

Conservative management of a lumbar compression fracture in an osteoporotic patient: a case report

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Objective: *To chronicle the conservative treatment and management of an osteoporotic patient presenting with acute back pain resulting from a lumbar compression fracture.*

Clinical features: *A 74-year old male presented with acute back pain in the thoracolumbar region after an episode of lifting. Radiographic evaluation revealed generalized demineralization and a moderate wedge compression fracture at L1.*

Intervention and outcome: *The conservative treatment approach included postural education, activity modification, interferential current, taping into extension, Graston Technique®, and rehabilitative exercise prescription. Outcome measures included verbal pain rating scale, medication use, and a return to activities of daily living (ADLs). The patient attained long-term symptom resolution with no recurrence of pain at 12 month follow-up.*

Summary: *A combination of conservative rehabilitation strategies may be successfully implemented to treat osteoporotic patients with mild to moderate osteoporotic vertebral compression fracture of the lumbar spine.*

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KEY WORDS: compression fracture, osteoporosis, Graston Technique®, chiropractic, rehabilitation

But : *Effectuer le suivi du traitement conservateur d'un patient ostéoporotique souffrant de lombalgie aiguë en raison d'une fracture lombaire avec tassement.*

Caractéristiques cliniques : *Un homme de 74 ans souffre de lombalgies aiguës dans la région thoracolombaire survenues après avoir soulevé un objet. Une évaluation radiographique révèle une déminéralisation généralisée ainsi qu'une fracture de L1 avec tassement cunéiforme modéré.*

Intervention et résultat : *L'approche thérapeutique conservatrice comprenait l'éducation posturale, la modification d'activités, l'électrothérapie à courants interférentiels, l'application de bandages élastiques (taping) en extension, la technique Graston^{MD}, et la prescription d'exercices de réadaptation. Les résultats ont notamment été mesurés par une échelle verbale de notation de la douleur, la quantité de médicaments ingérés, et le retour aux activités de la vie quotidienne (AVQs). Le patient est parvenu à une résolution à long terme des symptômes, sans récurrence de la douleur en date du suivi effectué après 12 mois.*

Résumé : *Une combinaison de stratégies de réadaptation conservatrices peut être mise en œuvre avec succès dans le traitement de patients ostéoporotiques atteints de fractures vertébrales ostéoporotiques avec tassement d'intensité légère à modérée au niveau de la colonne lombaire.*

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MOTS CLÉS : Fracture avec tassement, ostéoporose, technique Graston^{MD}, chiropractie, réadaptation

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Introduction

Individuals with osteoporosis have a greater likelihood of suffering vertebral compression fractures (VCFs), which can range from mild to severe in terms of associated pain and resultant disability.¹ In the United States, it is estimated that at least 10 million people suffer from osteoporosis and an additional 18 million people are at significant risk for development of the disorder. Within this affected group, it is estimated that 700,000 VCFs occur each year and approximately 70,000 result in hospitalization, with an average hospital stay per patient of 8 days.² The risk of major osteoporotic fracture in Canada is among the highest in the world,³ with the incidence of VCFs expected to increase as the Canadian population ages.⁴ The annual incidence of osteoporotic vertebral compression fractures (OVCFs) among Canadian women is currently reported to be approximately 37,000.³ Although considered a female health issue, osteoporosis is also becoming a major health concern among males.⁵⁻⁸

It is estimated that many OVCFs remain asymptomatic, and that only one-third of individuals seek immediate medical attention, presenting predominantly as acute back pain patients.⁹⁻¹² For any given case, the diagnosis of a single OVCF increases the risk of subsequent fractures by a factor of five.¹² Patient population studies indicate an increased mortality rate in patients with OVCFs that correlates with the number of involved vertebrae.¹³ In addition to acute pain and the risk for developing chronic pain, OVCFs may also be accompanied by other physical and emotional consequences.^{1,9-11} Early recognition, diagnosis, and conservative management can play important roles in minimizing the negative sequelae of OVCF.

This case study was conducted to evaluate the conservative treatment and management of an osteoporotic patient presenting with acute back pain resulting from a lumbar compression fracture. Salient clinical features and diagnostic considerations are also discussed.

