

Use of post-isometric relaxation in the chiropractic management of a 55-year-old man with cervical radiculopathy

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This case report chronicles the successful management of a 55-year-old patient diagnosed with cervical radiculopathy using spinal manipulative therapy and cervical paraspinal post-isometric relaxation stretches. (JCCA 2012; 56(1):9-17)

KEY WORDS: cervical radiculopathy, post-isometric relaxation, proprioceptive neuromuscular facilitation, chiropractic.

Introduction

Cervical radiculopathy (CR) is an impingement or inflammatory irritation of the cervical spine nerve root(s), resulting in pain (or numbness) radiating along nerves of the upper extremity;^{1,2} the C6 and C7 levels are most often affected.^{1,3} Limited research is available on the incidence and prevalence of CR; however, the incidence rate (in Rochester, Minnesota) has been reported at 83.2 cases per 100,000 people per year (107.3/100,000 for males vs. 63.5/100,000 for females), with peak incidence in those aged 50–54 years.¹ A history of physical exertion or major trauma precedes the onset of symptoms in less than 15% of cases. The most common causes are cervical spondylosis and intervertebral disc herniation,^{1,3} accounting for approximately 70% and 20% of cases, respectively.¹ In the former, posterior vertebral body osteophytes and/or facet joint/ligamentum flavum hypertrophy encroach upon the intervertebral foramen; posterolateral herniation of disc material results in foraminal encroachment in the latter. In either case, cervical nerve root pain and dysfunction can occur.⁴

Le présent exposé de cas suit la gestion réussie d'un patient de 55 ans chez qui l'on a diagnostiqué une radiculopathie cervicale au moyen d'une thérapie manipulative et d'étirements de relaxation postisométrique des muscles cervicaux paraspinaux. (JCCA 2012; 56(1):9-17)

MOTS CLÉS : Radiculopathie cervicale, relaxation postisométrique, facilitation neuromusculaire proprioceptive, chiropratique

Post-isometric relaxation (PIR) is a technique often used by manual therapists (including some chiropractors) for treating muscle tension and joint dysfunction in myofascial pain syndromes;⁵ however, studies investigating its effectiveness in the treatment of CR are extremely scarce. This case report chronicles the successful management of a 55-year-old patient diagnosed with CR using spinal manipulative therapy (SMT) and cervical paraspinal PIR stretches.

Case Report

History

A 55-year-old white male presented with severe and progressive right-sided neck, shoulder blade, and arm pain. He woke up (a week earlier) with pain after spending the day at home installing ceiling tiles. His arm pain was now described as a constant “burning” sensation, wrapping around through his right triceps muscle to the lateral forearm. The pain severity was graded as a 9 on a numeric rating scale of 10. The patient’s symptoms also included

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Table 1 *Select orthopedic exam procedures for cervical radiculopathy*

Test	Description of procedure	Positive findings
Spurling	Patient seated with their neck extended and rotated to the ipsilateral side, and doctor applies a downward pressure through the top of the patient's head	Radicular symptoms are provoked
Upper Limb Tension	Patient supine and doctor performs the following movements to the patient's upper extremity: 1. scapular depression 2. shoulder abduction 3. forearm supination, wrist and finger extension 4. shoulder external rotation 5. elbow extension 6. ipsilateral/contralateral rotation of the neck	Radicular symptoms are provoked
Cervical Distraction	Patient seated and doctor grips under the patient's mastoids and tractions superiorly	Radicular symptoms are relieved
Valsalva	Patient seated and is asked to take and hold a deep breath while bearing down (as if for a bowel movement)	Radicular symptoms are provoked

