CONSERVATIVE MANAGEMENT OF A PATIENT WITH LUMBAR DISC DISEASE: AVERTING LUMBAR DISC SURGERY

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Paper submitted March 31, 2004; in revised form March 19, 2005.
Sources of support: No funds were received for the preparation of this manuscript.

ABSTRACT

Objective: To illustrate multifaceted clinical components often present with lumbar disc herniation that require concomitant resolution before optimal conservative case management can be achieved.

Clinical Features: A 33-year-old male with insidious low back pain and a gradual onset of lower extremity symptoms had a declining physical activity lifestyle, diminished fitness level, and weight gain over a 4-year period. Symptoms progressively worsened over a two-year period. Magnetic resonance imaging revealed a disc herniation with neurological compromise and surgical intervention was medically recommended.

Intervention and Outcome: Management consisted of patient education, acute inflammation control, closed disc reduction, remedial therapeutic (passive joint movement) care directed at preservation and improvement of joint and soft tissue mobility, low tech physical capacity evaluation and individualized rehabilitation training for home based care exercise. Patient compliance was ultimately achieved with a positive long-term outcome.

Conclusion: This case illustrates common clinical components of care associated with disc herniation case management, the potential of conservative care, and the benefits of combining manual therapy and rehabilitative exercise. (J Chiropr Med 2005;4:162–176)

Key Indexing Terms: Low back pain; Intervertebral Disk Displacement; Chiropractic; Rehabilitation

INTRODUCTION

It may be fair to state that because the intervertebral disc is so resilient, many disc injuries, unless preceded by an inordinately forceful event, occur after a period of attenuation associated with multiple precipitating or predisposing factors. If we accept this premise, it is logical that many patients with "acute disc lesions" have not only developed maladaptive changes in the neuromusculoskeletal system as a consequence of the painful lesion, but also may harbor antecedent abnormal or detrimental postural and biomechanical functional deficits. This would necessitate addressing not only the acute pain and the disc lesion but also the concomitant pre-existing deficits for optimal recovery and stabilization (Fig 1).

CASE REPORT

A tall 33-year-old moderately over-weight male with a sedentary lifestyle experienced insidious, constant low back pain (LBP) and intermittent right lower extremity symptoms to the foot. He had experienced intermittent mild LBP over a two-year period. His family health history, past medical history, and systems review were unremarkable.

The initial exam was remarkable for right lateral glide of the pelvis and normal dorsolumbar active range of motion (ROM) in all planes of movement, experiencing only focal LBP on flexion. His neurological exam was normal, including phasic reflexes, pathologic reflexes, sensory (pain and light touch), motor, balance and coordination. A positive right sitting straight leg raise (SLR), reproducing low back and lower extremity symptoms was present. A sitting left SLR produced focal LBP. Supine SLR was positive on the right, at less than 30 degrees, reproducing low back and lower extremity symptoms, but without a Braggard correlate. Valsalva maneuver during the sitting SLR intensified the symptoms. Palpation revealed paraspinal muscle hypertonicity and para-articular pain the L5–S1 level. Gross pas-

0899-3467/05/1002-049$3.00/0
JOURNAL OF CHIROPRACTIC MEDICINE

- Development of sub-optimal compensatory movement strategies resulting in maladaptive dysfunction of the neuromusculoskeletal system,[20] with disrupted patterns of muscle recruitment and co-contraction within and between muscle synergies of the low back
- Abnormal erector spinae muscle activity[21]
- Abnormal multifidi muscle adaptive response[22]
- Compensatory global muscle substitution
- Aberrant synergists activation
- Overactive antagonists
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- Sub-optimal axis of movement of the joints, both extremity and axial
- Spinal intersegmental hypomobility
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- Aberrant proprioception both axial (core) and extremity
- Trigger points
- Maladaptive postural & biomechanical faults and behaviors
- Adaptive muscle shortening
- Adaptive ligament contracture with eventual cross linking adhesions
- Deconditioning

Figure 1. Potential postural and biomechanical functional deficits to consider in case management.

sive ROM, assessed on a Leander table, was restricted on extension and lateral flexion bilaterally. McKenzie's assessment procedures failed to produce favorable response to loading. Radiographic findings included mild posterior narrowing of the L4–5 disc space and mild levoscoliosis.

The initial clinical impression was that the patient had cumulative stress, lumbar strain/sprain, and a suspected intervertebral disc disorder with radicular features. Initially, the patient was given a report of findings, plan of care explanation, a probationary period of 2 to 4 weeks, options for care and a recommendation to seek second medical opinion in the event this treatment program failed to provide satisfactory results. Patient education was initiated with regard to activity modification, postural, biomechanical and ergonomic considerations where

feasible. A special emphasis was placed on avoidance of flexion activities and posture.