Case report

A 74-year old male presented with acute back pain of three days duration localized to the region of the thoracolumbar spine. The patient explained that this pain occurred while he was lifting 30–40 lb pieces of wood. During the mid-point of a lift, with his spine forward flexed, he reportedly heard a “pop” in his back and a sensation of

pain immediately ensued. The patient did not seek medical treatment following this incident. He reports that he managed his symptoms with over the counter medication (ibuprofen).

The patient rated his pain as 8/10 on the Verbal Pain Rating Scale (VPRS) where 0 is “no pain” and 10 is the “worst pain that he had ever experienced.” The pain was described as sharp and stabbing, and it was exacerbated by direct pressure over the painful area and any movements of the lower axial spine. He denied any radiating/referred pain symptoms into the lower extremities or difficulty with bowel and bladder function. Past medical history revealed that he had been diagnosed with “mild” osteoporosis two years prior. Systems review and family health history was unremarkable. The patient was a lifelong non-smoker. He did not report any previous history of disabling back injury. He indicated that he lived a very active lifestyle and walked two to four kilometres daily. His current state did not allow for him to continue his daily walking routine and he was having trouble getting a good night’s sleep due to difficulty with finding a comfortable position.

Initial observation revealed that the patient walked slowly and moved in a guarded fashion during transfers. A slightly forward stooped posture was noted in the standing position. Lumbar ranges of motion were significantly restricted in all planes due to pain. Motor, reflex, and sensory testing for the lower extremities was within normal limits bilaterally. Seated straight leg raising was unremarkable bilaterally for nerve root tension signs. Percussion of the spinous processes with a reflex hammer revealed tenderness most notably over T11, T12, L1 and L2. Digital posterior to anterior (P-A) pressure of the spinous processes reproduced a sharp pain at these levels. Palpation revealed marked muscle spasm bilaterally in the thoracolumbar paraspinal muscles.

In consideration of the patient’s reported health history, mechanism of injury, and physical examination findings, A-P and lateral thoracic and lumbar radiographs were completed due to suspected OVCF. The radiographic examination revealed generalized demineralization and a moderate wedge compression fracture at L1. There were no other radiographic features of significance identified that would clearly explain the patient’s acute symptom presentation.

In office treatment commenced four days after initial

presentation. The patient was instructed after the initial assessment to maintain a neutral spine position and try to avoid forward stooped/spinal flexion movements. He was also advised to try and stay mobile and avoid prolonged inactivity. Initial treatment was focused on providing adequate pain control. This was accomplished with interferential current (IFC) applied to the hypertonic thoracolumbar paraspinal muscles, followed by taping of the thoracolumbar spine into a position of slight extension bias (Figures 1A–C). Exercises consisting of abdominal bracing, scapular setting, and gentle extension movements of the thoracolumbar region were introduced in week 3.

The patient made continuous improvement during the course of treatment with respect to pain scores, as well as his functional and impairment status. At the beginning of week 5, IFC application and taping into extension was discontinued. Augmented soft tissue mobilization using Graston Technique® (GT) was introduced and applied to the thoracolumbar paraspinal muscles. The patient's exercise program was also increased at this time. A sampling of these exercises is provided in Figures 2–7. A summary of the full treatment protocol and prescribed exercises is included in Table 1.

At week 9, the patient reported no spinal stiffness or pain and had resumed all his ADLs. The patient was encouraged to continue with his exercise program as a preventative measure. He was subsequently discharged from active care and advised to return if his symptoms recurred. At 12 month follow-up conducted via telephone, the patient reported no recurrence of symptoms.

Discussion

Vertebral fractures are one of the important clinical manifestations of osteoporosis. The prevalence of vertebral fractures rises with age, and may increase as much as five times between the ages of 50–54 and 75–79.⁹ The risk factors associated with VCFs and osteoporosis are similar¹, and include nonmodifiable and modifiable factors (Table 2). Early recognition, diagnosis, and conservative management can play an important role in minimizing the complications and negative sequelae of OVCF (Table 3).