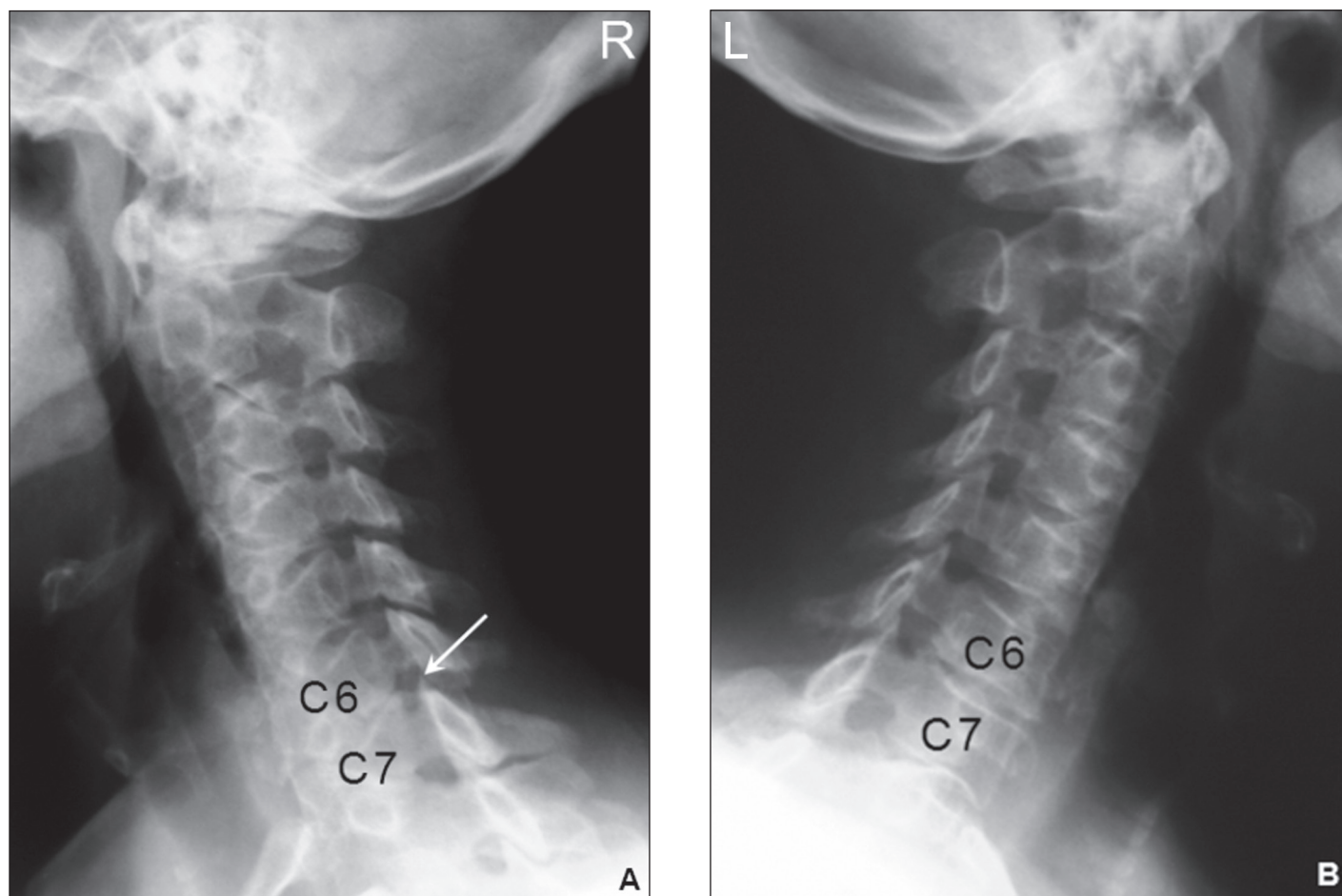
generalized weakness and “numbness” in his right hand. Any attempt to lift or reach would shoot a “stabbing” pain down his right arm. Holding the arm (bent at 90°) close to his body was palliative. Coughing, sneezing, or bearing down for a bowel movement (i.e. Dejerine's Triad) did not reproduce the neck, shoulder blade, or right arm pain. The patient also denied any lower extremity or myelopathy symptoms, and exhibited normal gait. Medically prescribed anti-inflammatories (Naprosyn), muscle relaxants (Robaxin), heat therapy, and time off work had not provided any relief.