Treatment goals in the order of progression were: reduction of inflammation and edema; reduction of counterproductive biomechanical behaviors/activities with activity modification (education/restrictions); closed disc reduction for suspected disc herniation/disorder; remedial therapeutic care directed at preservation and improvement of joint and soft tissue flexibility/mobility by passive manual therapy; transition to more active forms of management directed at functional stabilization using therapeutic stretching and exercise.

Initial care began with interferential and cold therapy. A focus on closed disc reduction was initiated on the second visit, performed on a manual, non-automated, Leander table. This table enables distraction and flexion of the caudal section, lumbar extension, lateral flexion and rotation. Distraction of the lumbar spine was achieved by means of flexion of the caudal section of the table, in the mid-line position (Fig 2). Initially, the degree of flexion of the table did not exceed 7 degrees as recommended by Cox.[1] The patient remained in this position for 5 to 15 minutes. The rationale for this procedure is based on Cox principles and various other traction principles in the literature, not the Cox principles alone. In some instances, sustained traction calls for distraction of the joints for periods of up to 30 minutes.[2] This procedure was limited to 15 minutes to avoid possible detrimental effects of creep.[3] On the third visit, lateral flexion was integrated into treatment. This was done while the patient was in the flexion position (Fig 3). The direction and degree of movement is determined empirically by patient tolerance and reduction of lower extremity symptoms. As treatment procedures became more dynamic, moist heat was applied in advance, in an effort to make the tissues more amenable to stretch. In the early treatment stages, visits concluded with interferential therapy and ice; these were reduced judiciously through the course of care. After 1 week (3 visits) the patient reported reduction of lower extremity symptom frequency.

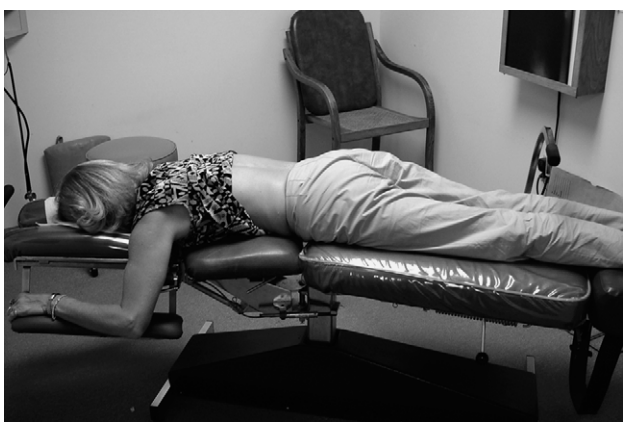

Figure 2. Distraction of lumbar spine using mechanized table in static flexion.

Figure 3. Lateral flexion of spine on mechanized table.

In the second week of care, movement dynamics increased by means of a gentle pumping action of the caudal section of the table in flexion with the heel of the hand contact at the suspected level of the lesion (Fig 4). Subjectively, the patient indicted this further reduced his symptoms. Progressively, right

Figure 4. Flexion pump using mechanized table.

and left lateral movements were included (Fig 5). This was accomplished by contacting the mamillary processes at each level in the lumbar spine with the heel of the hand (thenar or hypothenar eminence) on the side of lateral flexion with gentle overpressure sufficient to encourage some movement at the desired segment, while moving the upper section of the table laterally in a gentle, rhythmic fashion. This movement was performed in the patient's functional range and addresses the coupled movement of lateral flexion and rotation. The flexion pumping action, in theory, continues to address the closed disc reduction. The dynamic nature of both flexion and lateral flexion are directed at the benefits of mobility work (Fig 6),[4] and augmented by the hands-on contact, ensuring some movement occurs at the level of contact. Additionally, ischemic compression and myofascial release were used, based on palpatory findings each visit.

At 3 weeks the patient's subjective progress seemed to plateau, rated at 60% improved. However, objectively, paraspinal muscle activity was reduced an estimated 50% and gross passive ROM had significantly improved. Patient compliance was poor due to a job schedule conflict. As the end of the 4-week trial probationary period approached, the patient still presented with lower extremity complaints, although these symptoms had improved. To be prudent, it was decided to schedule a second opinion with a neurologist.

At week number 4 (8 visits), the patient's symptoms were effectively centralizing. During this period, treatment included lumbar extension (Fig 7). This was achieved by lowering the abdominal/pelvic section of the table. Gentle overpressure, with the fingers or heel of the hand, was gently applied to patient tolerance, to augment the movement and ensure that the effects were exerted at the desired segmental levels. This progression in treatment addresses two potential remaining issues. First, although flexion/distraction may be empirically effective, hypothetically, additional disc reduction can occur if we progressively apply the extension principle, which is thought to further aid in maintaining the achieved disc reduction as healing continues and further stabilizes.[2] Additionally, in line with the goals of mobility work, this procedure addresses any extension dysfunction (segment hypomobility) that may have developed or pre-existed.