Unfortunately only about one third of VCFs are actually diagnosed.^{14–16} Pain symptoms arising from OVCFs can be variable, ranging from asymptomatic,¹⁷ to acute and intolerable pain.⁹ Fractures may also escape diagnosis due to being dismissed as muscle strains, arthritis, or

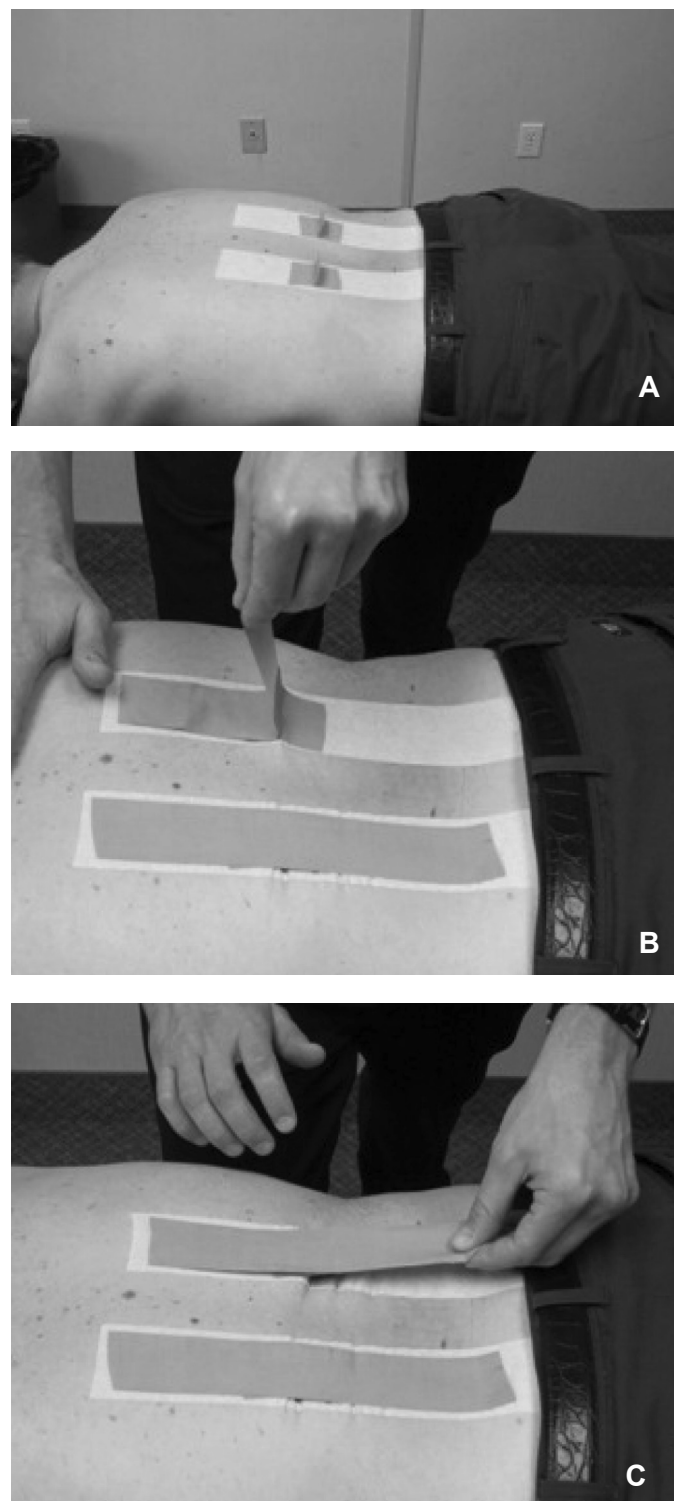


Figure 1(A–C) Taping into extension bias of the thoracolumbar spine



Figure 2 *Proprioceptive training with one-legged stance*

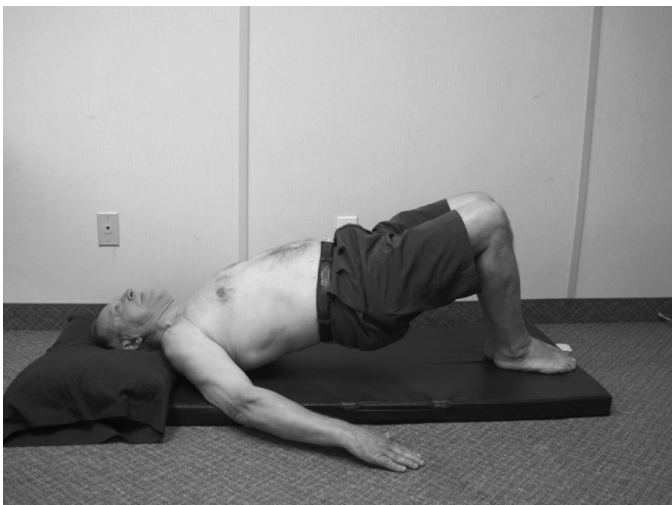


Figure 3 *Lumbopelvic conditioning with bridging exercise*



Figure 4 *Theraband scapular retraction exercises*



Figure 5 *Proprioceptive training with a Rocker Board*

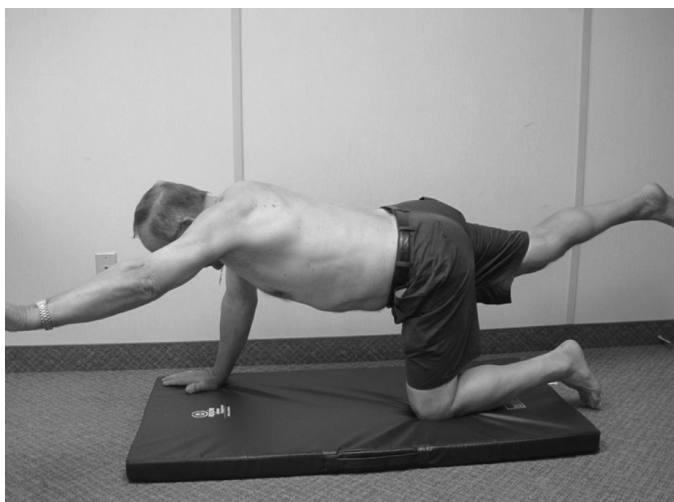


Figure 6 *Lumbopelvic and back extensor training with Quadruped exercise*



Figure 7 *Theraband pull-down exercises*

a normal part of aging,^{1,10} and may have no clear event tied to the onset of symptoms. Individuals with advanced osteoporosis may sustain a VCF after sneezing or lifting a light object, whereas patients with mild to moderate osteoporosis will require a greater force to create a fracture such as falling off a chair, tripping, or attempting to lift a heavy object.¹ Health professionals should consider OVCF as a diagnostic differential in all patients older than 50 with acute onset of back pain if one or more risk factors are present.¹⁸

It is reported that many patients with OVCFs experience a relatively benign natural history with predictable pain improvement over 6 to 12 weeks.