Medical history was remarkable for coronary artery disease, including angioplasty surgery (4 years prior). Medications included Lipitor, Altace, Rhoxal-bisoprolol, and Aspirin. The patient denied any motor vehicle accidents, major falls or injuries, and had no previous history of neck problems. He had seen a chiropractor once before because of lower back pain, with good results. He was married with 3 children and had been employed as a shipper/receiver for the past 7 years. He did not smoke and consumed an average of 7 alcoholic beverages per week. He also walked a total of 2 hours per week for exercise and took a daily multivitamin.

Examination Findings

Blood pressure was normal at 104/68. Postural exam revealed severe antalgia, with the patient holding his head forward and tilted to the left. Motion palpation of his spine revealed joint restriction at C2-3 and C3-4 in left rotation, and T5-6 and T6-7 in extension. Static palpation revealed myofascial trigger points within the right rhomboid muscles, along with hypertonicity of the right paraspinals and localized tenderness of the right C2-3 and C3-4 facet joints. Cervical spine range of motion (ROM) was very painful (with paresthesia) and 90% restricted in extension, 75% in right rotation, and 90% in right lateral flexion. Passive flexion of the patient's neck produced some cervical facet pain on the right, without signs of myelopathy. The Spurling and Upper Limb Tension Tests provoked the patient's right-sided radicular pain, while the Cervical Distraction Test relieved it (see Table 1 for orthopedic test descriptions). Depression of the right shoulder while holding the neck in flexion and left rotation (i.e. Shoulder Depression Test) also provided relief. Upper extremity neurologic examination was unremarkable for motor, reflex, sensory, and vibratory testing, except for weakness of the right deltoid muscle (graded as

Figure 1 Anterior oblique radiographs of the cervical spine showing (A) mild-to-moderate bony foraminal narrowing at C6-7 on the right (arrow), with mild narrowing at this same level on the left (B).



4/5), because of right-sided neck and radicular pain. Cervical spine radiographs revealed moderate degenerative disc disease at C6-7, with mild-to-moderate bony foraminal narrowing at this level on the right (Figure 1A) and mild narrowing on the left (Figure 1B). The patient was diagnosed with acute, right-sided C7 radiculopathy.

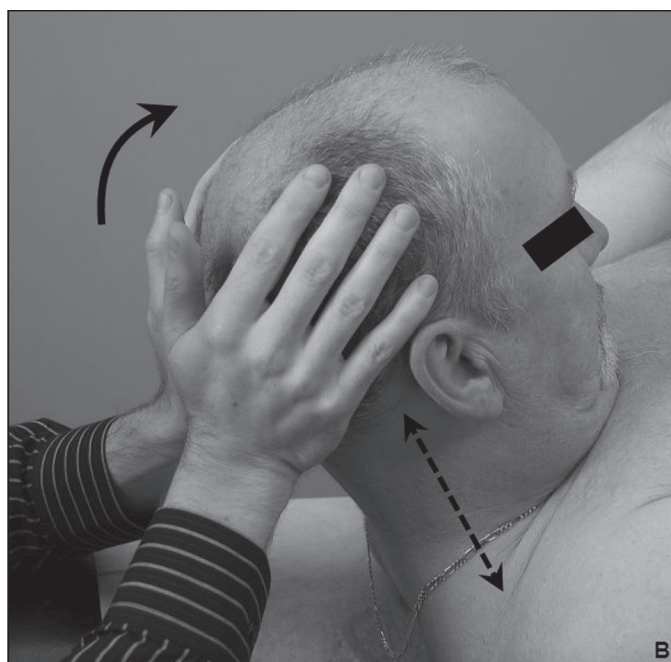
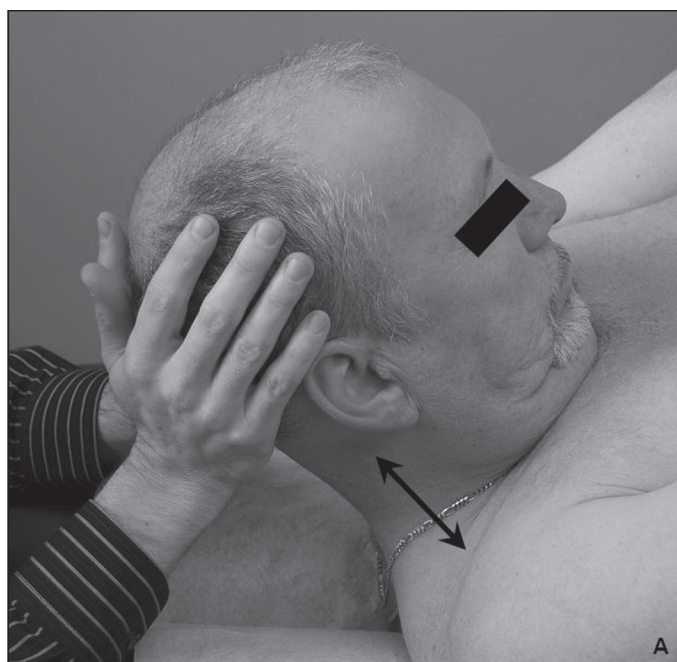
Plan of Management & Results