Figure 5. Dynamic right lateral flexion on mechanized table.

Through 5 weeks (11 visits), the patient rated his progress at 85–90% improved with infrequent minimal lower extremity symptoms. A physical capacity assessment was scheduled, however, the patient did not show for his scheduled appointment. The patient did return after a 3-week interim period, without regression. In the interim, the neurologist ordered a MRI and electrodiagnostic studies. The patient was rescheduled for the physical capacity assessment and again failed to keep his appointment. After a 2-week interval the patient returned reporting he had consulted with a neurosurgeon, who recommended surgery. The MRI revealed a right lateral recess disc herniation with superior extension in the right anterior epidural space, encroaching upon the right L5 and possibly S1 nerve roots. Electromyography/nerve conduction studies revealed evidence of right L5/S1 radiculopathy with ongoing denervation. The patient discontinued conservative treatment, despite his improvement and notwithstanding the neurologist's recommendations to continue chiropractic care.

A year later the patient again returned with insidious, recurrent low back and right lower extremity pain. He had received no treatment during his hiatus. He stopped treatment the year before because he felt well. He presented with very similar subjective and objective findings. The pain intensity was rated at 7 on a scale of 10 and constant. Pertinent exam findings included positive supine SLR under 30 degrees with a positive Braggard's test. He experienced diminished sensation to pain at the S1 dermatome. Palpation revealed an increase in paraspinal muscle tone at the L4–5 and L5–S1 region. Gross

- Rehydration and hydration of connective tissues.
- Breaking and prevention of cross-linking in collagen fibers.
- Breaking and prevention of macro adhesions.
- Plastic deformation and permanent elongation of connective tissues.
- Allows better directional orientation and length of collagen fibers and scar tissue.
- Allows for molding and remodeling of collagen fibers during fibroblastic and maturation stages of scar formation.
- Prevents scar and collagen shrinkage.
- Allows for more generalized effects of increased blood flow, venous drainage, lymphatic drainage and increased cellular metabolism.

Figure 6. Benefits of mobility work.

passive ROM was restricted on extension and lateral flexion bilaterally. The clinical impression was recurrent disc herniation with a radicular component.

Treatment procedures and progression were very similar to the initial management program. Side posture lumbar manipulation was included, as a slightly more aggressive approach to treating lumbar joint dysfunction (hypomobility). This was tolerated well by the patient and proved beneficial in reducing focal LBP.

Figure 7. Augmented extension using mechanized table.

At 2 weeks, an interval exam revealed a return of normal S-1 dermatome sensation, significant muscle tone improvement and improved gross passive ROM. Subjectively, the pain level was reported at 4/10, only with increased use. Extremity symptoms were resolving and becoming more centralized. After one month, the patient rated his progress as 70%. His Oswestry score improved from a 42% ADL disability (moderate to severe) to 22% (mild). A physical capacity assessment was ultimately obtained and the patient was scheduled for reconditioning/rehabilitation.

The functional capacity evaluation (FCE) included a physical activities readiness questionnaire, postural evaluation, trunk flexibility assessment, lower extremity muscle length assessment, trunk strength and endurance tests[5] and lower extremity sensory motor evaluation with single leg stance (eyes opened and eyes closed). Findings of the FCE are described here. Right dorsolumbar paraspinal muscle over-activity was detected by visual inspection and palpation. Flexibility was reduced bilaterally in the hamstrings and piriformis muscles and unilaterally in the right adductor muscle group. The

right gluteus maximus was smaller than the left. Abdominal weakness was demonstrated during a bilateral supine straight leg raise lift test with posterior pelvic tilt hold and sit-up endurance test. The left quadratus lumborum was overactive, indicated by an elevated left hip and reduced right lateral flexion. Weakness of left hip abductors was demonstrated by a hip hike during the leg abduction test while side-lying. Poor trunk flexibility was demonstrated by the sit-up flexibility test. Weak trunk extensors were noted on the back extension test. Poor right lateral trunk flexion strength was demonstrated by the side-lying trunk lift test. Poor lower extremity proprioception (sensory-motor deficit) was demonstrated by single leg stance testing. The patient presented with a significant forward head translation, elevated left shoulder, anterior rounding of the shoulders and winging of the left scapulae.