^{11,12} However, these sources also acknowledge that some patients experience persistent pain and disability. Chronic back pain in individuals with osteoporosis may result from the continuous occurrence of new vertebral fractures,^{18,19} or may be a result of secondary changes in body configuration and posture,^{20,21} and biomechanical strain on the posterior elements.^{22,23} As individuals become more kyphotic, their back muscles, ligaments, and intervertebral joints are often extended beyond normal position and exposed to prolonged stress. This can result in joint dysfunction,^{22,23} muscle fatigue² and reduced spinal extensor strength.⁹ The pain brought on by this destructive cascade may continue long after the acute fracture has healed.²⁴

The majority of OVCFs occur at T6-T8, T12-L1, and L4.^{9,25} There are several clinical signs which may raise the suspicion of OVCF. The change in shape of the vertebral body after a fracture may result in a visible focal increase in kyphosis or loss of lumbar lordosis.^{12,26,27} Multiple OVCFs can lead to a noticeable loss of height and a further accentuation in postural change.^{9,12} Functional impairments, when present, typically affect activities such as walking, bending, transfers, carrying and lifting.^{9,11,19,28}

Physical examination may reveal tenderness with palpation or percussion directly over the area of fracture, and paraspinal muscle spasm.^{18,19,25,27,29} Active ranges of motion for the axial spine will be restricted with most acute fractures.⁹ In cases of stable compression fractures, straight leg raise will be negative and neurological examination will be normal. The emergence of neurological radicular symptoms requires investigation to evaluate the stability of the injured region.³⁰ Symptoms of cauda equina signifies the need for immediate emergency referral.