The patient underwent a course of chiropractic treatment consisting of supine cervical and thoracic SMT, soft-tissue trigger-point therapy to the right rhomboid muscles, home ice therapy (as needed), cervical spine isometric exercises, and ergonomic instruction (i.e. avoidance of provocative neck positions). To manipulate the right side

of the patient's neck (i.e. side of radiculopathy), the patient's head was rotated 90° to the left and then a right lateral flexion "modified rotary break" procedure was used.⁶ A supine rotary break (with 45° of right rotation and left lateral flexion) was used on the other side. The initial treatment frequency was 3 times per week for 2 weeks. Outcome measures used were numeric rating scale for pain; subjective changes in neck, shoulder blade, and arm pain; and patient self-rating of outcome (i.e. no, minor, or major improvement). Objective measures used were visual estimation for ROM, as well as orthopedic and neurological examination.

After 2 weeks of treatment, the patient's neck and shoulder blade pain had improved; each was reduced to

Figure 2 Cervical paraspinal PIR is performed (in this case) with the patient supine, while the doctor slowly lifts the patient's head toward the ceiling (A). Once a comfortable stretch is felt, the patient is asked to push their head back (with approximately 10% of their strength), while the doctor resists this movement; thus, creating an isometric contraction. This position is held for 8–10 seconds. The patient is then asked to inhale deeply and, upon exhalation, is instructed to relax while the doctor lifts the patient's head a little further towards the ceiling (B). After an 8–10 second stretch, the protocol is repeated (to patient and tissue tolerance) for 2 to 3 more repetitions.



between a 3 (at best) and 5 (at worst) out of 10. The right arm pain, however, remained unchanged. Cervical spine ROM was still painful and 75% restricted in right lateral flexion. Upper extremity neurological exam was normal, and the result of the Upper Limb Tension Test was negative. The Spurling Test was still positive, however, and passive flexion still elicited right-sided facet pain in the neck. At this point, the patient's self-rated improvement was "minor." Because of unresolved radicular symptoms, the author decided to include a cervical paraspinal PIR technique with patient treatment (Figure 2). On the next visit, during the application of this technique, the patient experienced immediate, short-term relief of his right arm symptoms. Based on this result, the patient was also instructed to begin performing cervical paraspinal stretches at home (Figure 3). Using this new protocol, the patient continued to be treated at a frequency of 2 times per week for 3 more weeks.

After 6 weeks and a total of 12 treatments (including 6 with PIR), the right-sided neck, shoulder blade, and arm pain were all reduced to between 1 (at best) and 3 (at worst) out of 10. Cervical ROM was within normal limits and unremarkable, except for right-sided neck and shoulder blade pain during passive right lateral flexion. Neurologic and orthopedic examinations, including the result of the Spurling Test, were normal. The patient's self-rated improvement at this point was "major." When asked to subjectively rate his overall percentage improvement on a scale of 0 (no improvement) to 100 (full improvement), he rated it at 75%. Regarding his activities of daily living, the patient's neck and arm pain were still provoked with prolonged sitting at work (at a computer) or when sleeping on his right side at home.

