Managing Low Back Pain With Exercise Interventions

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Many clinicians, both novice and the well experienced, who treat patients with low back pain (LBP) have experienced occasional frustration with determining the proper intervention for a complicated case. There are a number of reasons that the lumbar spine is such an intricate region of the body to treat. Imaging examinations can reveal pathologies that might or might not be causing a patient’s pain.\textsuperscript{1,2} In addition, LBP appears to be multifaceted, related to a combination of mechanical, neurophysiological, and psychological factors.\textsuperscript{3} The examiner should always take into account the patient’s clinical presentation to establish the proper course of treatment. Often a self-limiting condition, LBP is commonly benign, and approximately 90\% of patients recover within 6 weeks of its onset.\textsuperscript{3} Nonetheless, in cases that spontaneously resolve there is a high risk of recurrence without treatment.\textsuperscript{4} Mechanical causes include the following potential pathologies, which are responsible for 98\% of LBP: herniated or prolapsed intervertebral disk, facet pathology, spinal stenosis, stress fractures (spondylolysis and spondylolisthesis), compression fractures, and soft-tissue lesions associated with muscle strain, adaptive shortening, or ligamentous sprain.\textsuperscript{3,5-7} Early intervention is important to maintain the patient’s function, mood, and overall health.\textsuperscript{8}

There are numerous interventions available to clinicians for treating LBP. A few include mobilization, manipulation, massage (including myofascial release), electrotherapy, acupuncture, and therapeutic exercise.\textsuperscript{9-13} This article focuses on therapeutic exercise as the intervention of choice. Many different treatment philosophies govern the application of therapeutic activities, and some diametrically oppose one another. The purpose of this article is to equip clinicians with current knowledge of therapeutic exercise and its role in the rehabilitation of LBP. An attempt is made to present at least some of the current evidence from meta-analyses and outcome-based data.

Various clinicians, past and present, observed clinical presentation and behavior of patients with LBP and developed treatment schemes to guide appropriate intervention. It is important to note, however, that each classification and intervention system has its own strengths and weaknesses.\textsuperscript{14} Time and space do not permit an exhaustive presentation of the various systems, and the reader is referred to a critical analysis by Riddle\textsuperscript{14} for more information. Following are brief descriptions of a few common paradigms.

Common Paradigms

Williams’s Theory

Williams proposed a flexion-based philosophy that theoretically allows an even
distribution of compressive loads over the intervertebral disks of the spinal column.\textsuperscript{7,15} Williams\textsuperscript{7} contended that the natural forward tilt of the lumbosacral interface, or table, is associated with deterioration of the posterior intervertebral disk, predisposing one to LBP. Decreasing lumbar lordosis, which forms in a compensatory fashion to provide an upright posture, is key to alleviating back pain.\textsuperscript{7,15} Fahrni supported Williams’s contention by providing observational evidence of an Indian tribe that routinely engaged a hyperflexed lumbar posture during sitting and concomitantly experienced low incidence of LBP and posterior-disk deterioration.\textsuperscript{16} Conversely, Fahrni associated societies that embrace upright posture with posterior-disk deterioration. Thus, the flexion philosophy seeks to minimize lumbar lordosis during upright posture and various functional activities. Williams specifically abhorred spinal-extension activities, which directly opposes flexion-based LBP rehabilitation.\textsuperscript{7} Specific flexion-based exercises are presented in a later section of this article.

**McKenzie’s Theory**

Another approach is that of McKenzie. A McKenzie examination comprehensively assesses the patient’s response to various mechanical stresses by placing the spine in neutral, flexion, and extension.\textsuperscript{6} The assessment of the patient determines the appropriate therapeutic movement, which could be flexion, extension, rotation, or lateral flexion.\textsuperscript{6} Perhaps it is because McKenzie blamed prolonged flexion from poor sitting and standing posture, loss of extension range of motion, and improper body mechanics that many clinicians and researchers have associated McKenzie’s approach with extension-only exercises.\textsuperscript{17}

McKenzie believed that LBP related to mechanical pathology could be classified as one of three syndromes: postural, dysfunction, and derangement.\textsuperscript{6} The postural syndrome occurs because prolonged periods of elongation lead to inflammation of soft tissues. A key finding for postural syndromes is that pain diminishes with correction of the faulty posture. Dysfunction syndrome, caused by adaptive shortening, limits the patient’s movement in certain directions and causes pain before the patient achieves normal end range of movement. Finally, the derangement syndrome, often associated with constant pain, occurs from internal derangement of facet joint or intervertebral disks that concomitantly induces mechanical deformation of soft tissue.\textsuperscript{6} Pain centralization, or movement toward the spine, indicates a good prognosis with derangement and identifies the proper position in which the patient should begin rehabilitation. With dysfunction, however, the patient should engage in the offending movement so as to gradually stretch tight soft-tissue structures.

