A Functional Approach to the Assessment and Treatment of Acute Disc Related Low Back Pain

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ABSTRACT

The patient presented with acute vertebrogenic disc related low back pain of biomechanical origin. There was complaint of associated sciatic pain as well as trunk and lower extremity muscle imbalances. The mechanism of injury was a work related torsion injury to the lumbar spine. Initial medical management consisting medication provided only palliative relief. A four-month program of in-office rehabilitation including gym ball stability exercises, endurance training, proprioception training and work conditioning was administered. Initially a brief course of Phase II rehabilitation including therapeutic modalities and Otis Ring protocol were utilized. During phase II & III rehabilitation manipulation was utilized to support the primary treatment as necessary. This program proved effective in providing long-term resolution of the patient's low back pain along with an early return to regular work functional requirements and activities of daily living.

KEY WORDS

Acute Disc Related Low Back Pain, Phase II & III Rehabilitation, Chiropractic, Low Tech, Outcome Assessment

INTRODUCTION

Spinal manipulation has been shown to be an effective management tool in the treatment of acute low back pain.[1,2] Patient activation and rehabilitation concepts of treatment are key components in the emerging quality care paradigm. In order to provide proper neuromusculoskeletal care, the healthcare practitioner must know when to manipulate and move from passive to active care. Passive modalities, such as thermal or electrical physical agents applied for pain relief or to reduce inflammation, have a limited role in the management of musculoskeletal problems. There is a definite tendency to overemphasize the promotion of tissue healing and reduction of inflammation, which results in an overemphasis on passive modalities beyond the early stages of acute care. The danger of the injury/inflammation model is that it promotes overuse of physical agents and results in the physical and psychological deconditioning that leads to chronicity.

The primary focus of functional restoration opposes the application of an injury/inflammation model. The active care model embraces emerging rehabilitation standards. Functional restoration addresses improper motor control (spinal instability), joint dysfunction and muscle dysfunction. Such rehabilitation focuses on the entire locomotor system. Its focus is to restore function in the locomotor system using a multifaceted approach involving dynamic therapeutic activities, education and manipulation. It is recognized however, that most patients do not seek this type of treatment for their condition.[3] Instead, they seek treatment of their symptoms and often depend on ineffective measures such as bed rest or medication to solve their problem.[4] Unfortunately, 30% of these patients will develop chronic problems. It is chronic management that is responsible for 90% of the cost of treatment of lower back pain.[5] In those cases, where re-occurrence or persistence of lower back pain occurs, decreased strength, diminished proprioception, poor endurance and lack of flexibility are implicated in the development of the condition.[6] This suggests that a comprehensive rehabilitative program including exercise for flexibility, trunk strength, endurance, coordination, and cardiovascular fitness can significantly reduce the risk of functional loss.[7]

The following case demonstrates the value of early activation and transition from Phase II to Phase III rehabilitation. It further demonstrates the necessity of functional evaluation so as to determine the appropriate protocol of rehabilitative treatment. Finally, it demonstrates the achievability of the long-term functional outcomes that are demanded by patients and carriers alike.

Current research shows that it is beneficial to proceed to a rehabilitative phase of care as rapidly as possible, and to minimize dependency upon passive forms of treatment. Prolonged periods of inactivity are related to increased risk of failure in returning to pre-injury status. Studies indicate that low-tech rehabilitation protocols produced significant improvements with the longest periods of relief. These patient had a 92% return to work rate with 90% of them returning to their original work requirements. [17] It was the most cost effective and the method of choice recommended for the management of chronic low back pain patients.

CASE REPORT

History:

A 30-year-old, 6', 185 lbs., non smoker, male Caucasian presented with a complaint of "right low back pain" radiating down the back of his right leg. He indicated that he felt a "pop" in his lower back as he was turning while lifting wood onto a table in order to make cabinets. The wood weighed approximately 50 lbs. The pain was initially described as an "intense ache", which was worse in the morning and more intense as the day progressed. The pain eventually began to radiate down his right leg. The pain initially radiated into his buttocks then down his leg but above his knee. The patient had difficulty lying on his left side. He stated the pain made it difficult to turn over in bed but was relieved by laying on his back or stomach and relaxing leaning to the left.