Based on the physical capacity assessment, a home-based exercise program was initiated, which is a progressive series of training sessions whereby the patient sees the physical therapy assistant once or twice per week for 15 to 20 minutes. Attended visits continue until all prescribed exercises and protocols are learned and performed proficiently. Initially, exercises are directed at facilitating local muscle systems proprioceptive responses by initiating simple movements while maintaining position and balance on therapy ball (Appendix A). Lower extremity sensory-motor training (Fig 8) was used in the exercise program. Stretching and then resistance exercises follow sensory motor training. In this particular case, the patient had difficulty with hamstring lengthening and post isometric relaxation stretches were incorporated with good response. Subsequently the patient was able to resume independent stretching.

Resistance exercises were accomplished on a therapy ball (Appendix A, Fig 9). The versatility of the ball addresses strength, endurance, and isolation of the desired region to strengthen and incorporate balance and coordination with exercise on a labile surface. Additionally, aerobic fitness and weight loss was addressed with a simple walking program following target heart rate guidelines and some basic nutritional counseling.

After 9 weeks, including 4 weeks of rehabilitation exercise, the patient rated his progress at 85% improved, with occasional LBP and no lower extremity symptoms. Objectively, he presented with only mild paraspinal muscle over-activity. Passive care was reduced to 1 visit per month. A follow-up at 13 weeks demonstrated continued subjective and objective stabilization and the patient was scheduled for a 2-month follow-up with recommendation to continue home based rehabilitation program. After the 13-week visit the patient discharged himself from recommended monitoring. He did return after 6 months, demonstrating continued functional stabilization. His Oswestry score was zero, paraspinal muscle tone was near normal, gross passive ROM and active ROM was normal, he remained neurologically intact, and orthopedic test were negative. He was discharged at this time.

DISCUSSION

Medical and chiropractic authorities agree that the treatment of back and leg pain from disc herniation by skilled manipulation can be both safe and effective[6,7] and that the disc herniation should be viewed primarily as a nonsurgical disease to be treated by conservative methods.[8]

Studies indicate that a relatively high percentage of the population harbors asymptomatic disc herniation.[9] A disc herniation may not be the true source of local or distal symptoms. Research from the early 1990s suggests that regardless of the size of the herniation, without direct neurologic compromise, the space-occupying lesion was not the primary offending factor producing lower extremity symptoms, but rather the cause was an inflammatory response.[10] The biochemical irritants associated with inflammation, and perhaps increased pressure from edema and swelling, are thought to produce the predominance of the extremity symptoms. Both the chemical and mechanical factors probably need to be addressed. Once the diagnosis of herniated disc is established, activity modification and inflammation reduction is probably the first order of business. Cryotherapy is probably one of the most effective and time-tested conservative modalities to reduce inflammation, spasm and pain and should be used liberally in the acute inflammatory phase. Other effective pain and inflammation modulation modalities might include interferential or high volt galvanic in combination with cryotherapy.

Activity modification is a necessity to protect the injured site, but should be done without limiting activity to the point of predisposing the patient to

Propriosensory training (concentrated stimulation) is designed to improve faulty postural patterns, re-educate sub-cortical motor programs, retrain/reprogram sensory-motor pathways, increase neurological speed of transmission/response and improve coordination of responses.

In standing

- You will progress at your motor (muscle coordination) learning rate.
- Practice 10 to 15 minutes per day.
- Begin with small foot or small foot awareness while sitting then in standing.
- While standing the trainer will initiate light perturbations (pushes) , progressing to more challenging perturbations. Key your awareness on maintaining center of gravity.
- With feet apart perform squats with approximately 20 to 30 degrees of knee bend, concentrating on small foot awareness and center of gravity, then with feet together, knees out.
- With similar progression as above, a labile (unstable) surface will be introduced.
- As stability improves we will progress to single stance with similar progression as above.
- Lunges on stable surface progressing to lunges onto a labile devise, increasing from slower to faster.
- Finally in the same fashion as above we will progress to jumping onto a stable then to a labile surface.

Figure 8. Sensory-motor training.

the negative effects of bed rest or too much inactivity. This can be a real balancing act but helps to ward off fostering unwarranted pain avoidance behaviors that may ultimately lead to early deconditioning or chronic pain patterns. It is very important to find a balance as early as possible between physiologic protection and functional range movement. In the early stages of care, it is important to distribute and review additional spinal hygiene information, postural and body-mechanics behavior modification and ergonomic considerations, as there might be a tendency to fall back into unsound, habitual biomechanical behaviors.

Closed disc reduction techniques are employed as soon as possible with the goal of the centralization of symptoms. Probably the 2 most popular principles/techniques in physical medicine are advocated by McKenzie[11] and Cox[1]. Both principles are sound but there is no standard as to which to utilize

The exercise speed will be trained by the physical therapy assistant and should be at a rate of one concentric /eccentric movement every 3 to 4 seconds.