Based on the patient's overall improvement, the treatment frequency progressively decreased to once every 4 weeks. He was also encouraged to continue performing

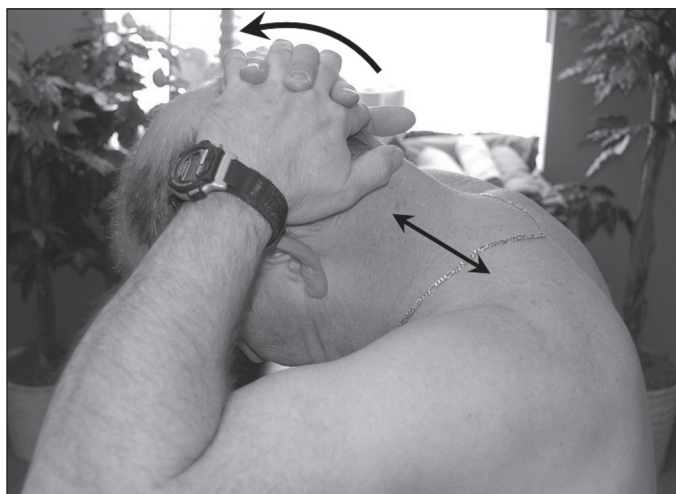


Figure 3 Cervical paraspinal stretch (held for 15 seconds); 2 repetitions, 1 to 2 sets per day.

his neck stretches on a regular basis (i.e. 1 to 2 times per day). Although the patient's symptoms had improved, his complaint of recurrent re-aggravation prompted a referral to his family physician for cervical spine magnetic resonance imaging (MRI) and needle electromyography (EMG) studies. MRI examination, performed 4 months after the onset of symptoms, showed dehydration and intervertebral disc bulging at multiple levels, most notably at C6-7; prominent stenosis of the right lateral canal was also evident at this same level (Figure 4).

Electrophysiological studies—including motor and sensory nerve conduction velocity of the radial, ulnar, and median nerves and EMG of the right deltoid, biceps, triceps, and extensor digitorum complex—were interpreted as normal. The attending neurologist did, however, report that the patient's history was "consistent with right C7 radiculopathy." He also noted that the patient's symptoms had "improved considerably [,] with residual cervical and right shoulder blade pain." Neurological examination was normal for cranial nerve, motor, sensory, reflex, coordination, and gait testing, with the exception of "mild weakness of the right tricep[s]." The neurologist told the patient that he had "no permanent damage" and that surgery was not indicated. The patient continued with chiropractic care and, at 6-month follow-up (after a total of 20 treatments, including 14 with PIR), the right-sided neck and radicular pain was completely resolved (graded as

0 out of 10). Cervical spine ROM and upper extremity neurological exam were normal.

