient managed to be out of pain for a day. The pain sensation moved to the left arm by the 14th visit. Visits 15 through 27 varied in subjective symptoms, but only two office visits stated that a pain sensation was present. By visit 28, the patient was feeling “much improved.”

MRI Outcome:

The initial MRI findings were as follows:

There is a mild dextroconvex curvature of the cervical spine, centered at the C5 level. There is a small Schmorl's node of the C5 inferior endplate. Osseous marrow signal is otherwise normal. Spinal cord is normal in caliber and signal intensity. Paraspinal soft tissues are unremarkable. Vascular flow voids are preserved.

- C2-3: Left central disc protrusion and bilateral facet arthropathy results in moderate left foraminal narrowing.
- C3-4: Bilateral uncovertebral and facet arthropathy, worse on left, resulting in mild to moderate left foraminal narrowing and mild right foraminal narrowing.
- C4-5: Central disc osteophyte complex and bilateral uncovertebral arthropathy results in moderate bilateral foraminal narrowing, worse on left, and mild canal narrowing.
- C5-6: Central disc osteophyte complex and bilateral uncovertebral and facet arthropathy results in mild canal narrowing, severe left foraminal narrowing, and moderate right foraminal narrowing.
- C6-7: Central disc osteophyte complex and bilateral uncovertebral arthropathy results in mild to moderate canal narrowing and mild bilateral foraminal narrowing.
- C7-T1: Disc desiccation but no canal or foraminal narrowing.

Impression:

1. Multilevel cervical spondylosis, worst at the C4-5, C5-6, and C6-7 levels where there is mild canal narrowing. There is multilevel foraminal stenosis as well, worst at the C5-6 level. Consider surgical evaluation.

The post MRI findings are as follows:

The T1, T2 and fat-saturated T2 sagittal images were reviewed first. The patient has mild to moderate spondylosis at C5-C6 and C6-C7 with milder changes at C4-C5. The patient has a congenitally narrow spinal canal. Posterior disc protrusion is noted on the right-hand side at C5-C6. No cord changed or cord edema is noted.

Axial images were obtained throughout the cervical spine in T2 weighted imaging.

- C2-C3: No disc herniations, neural foraminal narrowing or central canal stenosis are noted. Coronal plane imbalance is noted with approximately 10 degrees of clockwise rotation.
- C3-C4: No disc herniations, neural foraminal narrowing or central canal stenosis are noted. Coronal plane imbalance is noted with approximately 10 degrees of clockwise rotation.
- C4-C5: Mild to moderate spondylosis is noted with some mild narrowing of the left sided neural exit foramen.
- C5-C6: Left sided disc herniation with narrowing of the exiting C6 neural exit foramen is noted.
- C6-C7: Minimal spondylosis is noted without significant neural impingement.

or both, to the extent less than a luxation, occluding an opening, impinging nerves, and interfering with the normal flow of the mental impulses from the brain and tissue.”

By using this definition, we can decipher which subluxation mechanism coincides best with this definition.

The Subluxation Degeneration model aligns with this presenting case study. In Kent’s paper on the mechanisms of vertebral subluxation, he directly states that radicular symptoms could be caused by foraminal stenosis, secondary to arthritic changes.⁶

Homewood states that subluxation is the summation of stress, chemical, mechanical, chemical, and psychological factors. In this case, stress from a job may have compounded with the mechanical issues presented on MRI.¹⁵

Spondylosis, another diagnosed condition on the pre MRI, is the term these authors applied to degenerative changes which occur as a result of enlarging annular defects which lead to disruption of the attachment sites of the disc to the vertebral body.⁶³ The presence of the spondylosis may have caused aberrant motion in the cervical vertebrae, or vice versa. As there were mechanical changes made in the post MRI follow up, a correlation to pain relief, may have had to do with either, or both, the improved motion of the neck, and the lessening of the MRI findings. This view of subluxation is not complete though, as there are still degenerative changes noted on the MRI post care. An additional subluxation mechanism must be used.