- Day one, begin with one 15 second set.
- Day two, one 30 second set.
- Day three, one 45 second set.
- Day four, one 60 second set.
- After achieving two 60 second sets begin a rest day between sessions.
- The goal, following the same progression, is to work up to three to four 60 second sets per week.
- Should you experience increasing pain with exercise the exercises should be stopped and you should consult with the doctor. Minimal pain or soreness during or after exercise is acceptable. Moderate discomfort after exercise probably means you are progressing too rapidly and you should rest a day and begin again at a reduced time interval.
- The duration of the exercise program and reduced training recommendations according to the American College of Sports Medicine (ACSM) Resource Manual is, after 12 to 18 weeks, exercise sessions can be reduced to one day per week without significant loss in strength, for up to 12 weeks. In general, the ACSM recommends resistance training of moderate to high intensity as an integral part of a fitness program, involving large muscle groups, at least two days per week. It's important not to discontinue training altogether.

Figure 9. Description of exercise ball protocol.

first. If McKenzie protocols prove initially ineffective (no directional preference can be found), possibly due to loss of disc integrity (loss of hydrostatic properties), then distraction techniques may prove beneficial. Many times patients will ultimately begin to respond to McKenzie principles. I have found it is of particular importance to educate and reinforce upon the patient that maintenance of lumbar lordosis is critical, once re-established, to avoid recurrence of the problem.[2,11–13]

Once pain management and closed disc reduction has been clinically established the goal of care should be to direct the preservation and improve-

ment of joint and soft tissue mobility during the repair stage of healing. This may be achieved with passive manual therapy, gradually progressing to more active forms of movement and mobilization. Maxey and Magnusson[4] describe soft tissue injury and repair in four phases. In the third phase, which some authors call the repair phase or the fibroblastic phase, they provide physiologic rationale for movement/mobilization. Because collagen is laid down at an accelerated rate during this phase, forming weak hydrostatic bonds, tissue elongation is more amenable to therapeutic movement during this healing stage. This intermediate stage of care presents an excellent window of opportunity for reshaping and molding scar tissue, with various forms of passive manual therapy and active therapeutic movement procedures without a great risk of tissue re-injury.

Chiropractic is distinct from most other health-care providers because of the manual therapy component. The likely advantage is the focus of application. Because the spine is a multiple joint system, many times other mobilization or movement procedures, which are accomplished actively by gross movement, may not be as effective at addressing the specific problem area. Therefore, spinal injuries may be treated more effectively with hands-on, site-specific procedures. Active mobilization exercises may also have limited effects because of muscle guarding and adaptively shortened ligaments. Consequently, during active movement procedures, the injured segment(s) may not derive the benefits of therapeutic movement. Hands-on manual therapy techniques augment movement, ensuring remedial therapeutic benefits at the involved segments. This includes passive manual therapy, mobilization, manipulation, distraction mobilization and manually augmenting some of the McKenzie procedures. Site specific hands-on movement may also enhance the closed disc reduction procedures or techniques as well. Once reduction of radicular symptoms (centralization) has been accomplished, site-specific manual therapy may continue through the repair phase of the soft tissue healing process and may continue to be beneficial, on a limited basis, during remodeling further retarding unorganized tissue repair and ligament contraction and thus preserving and improving mobility and flexibility.[4] A gradual shift is made to more active mobilization procedures as the healing process transitions to the remodeling phase with a curtailed frequency of passive manual therapy. In the remodeling phase, collagen begins to solidify and shrink; nonetheless, collagen synthesis is still occurring and additional therapeutic benefit can be attained with appropriate intervention, as the tissues continue to mature.[4]

It may be more effective to address muscle imbalance, dyscoordination and balance deficits before strengthening, as these factors may impede strengthening efforts by producing abnormal joint movement and therefore undue musculoskeletal stress during exercise. Many therapeutic stretch programs can be accomplished independently by the patient after adequate training. However, some muscle over-activity can be refractory and require the assistance of the healthcare practitioner with the utilization of various manual resistance stretch techniques. Articular dysfunction (intersegmental hypomobility) can be a complicating factor, which can also hinder rehabilitation efforts and may benefit from manipulation.

Progressive resistance exercises are implemented into the treatment plan and directed at hypertrophy and hyperplasia of the maturing injured tissue.[14] If therapeutically unattended, the collagen fibers may develop significantly more unorganized scar tissue, shrinkage and cross-linking. Once the tissues mature, management becomes a more difficult proposition as the tissue reverts to a more inactive and non-pliable status.

The therapy ball may be one of the most cost effective tools for spinal rehabilitation. It is inexpensive, takes up little space, portable and extremely versatile. It provides a means to target specific muscle groups, such as the abdominals and the spinal extensors, and it addresses strength, endurance, flexibility, balance, coordination, and postural enhancement.