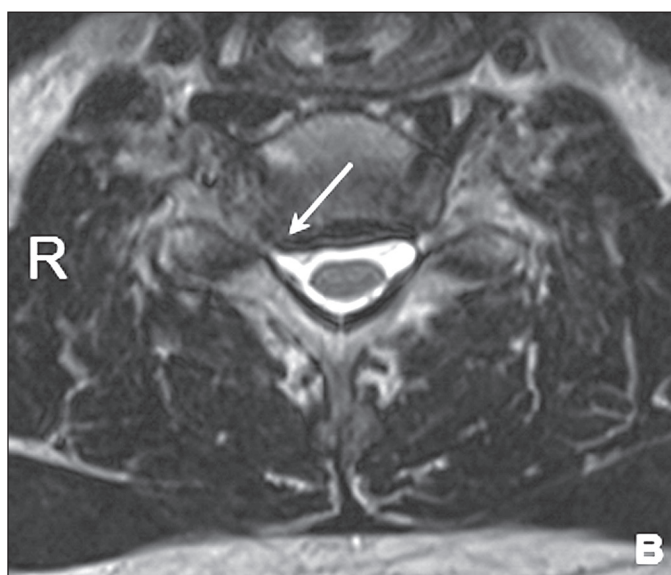
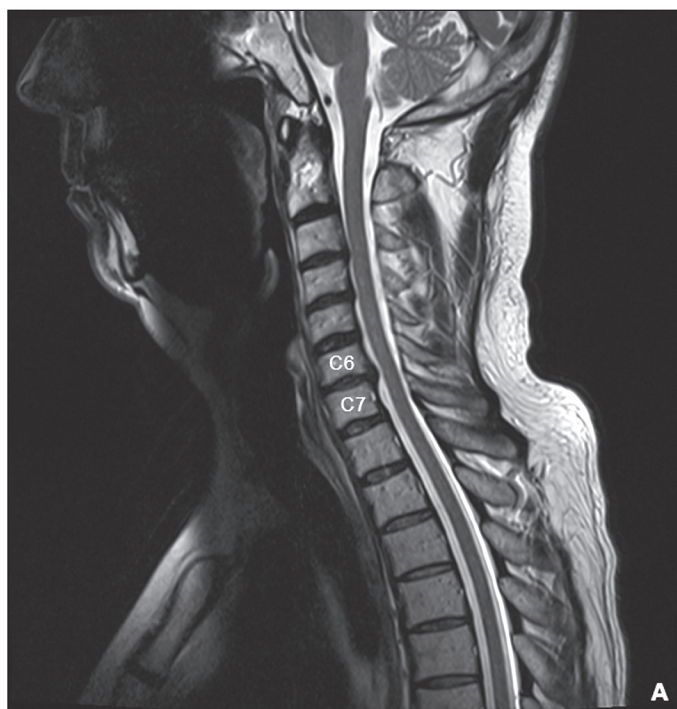
After 3 years, the patient's radicular symptoms continue to be graded as 0 out of 10, and he reports no limitations in his activities of daily living. Cervical spine ROM and upper extremity neurological examination remain normal. Only 2 minor episodes of neck pain (i.e. *without* radiculopathy and graded as 3 out of 10) have been reported during this time. Both were attributed to postural strain from sitting at a computer at work. The first episode was self-resolving, while the second was relieved with 1 treatment of manipulation and PIR. In addition, the patient continues to report that he has not used any prescription or over-the-counter medications during the entire course of treatment. The patient has given written consent to having his personal health information, including radiographs and photographs of his likeness, published.

Discussion

Examination of patients presenting with CR should include assessment of motor strength, deep tendon reflexes, and dermatomal sensation. In the absence of frank neurologic findings, more sensitive (or provocative) exam procedures may be required. In a recent systematic review, Rubinstein et al.⁷ concluded that when consistent with history and physical examination findings, the Spurling, Neck Distraction, and Valsalva Tests (given their high specificity), along with the Upper Limb Tension Test (given its high sensitivity) are most useful in establishing a diagnosis of CR, especially in patients without neurological deficits. The scientific literature also supports the use of modern imaging techniques (e.g. MRI) and needle EMG, in diagnosing the cause and site of CR.⁸ Advanced diagnostic testing can be expensive, however, and in the case of needle EMG, invasive.⁷ In addition, MRI findings of disc herniation may not necessarily correlate with patient symptoms.⁹ For the chiropractor, proper patient history and physical examination are the most cost-effective and non-invasive methods for diagnosing CR.