The patient was taking over the counter medications for pain relief. He placed a piece of plywood under his mattress to diminish his symptoms while sleeping. He indicated that he sleeps on his right side or on his stomach in an extended position. He did not have a history of lower back pain. His past medical and family history was unremarkable. His social activity was significant in that he continued to work performing modified job tasks subsequent to this incident. The patient also continued to perform modified activities of daily living that were required to maintain his person and household. The patient completed Outcome Assessment forms. The forms were scored demonstrating a perception of moderate disability. [31]

Examination Findings:

The patient initially presented with antalgic posture and gait leaning to the left while avoiding weight bearing on his right side. Orthopedic/neurological examination revealed negative spinous percussion, positive Valsalva's maneuver, positive Minor's sign, positive left Kemps, Elys, Nachlas, Hibbs, Yeomans, and Bilateral Leg Raise with pain noted in the region of the fifth lumbar vertebra on the right radiating to the right sacroiliac joint. Lumbar range of motion was moderately reduced with pain noted at the fifth lumbar vertebra on flexion, right rotation, and right lateral flexion. [25,29] McKenzie analysis indicated right lateral flexion dysfunction and extension dysfunction. [16] The patient was unable to perform functional testing on presentation.

Radiographic Findings:

AP & lateral lumbosacral x-rays revealed mild right lumbar tilting, disc wedging at the fifth lumbar vertebra with spinous rotation to the left. Facet syndrome on the right side was noted between the fifth lumbar vertebra and the sacrum with mild decreased vertical disc height at the fifth lumbar vertebra and sacrum. The films were unremarkable for degenerative changes.

Impression:

The patient was assessed with a working diagnosis of acute lumbar sprain/strain, disc injury, muscle imbalance, abnormal posture and gait associated with sciatica.

Initial Plan:

Progressive management was implemented initially to include manipulation, PNF, mobilization, electro-therapy, cryocuff compression therapy, core activation/stabilization and Otis Ring protocol.

The patient was provided instructions in appropriate modifications to activities of daily living. He was additionally provided a home exercise program to support the in-office care program. McKenzie exercise protocols consisting of end range extension and lateral flexion protocols were recommended for this home based program.

Mobilization was performed on a motorized kinetic table for muscular balance and to increase ROM in the lower back. The kinetic table settings were 25 degrees of extension followed by 15 degrees of flexion at 7 cycles per minute for thirty minutes. The physiological effects of the mobilization were extracapsular. [28]

Manipulation was not performed until the third week of care. Manipulation was then performed on a PRN basis for the remainder of treatment. The physiological effects of manipulation are intracapsular. Manipulation was focused to correct the biomechanics of the affected joints.

PNF was performed to balance and stretch the muscles of the lower back and lower extremities. PNF was performed using 6 repetitions of 6 seconds with 6 seconds of rest beginning at 15 degrees of elevation increasing 15 degrees per set until reaching a plateau.

Cryocuff compression therapy was performed for pain relief and to reduce inflammation. Cryocuff compression was performed using ice in water circulating at 100 percent through a bladder wrapped around and compressing the lower back.

Electric Stimulation was implemented using a sequential protocol that involved interferential therapy to reduce inflammation and to relieve pain followed by a Variable Modulated Sinewave (VMS) waveform to reduce muscle spasm, increase circulation, and facilitate the healing process. Therapy was performed using the setting for muscle spasm for 10 minutes to promote enkephan production and ended with the setting for pain control for 10 minutes to promote endorphan production. [21,18]

Core stabilization was performed using Otis Ring protocols following mobilization during cryocuff and electric therapy. This phase of care involved treatment three times weekly for three weeks.

As expected, the patient's initial symptoms improved and the magnitude and duration of his pain subsided. The patient completed updated Outcome assessment forms demonstrating markedly improved scores indicating a perception of slight to mild disability. The patient continued modified duty at his place of employment. He worked in a facility that designed, manufactured and installed custom cabinets and furniture. His regular work requirements as described by NIOSH definitions of occupational titles would be "Heavy". [17] The patient also began performing more and more of his lighter activities of daily living with out modification. The patient did exhibit concern regarding the potential for exacerbation of his condition. The patient was offered and agreed to a trial of Phase III in-office rehabilitation using low-tech protocols.

The patient completed a cardiac screening questionnaire that demonstrated no contraindications for rehabilitation. Functional testing was performed to validate the necessity and appropriateness of work conditioning, to establish a base line from which progress evaluations would be compared such that the efficacy of the treatment plan could be demonstrated.