The Neurodystrophic Model of subluxation goes hand in hand with the Subluxation Degeneration model. As radicular symptoms occur from an aberrant signal from a nerve root, a stress response that can alter the oxygen levels surrounding a nerve can alter firing rates.⁶⁴

According to Kent⁶³ blood chemistry changes occur when the sympathetic nervous system fires in chronic ways. From our understanding of thermography, skin on the posterior back, which is a branch off of the nerve root, will change temperature based on sympathetic tone. It is not impossible to imagine that this plays an intricate role in capillary blood levels in and around the nerve root.⁵⁸

Higher sympathetic tone is a result of decreased threshold in the efferent neurons arising from the lateral and anterior horn cells, which results in increased firing rates to the distal cells, tissues, organs.⁶³ This may indicate how the pain has been reduced to nothing, even though there are still findings of spondylosis on the post MRI.

Neurobiological Cascade

It is extremely important to note that while subluxation may be a direct cause of a radiculopathy, the location of the subluxation does not have to be on the same spinal segment as said radiculopathy. A subluxation in another location of the spine may lead to a compensation that alters gravity on a particular, causing mechanical pressure. Therefore, it may be in the chiropractors best interest not to just focus directly on

Impression:

1. C5-C6 disc herniation on the left hand side with narrowing of the left C6 neural exit foramen.
2. Adjacent segment spondylosis at C4-C5 and C6-C7 without significant neural foraminal stenosis.

When comparing the MRI studies the observation at C2-3 is grossly different. The initial MRI states that there is disc protrusion, facet arthropathy, and left foraminal narrowing. The post MRI shows none of this. The observation at C3-4 is grossly different. The initial MRI states that there is bilateral uncovertebral and facet arthropathy, moderate left and mild right foraminal narrowing, while the post MRI describes none of this. The observation at C4-5 is marginally different. The pre-MRI states that there is moderate IVF encroachment on the left, while the post MRI indicates that it is mild.

The pre-MRI at C5-6 indicates a severe IVF narrowing on the left side, while the post-MRI indicates that there is just narrowing of the left side. No metric is given to the severity. The observation at C6-7 is marginally different. The pre-MRI indicates mild bilateral foraminal narrowing, while the post does not indicate foraminal narrowing. See Figures 1 and 2 for comparison.

Discussion

It is critical for the reader of this paper to differentiate the MRI diagnosis, and the chiropractic diagnosis. The location of the MRI diagnosis did not direct the practitioner to that location in order to find subluxation, the chiropractic analysis led to the location of subluxation, and through a series of adjustments, the MRI diagnosis, as well as symptomatology, were able to heal. This is the underlying principle of chiropractic care. Therefore, when assessing subluxation mechanism, we can look at ways that subluxation may have led to improper mechanics, which in turn led to radiculopathy, and not that radiculopathy caused subluxation.

Subluxation

In this paper the author will use the definition presented by Dr. Pierce, as stated in his technique manual:

“a condition where a vertebra has lost normal juxtaposition with the one above or the one below

the area of radiculopathy.

Disc degeneration, foraminal stenosis, or herniations can all alter the area of the intervertebral foramen. A degenerative model has the ability to alter normal biomechanics of the spine, allowing fixations to occur.⁸ These are cyclic in perpetuation of further fixations as a lack of imbibitions or ischemia sets in around the bones or disc. This amplifies the degenerative model leading to changes in nociceptive or mechanoreceptive fibers.

The changes in these fibers firing rate along with assumed altered posture may now alter local or global sympathetic sensation to the body. This can directly alter the conductivity of a cell, forcing it to over fire, and create pain.¹⁵ From this it should be apparent that a subluxation may stem from a radiculopathy, regardless of disc herniation or IVF encroachment, or vice versa.

Adjustment

The adjustments in this study were that of the Pierce Results System. This means that all adjustments were done with the doctor in a fencer stance position, with a posterior to anterior and inferior to superior line of drive. The adjustments were delivered to the vertebra that was documented as being subluxated by the videofluoroscopy. The effect of the spinal manipulations given to this patient increased joint mobility, increased a new impulse to the afferent muscle spindles, and altered the firing rates of neurons.⁶⁵

According to Kent, it is believed that “correcting the specific vertebral subluxation cause is paramount to restoring normal afferent input to the CNS, and allowing the body to correctly perceive itself and its environment.”⁶³ Said another way, a chiropractic adjustment has the ability to create a high frequency discharge from several types of dynamically sensitive mechanoreceptive and nociceptive paraspinal primary afferent neurons. According to the neurodystrophic model, the alteration in sympathetics can alter nociceptive pain signals.⁶⁶

Limitations

While this study showed changes to both MRI and x-ray study, the compound effect of each modality does not allow separation as to the efficacy of each. This study cannot be generalized over the gross population as further studies would need to be done, that also show improvements made at an MRI level as well as an x-ray level.