As care runs its course, neurological and provocative tests many times lose their utility, becoming less reliable at determining the physical affects of the injury. The use of additional subjective and objective outcome assessment tools may be necessary to track functional/physical problems that develop. These tools can play an essential role in making clinical management decisions and documenting need for care. From a medicolegal perspective, these contemporary assessment procedures help quantify and validate complaints of pain and deficits of function, which in turn eases some of the burden of proof for impairment and subsequent disability determination, when applicable and necessary.

Subjective outcome assessment questionnaires can be utilized throughout the course of care to quantify the patient's pain and related disability. Examples might include the Oswestry LBP questionnaire, neck disability index, Roland Morris LBP questionnaire, pain drawings, and others. The reliability and validity for these tools is regarded as exceptional, and many times out performs physical performance tests.[15] These tools provide good insight regarding the patient's activity intolerances and are considered good preliminary psychometric screening tools. Disproportionate illness behavior should be identified early if present and managed accordingly. At times, patients may have complicating psychosocial issues that are made worse by back injury.

Ordinal verbal rating scales simplify the monitoring of subjective progress on a visit by visit basis and are useful as an adjunct to the interval use of questionnaires. Numerical pain rating scales and visual analog scales can be utilized as well. For ease of application, verbal rating scales were used in this case, asking the patient on successive visits to rate his pain on a scale of 0 to 10 and to rate his progress on a scale of 0 to 100% improved. These rating scales seem to correlate nicely with one another and with clinical findings.

In some instances, even the most subtle attendant physical capacity deficits can have an adverse affect on the patient's activities of daily living and potentially limit optimal recovery. With the functional or physical capacity evaluation, the above issues can be identified and addressed with appropriate reconditioning/rehabilitation. The physical capacity evaluation also aids in documenting impairment, once maximum medical improvement is determined. Reactivation of functional range movements with simple activities of daily living should begin as soon as possible; however, there is no conformity as to when rehabilitation should begin in earnest. Mayer and Polatin[16] suggest that rehabilitation should not begin until a FCE is performed, identifying the degree and location of deficits. Deciding when to actually perform the FCE is always a difficult proposition because of re-injury risks. Liebenson[17] suggests that objective measurements should begin as soon as the patient emerges from the acute stages of injury. According to Mooney, the FCE should begin at 2 weeks and Triano suggests 4 weeks as an appropriate period.[17] Other experts have suggested beginning the FCE as treatment progress plateaus.

Yeomans[15] explains that assessments for work capacity versus physical performance are different but interrelated and often overlap. Physical capacity assessments relate to muscle length, strength, ROM, etc, while the work capacity assessment measures activities of daily living such as bending, climbing and reaching. Yeomans suggests that physical performance testing should begin on a case-by-case basis, as soon as possible. The true FCE is defined as a systematic, comprehensive, objective measurement of maximum work ability.[15] Most comprehensive FCEs are reserved for workers' compensation and personal injury cases. Logistically, most small practices must refer these evaluations to rehabilitation centers that are better equipped for such evaluations. Nonetheless, physical capacity evaluations are more than adequate for prescribing rehabilitation exercises.

Liebenson[17] and Yeomans[15] both offer quality explanation and instruction for valid and reliable low-tech FCE procedures. These procedures are both qualitative and quantitative and can be correlated to enhance documentation of suspected deficits. An FCE might include postural evaluation, identification of adaptive muscle imbalances (described by Vasillyeva and Lewit),[18] inspection of gait, balance, coordination, ROM, flexibility testing and altered movement patterns, as described by Janda.[19] Strength and endurance testing can be addressed with the trunk performance tests, which can be compared to normative data. The back, leg and arm dynamometer, used for isometric strength testing, can produce data that can be compared with normative data, validated by calculating coefficient of variation, and is also a useful and relatively inexpensive tool. Simple aerobic fitness testing, such as the 3-minute step test, can also be included in a FCE. Deficits, once identified, should be addressed if optimum patient recovery is expected. If not addressed, delayed recovery, chronicity, or predisposition to recurrent problems is more likely.

CONCLUSIONS

This case offers a review of the multiple clinical components and treatment methods used to conservatively manage a common but clinically significant disc herniation. Additionally, aside from avoiding surgery, this case demonstrates that low-tech assessment and home based rehabilitation can be effectively accomplished. Though this patient may experience recurrent problems in the future because of

unforeseen extenuating circumstances, lack of due diligence on his part and probable predisposition, his outcome could have been much less favorable. He is now more knowledgeable, with independent management skills, and may be less likely to become dependent upon passive care and become a chronic pain syndrome patient.