Functional Examination Technique:
Posture analysis was performed based on the research and standards developed by Pettibon. [20] Janda's method of muscle analysis was used to determine muscle imbalances. Janda's muscle analysis system is based on "tightness-weakness". What may appear to be a strong healthy muscle may actually be a short, tight, and weak muscle that may be the cause of imbalance. [16] Research and evaluation techniques by Lewit were also considered as they relate to posture, soft tissue and

muscle analysis. Waddell's signs were used to rule out psychosocial issues. [15] The Alaranta and Sorensen's physical performance tests were performed and included repetitive sit-ups, arch-ups, squatting and static back endurance. [16] Measured manually were range of motion and strength of the thoracolumbar spine. Measured were Flexion, extension, right lateral flexion, left lateral flexion, right rotation and left rotation. The strength was measured using equipment manufactured by J-tech.

Findings:
The patient's past history revealed no contraindications to rehabilitative management. Family history was non-contributory. Initial Postural and muscle analysis indicated lower back extensor weakness of the lower back and lower extremity more pronounced on the right. This resulted in an "altered movement pattern" as described by Janda. Essentially, Janda analysis classifies muscles into two groups; "postural" and "phasic". Postural muscles have a tendency to become overactive, hypertonic, weak and shorter. Phasic muscles become weak and inhibited. This leads to one muscle group overpowering another muscle group. Usually muscle action during movement consists of interaction between the agonist, synergist and antagonist. [16] In this patient's case the psoas muscle was over powering the erector spinae and the biceps femoris. This resulted in piriformis compensation where the piriformis muscle becomes shorter and overactive. The quadriceps muscles were overpowering the hamstrings. This was also clinically verified by a modified Thomas' test. The modified straight leg test revealed shortened, weak and tight hamstrings. The patient initially demonstrated shallow breathing patterns. The patient demonstrated a positive response to the one legged standing tests with decreased proprioception on the right side. This indicates weak and or inhibited core and postural stabilizers. The Alaranta and Sorensen's tests demonstrated levels initially only 15% of expected values. [17] The patient demonstrated decreased range of motion in extension and right lateral flexion and rotation. The patient is right-handed. The manual muscle tests demonstrated measurable weakness when comparing the right to the left side. The dominant side was expected to be at a minimum of 10% and up to 15% stronger than the non-dominant side. The finding here was that the right side (dominant) was actually weaker when compared to the left (non-dominant). Waddell's signs were negative indicating no psychosocial issues were present increasing the chance of a favorable outcome. [17]

Treatment Program:
The work-conditioning program (detailed below) was performed three times weekly for 16 weeks. At the 16-week point the patient's functional progress had reached a plateau. [15] The patient was then released from care. The patient was transitioned to regular work requirements based on his progress during the work-conditioning program. The patient was returned to the performance of all of his regular work and home activity requirements at the time of his release from treatment. The patient was instructed only to continue treatment if his symptoms returned or his ability to function in his home and work activities became compromised due to deterioration in his functional status.

The work-conditioning program was focused on functional restoration. This program concentrated on proprioceptive training, aerobic training, endurance training, stability training, and strength training using modified Oxford protocols.

Treatment was performed in the following manner:

Warm-up:
The patient was instructed in the performance of active range of motion stretching within a pain free zone. The stretching program encompassed full body. As motion increased, the patient increased the stretch, up to, but not beyond the new pain free zone. These exercises were performed three times per week prior to beginning work conditioning. [19]

Aerobic Conditioning:

Cross-training is a critically important method of performing aerobic activities. The human body is very adaptable. Cross-training prevents the body from adapting to an exercise and therefore allows the patient to achieve their maximum potential. This is an important procedure in the recovery of all types of soft tissue injuries. Not only does the patient with a soft tissue injury have to complete the stretching and strengthening rehabilitation program to achieve the planned functional outcome, but they must also learn cross-training for aerobic exercise. Treadmills, stationary bikes, recumbent bikes, cross country ski machines, versaclimbers, rowing machines, cardioglides, skywalkers and elliptical walkers can produce the needed aerobic conditioning. The benefits of these aerobic activities included increased muscle tone, flexibility, aerobic potential and endurance. These are very important factors in avoiding future injury. [21,27]

Proprioceptive Training:
Otis Ring Protocol [32] and the Body Blade Pro protocols [33] were utilized to re-educate the proprioceptive properties of the injured sensory nerve endings, which may or may not be directly or indirectly involved. The key component of the Otis ring and body blade protocol is isometric stabilization focused to motor learning. The effects of Otis ring and body blade protocols are increased movement, effective posture and stability, endurance, ROM, speed, balance and coordination.