Conclusion

The use of the traction when treating cervical radiculopathy is evident through this literature as being beneficial in reducing patient symptoms. However, in almost every case, the sole definition of “beneficial” is based on a plethora of relative subjective pain scale rating systems. This case study may very well be the first documented and published case of an MRI post chiropractic care, on a confirmed case of radiculopathy.

The vast majority of sources in the literature review used a combination of both chiropractic manipulations and traction.

The use of traction alone was also reviewed in basic detail. Regardless of chiropractic manipulation, these patients under traction, in the review of literature, showed improved subjective findings.

In this case study, the changes in X-ray improved based on the x-ray parameters put forth in the Pierce Results System. The changes in the post MRI when compared to the pre-MRI shows that there is evidence that Pierce Results System in combination with traction has the ability to greatly alter structure. Future research must be done to validate these findings.

It is evident through this study that while a radiculopathy may occur at one level of the spine, an adjustment does not need to be delivered at that same spinal segment. This case followed the PRS protocol, and improved the patient’s structure and function, while simultaneously reducing symptoms of radiculopathy. It is recommended that more research on the subject of, not only MRI, but of x-ray, needs to be done in an attempt to identify changes present in cervical radiculopathy cases.

Additional research needs to be done in an attempt to isolate the best possible use of the patient’s time. While this study outlines significant MRI and X-ray changes, further research must be done on the validity of each PRS and traction in an ANOVA based set of data.

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Figure 1. Comparing pre and post MRI findings by vertebra.

Disc Level	Pre MRI	Post MRI
C2-3	<ul style="list-style-type: none"> • Left central disc protrusion • Bilateral facet arthropathy • Moderate left foraminal narrowing. 	<ul style="list-style-type: none"> • No disc herniations • No foraminal stenosis • No central canal stenosis
C3-4	<ul style="list-style-type: none"> • Bilateral uncovertebral • Bilateral facet arthropathy • Mild to moderate left foraminal narrowing • Mild right foraminal narrowing. 	<ul style="list-style-type: none"> • No disc herniations • No foraminal stenosis • No central canal stenosis
C4-5	<ul style="list-style-type: none"> • Central disc osteophyte complex • Bilateral uncovertebral arthropathy • Moderate bilateral foraminal narrowing, worse on left • Mild canal narrowing 	<ul style="list-style-type: none"> • Mild to moderate spondylosis • mild narrowing of the left sided IVF
C5-6	<ul style="list-style-type: none"> • Central disc osteophyte complex • Bilateral uncovertebral and facet arthropathy • Mild canal narrowing, • Severe left foraminal narrowing • Moderate right foraminal narrowing 	<ul style="list-style-type: none"> • Left sided disk herniation • Narrowing of left C6 IVF
C6-7	<ul style="list-style-type: none"> • Central disc osteophyte complex • Bilateral uncovertebral arthropathy • Mild to moderate canal narrowing • Mild bilateral foraminal narrowing 	<ul style="list-style-type: none"> • Minimal spondylosis • No neural impingement
C7-T1	<ul style="list-style-type: none"> • Disc desiccation • No canal or foraminal narrowing 	<ul style="list-style-type: none"> • No findings

Figure 2. Comparing pre and post MRI impressions.

	Pre MRI	Post MRI
Impression	<ul style="list-style-type: none"> - Multilevel cervical spondylosis, worst at the C4-5, C5-6, and C6-7 - Mild canal narrowing - Multilevel foraminal stenosis, worst at the C5-6 level - <i>Consider surgical evaluation</i> 	<ul style="list-style-type: none"> - C5-C6 disk herniation on the left hand side - Narrowing of the left C6 IVF - Adjacent segment spondylosis at C4-5 and C6-C7 without significant neural foraminal stenosis

Figure 3. Comparing pre and post lateral cervical films.