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Appendix A

Exercises prescribed to patient. Exercise illustrations reprinted with permission from Bio Ex Systems (www.bioexsystems.com).

- Development of sub-optimal compensatory movement strategies resulting in maladaptive dysfunction of the neuromusculoskeletal system,[20] with disrupted patterns of muscle recruitment and co-contraction within and between muscle synergies of the low back
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- Compensatory global muscle substitution
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- Allows for molding and remodeling of collagen fibers during fibroblastic and maturation stages of scar formation.
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- Allows for more generalized effects of increased blood flow, venous drainage, lymphatic drainage and increased cellular metabolism.
- Propriosensory training (concentrated stimulation) is designed to improve faulty postural patterns, re-educate sub-cortical motor programs, retrain/reprogram sensory-motor pathways, increase neurological speed of transmission/response and improve coordination of responses.

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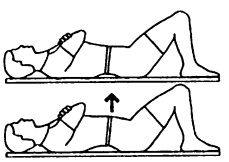
- Begin with small foot or small foot awareness while sitting then in standing.
- While standing the trainer will initiate light perturbations (pushes), progressing to more challenging perturbations. Key your awareness on maintaining center of gravity.
- With feet apart perform squats with approximately 20 to 30 degrees of knee bend, concentrating on small foot awareness and center of gravity, then with feet together, knees out.
- With similar progression as above, a labile (unstable) surface will be introduced.
- As stability improves we will progress to single stance with similar progression as above.
- Lunges on stable surface progressing to lunges onto a labile devise, increasing from slower to faster.
- Finally in the same fashion as above we will progress to jumping onto a stable then to a labile surface.
- The exercise speed will be trained by the physical therapy assistant and should be at a rate of one concentric/eccentric movement every 3 to 4 seconds.
- Day one, begin with one 15 second set.
- Day two, one 30 second set.
- Day three, one 45 second set.
- Day four, one 60 second set.
- After achieving two 60 second sets begin a rest day between sessions.
- The goal, following the same progression, is to work up to three to four 60 second sets per week.
- Should you experience increasing pain with exercise the exercises should be stopped and you should consult with the doctor. Minimal pain or soreness during or after exercise is acceptable. Moderate discomfort after exercise probably means you are progressing too rapidly and you should rest a day and begin again at a reduced time interval.
- The duration of the exercise program and reduced training recommendations according to the American College of Sports Medicine (ACSM) Resource Manual is, after 12 to 18 weeks, exercise sessions can be reduced to one day per week without significant loss in strength, for up to 12 weeks. In general, the ACSM recommends resistance training of moderate to high intensity as an integral part of a fitness program, involving large muscle groups, at least two days per week. It's important not to discontinue training altogether.

AROM lumbar neutral spine supine

- Lie on back with knees bent.
- Maintain neutral back position.

Perform 1 set of 1 Minute,

Perform 1 repetition every 4 Seconds.
Rest 1 Minute between sets.

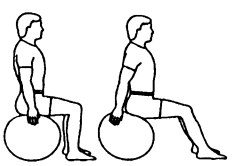


AROM lumbar pelvic tilt ant supine

- Lie on back, knees bent.
- Tighten low back muscles, arching low back off floor.
- Relax and repeat.

Perform 1 set of 20 Repetitions,

Perform 1 repetition every 4 Seconds.
Rest 1 Minute between sets.



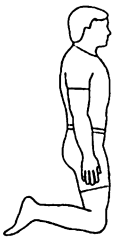
AROM lumbar front to back sit on Ball

- Sit on Ball.
- Using small steps, move forward.
- Return to center.
- Repeat.

Special Instructions:
Maintain proper low back posture.

Perform 1 set of 20 Repetitions,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.

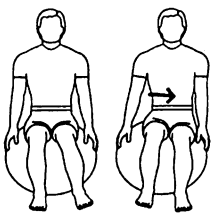


AROM lumbar neutral spine tall kneel

- Begin in a tall kneeling position.
- Maintain neutral spine by tightening abdominal muscles.
- Hold, relax, and repeat.

Perform 1 set of 1 Minute,

Perform 1 repetition every 4 Seconds.
Rest 1 Minute between sets.



AROM lumbar side to side sit on Ball

- Sit on Ball.
- Using small steps, move to left side.
- Return to center and continue over to right.
- Repeat.

Special Instructions:
Maintain proper low back posture.

Perform 1 set of 20 Repetitions,

Perform 1 repetition every 4 Seconds.
Rest 1 Minute between sets.

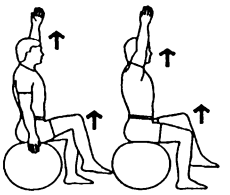
AROM hip marching on Ball

- Sit on ball with hips and knees at 90 degrees.
- Lift up one leg and lower.
- Repeat with other leg.