In patients with cervical spondylosis, as in the current case, the possibility of spinal cord compression (myelopathy) should be considered. Clinical findings may include abnormal gait, clumsiness, bowel or bladder dysfunction, or other upper motor neuron signs (e.g. hyperreflexia, muscle spasticity, Babinski's sign).^{2,3} The chiropractor's differential diagnosis of CR should also include myofa-

Figure 4 (A) T2-weighted sagittal MRI of the patient's cervical spine showing moderate intervertebral disc desiccation and protrusion at C6-7. Mild degenerative changes are also evident from C2 to C5, with mild disc protrusion at C3-4 and C4-5. (B) T2-weighted coronal MRI showing lateral canal stenosis and intervertebral foraminal encroachment at C6-7 on the right (arrow).



social trigger-point referral, peripheral nerve entrapment syndromes (e.g. thoracic outlet, carpal and/or cubital tunnel), and rotator cuff pathology. In the current case, radiculopathy was suspected over peripheral neuropathy because, in addition to patient history and diagnostic imaging findings, the patient had positive Spurling, Upper Limb Tension, and Cervical Distraction Tests, as well as limited ipsilateral neck rotation. Wainner et al.¹⁰ found that when these 4 tests are positive, they together identify (with 90% probability) the presence of CR. Less common causes include referred cardiac pain, herpes zoster (shingles), and intra- or extraspinal tumours (e.g. Schwannomas, Pancoast tumours, lymphomas).^{2,3}

Traditional medical management may include nonsteroidal anti-inflammatories, activity modification, traction (or other physical therapy modalities), epidural steroid injections, and/or surgery (if necessary).¹⁻³ Several chiropractic studies have described good outcomes in patients

treated with SMT—either alone or in combination with other conservative therapies.^{4,11-15} In their case series, Hubka et al.¹³ also discuss the importance of the direction of thrust when treating CR patients using SMT procedures. In particular, these authors note that neck manipulation is best tolerated by the patient when performed by contacting on the side of radiculopathy, laterally flexing the neck toward the side of radiculopathy, and then rotating the neck away from the side of radiculopathy (followed by a gentle manipulative thrust). This is similar to the technique used in the current case. In their experience, Hubka et al. have found that manipulation in the opposite direction may provoke the patient's symptoms, as might prone upper thoracic SMT.¹³ In the current case, supine upper thoracic and bilateral cervical manipulations were used, with no adverse effects. In their discussion on the safety of neck manipulation, Murphy et al.⁴ conclude that, “when applied by properly trained and experienced

practitioners, [cervical SMT] is potentially a safe option for patients with CR.” Nevertheless, the evidence base for both conservative and surgical management of CR, including data on its natural history, is limited.^{4,16,17}

PIR Technique

The primary purpose of this article was to showcase a PIR technique that, when combined with SMT, may be useful to chiropractors in treating patients with CR. Historically, PIR has been used as a “muscle energy procedure” for joint mobilization and muscle relaxation.⁵ The technique begins by placing the muscle (to be treated) in a stretched position. Lewit⁵ describes this as “taking up the slack” in the muscle, by lengthening it, to the point where the first slight resistance (or “barrier”) is felt. Next, the patient is instructed to resist this movement with minimum force, isometrically, for about 10 seconds, and then told to let go (or relax). Lewit stresses the importance of waiting until the patient has indeed relaxed, after which a gentle release is obtained and the muscle lengthens by “spontaneous decontraction” (relaxation). Release may continue for 10 seconds or more, until a new barrier is reached, from which point the procedure can be repeated. If nothing is gained by repetition, the normal physiologic barrier has been reached. In order to improve the patient’s cooperation and enhance the effectiveness of PIR, the technique should be combined with other methods of facilitation and inhibition (e.g. patient inhalation and exhalation).⁵ In general, inhalation facilitates muscle activity and is therefore useful during the isometric phase, while exhalation promotes inhibition and therefore helps relaxation. The overall goal of PIR treatment is to reduce muscle tension and relieve the resultant pain and dysfunction by restoring the full stretch length of the muscle.

The terms *PIR* and *proprioceptive neuromuscular facilitation (PNF)* are sometimes incorrectly used synonymously. The main difference with the PNF technique is that during the isometric contraction phase, the patient exerts against a much greater resistance (i.e. up to 100% of their maximum strength).¹⁸ Furthermore, during the relaxation phase, the patient’s muscle(s) is more aggressively stretched and the clinician does not necessarily wait to feel the patient’s muscle release. Therefore, practitioners should be cautioned when using PNF as it may result in considerable discomfort to the patient, particularly in an acute pain presentation.