Table 1 Overview of average pain range, functional status, impairment status, and treatment interventions

WEEK(S) SESSIONS	AVERAGE PAIN RANGE	FUNCTIONAL STATUS	IMPAIRMENT STATUS	TREATMENT INTERVENTION(S)
Initial Presentation	<ul style="list-style-type: none"> 8/10 Medication use to control pain symptoms 	<ul style="list-style-type: none"> Difficulty with most ADLs, mobility, transfers Unable to walk far distances Sleep disturbance due to pain 	<ul style="list-style-type: none"> Active lumbar ROM significantly restricted in all planes Bilateral thoracolumbar paraspinal muscle spasm/hypertonicity Percussion and digital P-A pressure over T11, T12, L1, L2 painful 	<ul style="list-style-type: none"> Postural education – neutral spine emphasized, avoidance of forward stooped/spinal flexion movements Activity modification – remain as active as possible and avoid prolonged inactivity
WEEK 1 • 3 sessions	<ul style="list-style-type: none"> Same as Above (SAA) 	<ul style="list-style-type: none"> SAA 	<ul style="list-style-type: none"> SAA 	<ul style="list-style-type: none"> Interferential Current (IFC) applied to thoracolumbar paraspinal muscles, 15 minutes each side Visits 2&3 taping into extension bias of thoracolumbar spine (Figures 1 A–C)
WEEK 2 • 2 sessions	<ul style="list-style-type: none"> 6/10 Medication use – SAA 	<ul style="list-style-type: none"> Same as week-1 with slight improvement in overall mobility 	<ul style="list-style-type: none"> Same as week-1 with slight improvement in lumbar extension and rotation movements corresponding with mobility improvements 	<ul style="list-style-type: none"> IFC – SAA Progressive taping into extension bias of thoracolumbar spine
WEEK 3 • 2 sessions WEEK 4 • 2 sessions	<ul style="list-style-type: none"> 4–5/10 Medication use only before bedtime to help with sleep 	<ul style="list-style-type: none"> Mobility continuing to improve, resumption of some ADLs and pre-injury walking routine at 50% of usual distance Less overall difficulty with sleep positions 	<ul style="list-style-type: none"> Progressive improvement in lumbar ROM's, lumbar flexion still limited by 50–75% Diminishing thoracolumbar paraspinal muscle spasm/hypertonicity Digital P-A pressure reveals moderate pain, most notably over L1 spinous process 	<ul style="list-style-type: none"> IFC and progressive taping into extension bias of thoracolumbar spine – SAA Introduction of: <ul style="list-style-type: none"> *Abdominal Bracing; Scapular setting; Gentle Extension movements of thoracolumbar spine *Exercise prescription: 3 sets of 8–10 repetitions with 3–10 second holds **Exercise performed 2 times/week in office, 3 times/week at home
WEEK 5 • 2 sessions WEEK 6 • 2 sessions	<ul style="list-style-type: none"> 2–3/10 Medication use discontinued due to manageable pain levels 	<ul style="list-style-type: none"> Limitation in only some ADLs requiring bending at waist and lifting Return to pre-injury daily walking routine of 2–4 km No interference with restful sleep 	<ul style="list-style-type: none"> No sharp pain with axial movements; Lumbar forward flexion limited by 25° with report of discomfort and stiffness Mild-moderate hypertonicity and tenderness in the thoracolumbar paraspinal muscles Mild-moderate tenderness with P-A pressure over L1 spinous process 	<ul style="list-style-type: none"> IFC application and taping into extension bias discontinued Graston Technique® (GT) applied to thoracolumbar paraspinal muscles Exercise Progression to: <ul style="list-style-type: none"> – Pectoral stretching (15–20 second holds) – Proprioception – one-legged stance (Figure 2) – *Bridging (Figure 3); Prone hip/opposite arm extension; Theraband scapular retraction exercises (Figure 4) *3 sets of 10 repetitions **2 times/week in office, 3 times/week at home
WEEK 7 • 1 session WEEK 8 • 1 session	<ul style="list-style-type: none"> 0–2/10 	<ul style="list-style-type: none"> Gradual return to all ADLs 	<ul style="list-style-type: none"> Progression of lumbar forward flexion from mild pain discomfort at end range to stiffness at end range Residual hypertonicity and tenderness in thoracolumbar paraspinal muscles Mild discomfort with P-A pressure over L1 spinous process 	<ul style="list-style-type: none"> GT – SAA Exercise Program Addition of: <ul style="list-style-type: none"> – Rocker board training in office (Figure 5); Home proprioceptive challenge increased by performing one-legged stance with eyes closed – *Quadruped and Theraband pull-downs (Figure 6 and 7); Dynamic Prone Extension *3 sets of 10 repetitions **1 time/week in office, 4 times/week at home
WEEK 9 • Discharge	<ul style="list-style-type: none"> 0/10 	<ul style="list-style-type: none"> Return to all ADL 	<ul style="list-style-type: none"> Lumbar flexion full with mild stiffness reported at end range 	<ul style="list-style-type: none"> Discharged, encouraged to continue with home program