Special Instructions:
Maintain proper low back posture. Keep arms at sides

Perform 1 set of 20 Repetitions,

Perform 1 repetition every 4 Seconds.
Rest 1 Minute between sets.



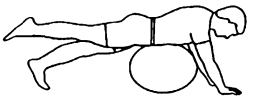
AROM hip marching w/alt arms on Ball

- Sit on ball with hips and knees at 90 degrees.
- Lift up left leg and right arm as shown.
- Lower arm and leg.
- Repeat with right leg and left arm.

Special Instructions:
Maintain proper low back posture.

Perform 1 set of 20 Repetitions,

Perform 1 repetition every 4 Seconds.
Rest 1 Minute between sets.



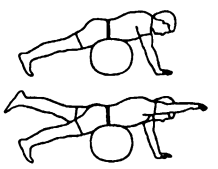
AROM lumbar alt leg prone on Ball

- Lie face down over ball as shown.
- Raise left leg up, keeping knee straight.
- Hold, lower and repeat with other leg.

Special Instructions:
Maintain proper back posture, do not allow hips to twist.

Perform of 1 Minute,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.



AROM lumbar alt arm/leg (hip bird dog) w/ball

- Begin lying with hips over ball as shown.
- Extend the right leg while lifting the left arm.
- Hold 2-3 secs.
- Return to start position and repeat with left leg and right arm.

Perform of 1 Minute,

Perform 1 repetition every 4 Seconds.
Use Ball.

AROM hip marching w/same arms on Ball

- Sit on ball with hips and knees at 90 degrees.
- Lift up left leg and left arm as shown.
- Lower arm and leg.
- Repeat with right leg and right arm.

Special Instructions:
Maintain proper low back posture.

Perform 1 set of 20 Repetitions,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.

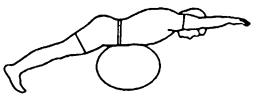
AROM lumbar alt arm prone on Ball

- Lie face down over ball as shown.
- Raise left arm up, keeping elbow straight.
- Hold, lower and repeat with other arm.

Special Instructions:
Maintain proper back posture, do not allow hips to twist.

Perform of 1 Minute,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.



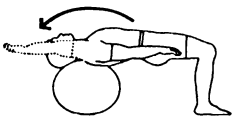
AROM lumbar bil arm prone on Ball

- Lie face down over ball as shown.
- Raise both arms up, keeping elbows straight.
- Hold, lower and repeat.

Special Instructions:
Maintain proper back posture, do not allow hips to twist.

Perform of 1 Minute,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.



AROM lumbar alt arm supine on Ball

• Lie face up over ball as shown.
• Raise left arm up over head, keeping elbow straight.
• Hold, lower and repeat with other arm.

Special Instructions:
Maintain proper back posture, do not allow hips to twist.

Perform of 1 Minute,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.

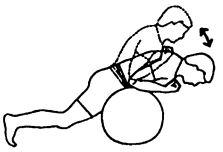
AROM lumbar alt arm/leg supine on Ball

• Lie face up over ball as shown.
• Raise left arm up over head, and straighten right leg.
• Hold, lower and repeat with right arm and left leg.

Special Instructions:
Maintain proper back posture, do not allow hips to twist.

Perform of 1 Minute,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.

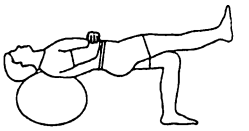


AROM lumbar ext prone legs bent w/ball

• Lie face down over ball as shown.
• Allow knees to bend.
• Lift trunk upward, straightening back.
• Lower and repeat.

Perform ,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.



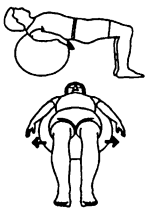
AROM lumbar alt leg supine on Ball

• Lie face up over ball as shown.
• Straighten left leg.
• Hold, lower and repeat with other leg.

Special Instructions:
Maintain proper back posture, do not allow hips to twist.

Perform of 1 Minute,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.

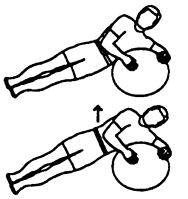


AROM lumbar static bridge w/hip abd/add on ball

• Position shoulders on ball.
• Maintain a static bridging position, with feet at shoulder distance.
• Move knees apart and together.

Perform of 1 Minute,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.



AROM lumbar sidebend w/ball

• Lie on side with upper body supported on ball.
• Lift hips upward, straightening the trunk.
• Lower hips and repeat.

Perform ,

Perform 1 repetition every 4 Seconds.
Use Ball.
Rest 1 Minute between sets.