Stability Training
Next the patient performed balance board protocols. The balance boards used included a modified version of a BAPS board, a lateral Rocker Board (for front to back and side to side balancing) and standard Round Balance Board for three-dimensional balance training. The purpose of these exercises is similar to the Otis Ring and Body Blade, with the exception that the exercise focuses on the stability and proprioceptive capacity of the lower kinetic chain. [16] The primary focus of this treatment protocol results in the activation and dynamic strengthening of core and postural stabilizers. This initially occurs at an increased rate of improvement as compared to traditional weight training.

Gym ball exercises were utilized to address the stability of the low back and the remainder of the body. A variety of exercises were performed in progression throughout the period of treatment as identified in “Rehabilitation of the Spine – A Practitioners Manual” by Craig Liebensen, DC. Exercises for the initial 4-week program were directed at the low back. Following this period of care additional exercises were directed at the remaining areas of the body to develop stability and to maintain proper muscle balance globally. [16]

Exercise:
Isotonic contractions are the most common form of exercise utilized in rehabilitation. This type of exercise defined as a muscle contraction through a range of motion using a constant resistance. The speed may vary. Isotonic contractions can be concentric or eccentric. A concentric contraction occurs when the muscle shortens as force is exerted. An eccentric contraction occurs when the muscle lengthens as force is exerted.[26]

In the initiation of the exercise program isotonic exercises were performed using the unloaded body part moving against the force of gravity. Exercise progressed to tubing, free weight, cables and bands. Given that our goal was to restore the patient's work capacity, the exercise protocol chosen was the Oxford protocol. Secondary considerations were related to the gender of the patient. Women recruit muscle during exercise as opposed to hypertrophy. Therefore, women respond better to higher repetition exercise protocols. The Oxford protocols were performed three days per week. The technique consists of ten sets of ten reducing the weight after each set. The assessment of progress is 10RM. The exercise weight was increased by one pound per session where possible. Exercise was performed to all areas of the body to improve global functional performance and stability. [9]

Upon completion of the work-conditioning program the patient was given a home program of spinal stabilization exercises to enhance the functional gains. Continuing spinal manipulative therapy on a maintenance basis was recommended to address any joint dysfunction that could reflexively inhibit trunk musculature. [11] Since completing this program, the patient has not (to date) had any episodes of reoccurrence of her original condition. Over an 6-month period, the patient experienced three minor aggravations, all of which responded favorably to supportive care. The patient continues to perform his home exercise program. Patient reached an asymptomatic level and has chosen to return on an "as needed" basis only for further care.

DISCUSSION

It is believed that history, examination, and response to treatment were consistent with a diagnosis of Acute Disc Related Biomechanical Lower Back Syndrome including symptomatology consistent with a Facet Syndrome.[13] It is further believed that after sustaining his lower back injury, his condition would respond to a relatively short course of progressive chiropractic therapy and exercise stimulated muscle reconditioning. Early activation and transition from Phase II to Phase III rehabilitation was paramount in the success of this case.

The approach implemented in this case involved an initial course of progressive therapy with early activation and Phase II rehabilitation. The primary focused was to reduce the inflammatory component while initiating correction of underlying structural component. This resulted in effective functional evaluation and the performance of Phase III rehabilitation. As such, the initial phase of passive therapy was followed with a rehabilitative course of treatment aimed at provide a long-term resolution to his work related injury. The age and past history of the patient presented no contraindication to the potential of this favorable outcome. [9]

CONCLUSION

This patient presented with acute low back pain as the predominant complaint. This is not an uncommon finding. A low-tech rehabilitation program concentrating on proprioception training, restoration of muscle balance, endurance, joint stability and functional strength followed focused progressive care of short duration. The success of this treatment and the outcome achieved was objectively evaluated and documented using “Functional Evaluation” and “Outcomes Assessment” forms completed on initiation of care, during the progression of treatment at 30-day intervals and upon discharge. This case example demonstrates the viability of functional assessment for development of a treatment program aimed at resolution of acute low back pain so that the patient’s functional abilities are improved. This approach, while involving more aggressive treatment in the short term, proved to be more cost effective and provided higher patient satisfaction than other treatment alternatives. As such, it should be considered a valuable approach in today’s outcome focused healthcare environment.

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