Table 2 *Risk Factors for Osteoporosis and Vertebral Compression Fractures (VCFs)¹*

Advanced age	Low body weight
Female gender	Previous OVCF
Caucasian race	Tobacco use
Early menopause	Alcohol use
Estrogen deficiency	Insufficient physical activity
Bilateral ovariectomy	Dietary calcium and/or vitamin D deficiency
History of corticosteroid medication use	

Table 3 *Complications arising from OVCFs^{1,9-11}*

Constipation	Increased risk for further fracture
Bowel obstruction	Chronic pain
Prolonged inactivity	Loss of independence
Deep venous thrombosis	Functional limitations with ADLs
Increased osteoporosis	Low self-esteem
Progressive muscle weakness	Emotional and social problems
Crowding of internal organs	Increased nursing home admissions
Respiratory decrease-atelectasis, pneumonia	Mortality
Kyphosis and loss of height	

Plain frontal and lateral radiographs are the initial imaging study obtained for a suspected VCF. Common radiographic findings associated with VCFs include a step defect, wedge deformity, disrupted vertebral end-plate, linear zone of condensation, paraspinal swelling and abdominal ileus.³¹ Post-fracture stability is based on the classification of Denis where the spine is divided into three columns.³² According to this model, the likelihood of neurological injury is high when damage occurs to more than one of these columns. VCFs involve failure of the anterior column only. The middle column is completely intact and is typically characteristic of compression fractures. Pathologic fractures may be identified by loss of posterior body height, pedicle or other structures, and a paraspinal mass.³¹ Computed tomography (CT) and magnetic resonance imaging (MRI) may be used in cases of suspected spinal cord compression, progressive neurological deterioration, incongruous neurologic or skeletal injury, unexplained neurologic deficit, or suspicion of malignancy.^{1,33,34}

It is generally agreed upon that stable, non-malignant

compression fractures can be treated conservatively.^{1,10,12,35,36} An emphasis on pain control and maximizing functional outcome is important to prevent chronicity and the negative sequelae of OVCF. Even in acute cases, prolonged bed rest and inactivity should be avoided.^{1,12} Education in activities of daily living may include ways to minimize pain.¹⁰ In this case, the initial focus of treatment was to improve posture and body mechanics to reduce the compressive loads on the spinal column.³⁷ The patient was advised to avoid forward stooped-spinal flexion movements,^{37,38} attempt to stay mobile, and avoid prolonged inactivity.

Zambito et al.³⁹ demonstrated that interferential current (IFC) was effective in alleviating both pain and disability in patients with chronic back pain due to previous multiple vertebral osteoporotic fractures. Bracing has also been advocated as a pain management strategy. Bracing is believed to promote healing by stabilizing the spine,¹¹ facilitating neuromuscular re-education, and reducing pain by decreasing postural flexion that causes increased loading of the painful fractured periosteum.¹⁰

Progressive taping of the thoracolumbar region into extension bias was utilized in this case as an alternative to bracing and well tolerated by the patient during the first four weeks of treatment.