PIR and CR

A paucity of research exists on the effectiveness of PIR for neck pain and/or CR; therefore, it is difficult to compare this study with others in the scientific literature. Some authors have compared PIR with SMT in treating neck pain patients (*without* radiculopathy).^{19–20} For instance, Cassidy et al.¹⁹ found that 1 treatment of cervical SMT was more effective than mobilization (PIR) in decreasing neck pain intensity, while both treatments increased neck ROM to a similar degree. In a search of PubMed and Index to Chiropractic Literature, no studies were found combining the terms “cervical radiculopathy” and “post-isometric relaxation.” In a hand search of references retrieved using combinations of the terms “cervical spine,” “radiculopathy,” and “chiropractic,” the author found only 2 case reports relating PIR and CR.^{14,15} In the first case by Daub,¹⁴ he described the resolution of a C6 radiculopathy in a 44-year-old female following 18 treatments (over 7 weeks). Treatment consisted of cervical and thoracic SMT; PIR applied to the levator scapulae, anterior scalene, and suboccipital muscles; manual long axis traction of the cervical spine; and home-based exercises. After 1-year follow-up, any mild flare-ups of the patient’s CR symptoms were quickly resolved using the same aforementioned therapies. Whalen’s case¹⁵ was a 40-year-old female with CR caused by spondylosis and disc protrusion at C5-6 and C6-7. Resolution of the problem occurred within 3 months (including 20 treatments) and remained after a year. Treatment consisted of cervical SMT, along with home-based cervical traction and stretching exercises—including instruction on stretching the upper trapezius muscles using PIR. Whalen did not, however, use PIR to treat the patient directly; nor was it discussed as playing a major role in the patient’s recovery.

In the current case, the patient noted almost immediate relief of radicular symptoms with the application of PIR. PIR has been shown to reduce pain and improve joint function and ROM in the neck.^{19,21} In addition to relaxing the paraspinal musculature and mobilizing the facet joints, the technique used in this study incorporated traction (see Figure 2), which altogether may have alleviated compression on the neural structures in the patient’s neck. Other studies have demonstrated good results in CR patients when treated with cervical traction or other traction-type techniques (e.g. flexion-distraction).^{22,23} MRI and computed tomography scans have also shown that

both flexion and traction significantly increase the size of the intervertebral foramen in the cervical spine.^{24,25}

Practitioners should be cautioned when using the PIR technique described in this study—especially in patients presenting with acute cervical disc herniation and/or myelopathy. In cases of cervical myelopathy, this technique is contraindicated—particularly if, on physical examination, flexion of the patient's neck produces parasthesias and/or electric shock-like sensations that extend down the spine into the lower extremities (i.e. L'Hermitte's sign). In the current case, care was taken not to cause peripheralization of the patient's symptoms. All treatments (including both PIR and SMT procedures) were well tolerated by the patient with no reports of complications.

Limitations

Although remaining somewhat unclear, the natural course of CR is considered favourable;¹⁻³ therefore, this patient's positive outcome may not have resulted from the treatment(s) delivered. Furthermore, conclusions based on a single, retrospective case study are inherently limited. In light of the paucity of research on its use in the management of neck pain (with *or* without radiculopathy), more studies are needed to determine whether PIR (alone or in combination with SMT) is a safe and effective treatment for patients with CR. Future studies should include rigorous outcome measures for disability (e.g. Neck Disability Index, Bournemouth Neck Disability Questionnaire), which were lacking in this case.

Summary

Presented here was a patient with acute C7 radiculopathy that, despite MRI findings of a C6-7 disc protrusion with right-sided lateral canal stenosis, resolved following a course of chiropractic treatment that included SMT and cervical paraspinal PIR. The patient's radiculopathy symptoms did not return in 3 years of follow-up.

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