Paraspinal muscular pressure has been found to be highly increased in the flexed standing position with loading in normal control groups and significantly higher in patients with osteoporosis, degenerative spondylolisthesis and lumbar compartment syndrome.⁴⁰ Hammer et al.⁴¹ demonstrated reduced pain in a patient with lumbar compartment syndrome after using GT. GT utilizes stainless steel instruments to apply controlled microtrauma to the affected soft tissues.⁴² Studies suggest that this controlled microtrauma induces healing via fibroblast proliferation,⁴³ which is necessary for soft tissue healing.^{43,44} Additional studies have shown clinical efficacy using GT for the treatment of various disorders with painful soft tissue components.^{42,45–50}

Physical activity plays a critical role in the rehabilitation of osteoporotic patients with vertebral fractures.^{10,51–56} Extension or isometric back and abdominal strengthening exercises are useful and contribute to the avoidance of other fractures,^{10,38} whereas flexion exercises seem to be detrimental.³⁸ Spinal extensor training has been demonstrated to help reduce pain by decreasing compressive loads and maintaining bone mineral density.^{51,53} Proprioceptive exercises also appear to play a role in the rehabilitation of OVCF. Vertebral fracture has been associated with impaired balance characteristics in the osteoporosis population.⁵⁷ This may be as a result of several factors including pain, impaired muscle control and fear of falling.⁵⁷ Adding dynamic proprioceptive training can help reduce pain and the risk of falls in patients with kyphosis related to osteoporotic compression fracture.⁵⁵

Although spinal manipulation or adjustment is a routine mode of treatment administered by chiropractors, it was not utilized in this case. Osteoporosis is commonly regarded as a relative or absolute contraindication to spinal manipulation.⁵⁸ In a review of four cases, Haldeman et al.⁵⁹ indicated that manipulation or adjustment of areas suspected of compression fracture may result in increased pain and prolonged patient disability. Considering that occult compression fractures may be present in any osteoporotic patient, special care must be taken to avoid exacerbating the patient's condition.

Evaluation and management of osteoporosis is an in-

tegral part in the treatment of OVCF.⁵⁹ In this case, such management was deferred to the patient's family physician and naturopathic doctor as per the patient's request. Chiropractors can play a role in educating osteoporotic or at risk patients on preventative lifestyle choices such as calcium and vitamin D supplementation, increasing weight-bearing physical activity, and limiting/avoiding consumption of caffeine, alcohol, and tobacco.^{60–63} Other treatment alternatives available to a patient with OVCF include pain medication and epidural steroid injections.^{10–12} Surgical management is typically reserved for individuals with neural compression and progressive deformity with neurological deficits,¹² and may include percutaneous vertebroplasty or kyphoplasty.^{10,36,64–66}

The natural history of OVCF may have played a role in the favourable outcome of this case. However, the implementation of a structured rehabilitation program minimized the likelihood of chronicity and burden associated with OVCF, and the patient demonstrated no recurrence of pain at 12 months. With the exception of his previously diagnosed osteoporosis, this patient did not have any other co-morbidities that would have complicated recovery or limited his participation in an active exercise program. The patient also shared the belief that activity within his tolerance would be of benefit during recovery. Postural education, advice on activity modification, and pain relieving measures minimized prolonged immobilization and likely provided re-assurance for a patient already motivated to remain active. GT was useful in decreasing the paraspinal muscle spasm and allowed the patient to participate in a progressive rehabilitation program consisting of spinal extensor training, abdominal and lumbopelvic strength training and dynamic proprioceptive training. The passive treatments used in this case were primarily utilized to support the exercise program and provide pain control during the rehabilitative process.

Summary

This case does demonstrate the successful management of moderate OVCF of the lumbar spine using a variety of conservative interventions that can easily be employed by chiropractic practitioners. Although favourable results were obtained, it is important to note that the nature of this investigation was that of a case study involving one patient. Therefore the treatment protocol utilized may not be appropriate for all individuals with OVCF. There is a pau-

city of quality scientific research documenting conservative management for OVCF. Most of the treatment data is heavily weighted toward pharmacological and surgical interventions. Research in this field is urgently needed to deal with the ever increasing aging demographic in North America. Evaluating conservative interventions that focus on returning an individual back to ADLs in a timely manner and minimizing the risk of chronicity and burden associated with OVCF require investigation in clinical trials with large sample sizes to determine long and short term efficacy. Furthermore, study is needed to evaluate other parameters (age, number of fractures, co-morbidities, etc.) that may predict a positive course in recovery among individuals with OVCF who attend chiropractic offices.

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