The McKenzie approach predominantly relies on the premise that the nucleus pulposus (NP) migrates antagonistically to the spine’s direction of movement. For example, the NP moves anteriorly as the patient moves from trunk flexion into extension (posterior direction), and there is some evidence to support this in vivo.\textsuperscript{18,19} Edmondston et al., however, present data describing interindividual variability with respect to NP migration during flexion and extension and the complexity in determining the movement of the NP during flexion and extension movements.\textsuperscript{20} They found that the NP moved anteriorly during extension in most cases, but in a few subjects it migrated posteriorly.\textsuperscript{20} By stereotyping herniated NP movement across all individuals, it is possible that a clinician will choose the wrong intervention for some patients.

**Delitto’s Classification**

Building on the work of McKenzie and others, Delitto et al. presented a treatment-based classification approach for LBP patients.\textsuperscript{4} Their classification system identifies patients most likely to benefit from rehabilitation, places patients into a time-frame stage, and categorizes symptoms into various syndromes: extension, flexion, lateral shift, immobilization, traction, and mobilization.\textsuperscript{4} This LBP paradigm acknowledges that some patients do not immediately improve with movement testing and exercise intervention and adds immobilization, traction, and mobilization management as treatment options.\textsuperscript{4}

**Core Stabilization**

Another concept for treating LBP involves training the dynamic and static stabilizers of the spine with “core” strengthening. Once a patient is out of the acute injury phase, this approach allows him or her to exercise the various muscles of the trunk that promote spinal stability. This approach is gaining popularity, but more evidence-based studies are needed to establish its efficacy in rehabilitation (see the July 2005 issue of Athletic Therapy Today).
Implications From the Literature

The traditional battle lines drawn between flexion- and extension-based rehabilitation paradigms might be antiquated because each approach has limitations and newer paradigms are emerging for treating LBP. Paradigms that incorporate both philosophies as potential treatment options and that depend on the patient’s clinical presentation appear to offer the most potential. It is important to observe outcome-based investigations that compare the various therapeutic-movement models as the best evidence for clinical practice.

Evidence-based outcome studies comparing extension-based (often described as “McKenzie”) and Williams’s flexion-based treatment paradigms are relatively scarce. In a study of patients with prolapsed intervertebral disks, Nwuga and Nwuga found that a “McKenzie group” had better pain resolution, required fewer treatments, and experienced greater improvement in range of motion, and the duration of comfortable sitting time was longer than with a Williams flexion group. Furthermore, the authors reported that the patients in the Williams flexion group were more likely to relapse and need further treatment. These results are supported by those of Ponte et al., who also noted that participants in an extension-based program had greater reductions of pain, larger improvements in sitting time, and increased forward and lateral flexion ranges of motion; tolerated a greater degree of hip flexion during straight-leg raise after treatment; and required less treatment than the patients with LBP in a Williams protocol.

Other studies suggest that one particular exercise type is not necessarily better than another. Systematic reviews have not shown consistent differences between the various types of exercises, although graded activity might work well with subacute pain in the occupational setting. It is important to consider the phase of rehabilitation when prescribing exercise interventions.

Injury Time-Frame Considerations

Acute nonspecific LBP is difficult to manage because there are inconsistent findings with respect to the efficacy of various interventions, even when compared with a no-treatment option. Nonetheless, early intervention might benefit the patient with respect to psychosocial issues more than no treatment. In addition, Fritz et al. found that a treatment-classification system, based on clinical presentation, benefited patients with acute LBP compared with a group treated by traditional clinical guidelines. Gentle, pain-free range-of-motion activities and muscle-setting exercise are perhaps most appropriate in this phase.

There is also strong evidence to support the use of general exercise for nonspecific chronic LBP. Exercise reduces pain intensity and beneficially alters the patient’s anticipation of pain induced by physical activity. Types of exercises beneficial for patients with chronic LBP include flexibility, stretching, and mobility exercises; endurance training; and strengthening activities. Intensive dynamic strengthening equaled the results of a “McKenzie” group with respect to improving pain and reducing disability in patients with subacute or chronic LBP.

Therapeutic Exercise Prescription

Lumbar facet joints approximate during spinal extension, ipsilateral rotation, and lateral flexion but separate during flexion, contralateral rotation, and lateral flexion. Therefore, if the facet joint is inflamed or injured, one should avoid approximation of the joint surfaces. Clinically, flexion-based exercises seem to work well for most patients with facet pathology.

Traditional Williams flexion exercises include the sit-up, supine bridge, posterior pelvic tilt, bilateral knees to chest (Figure 1), long-sit reach, iliotibial-band stretch in lunge position, and flat-footed squat. The traditional sit-up, supine bridge, and flat-footed squat were advocated to strengthen the abdominals, gluteals, and lower extremities. Williams included the bilateral knee-to-chest and long-sit-reach exercises to stretch the erector spinae, tight fascia, and posterior ligaments. In addition, the long-sit reach is designed to stretch the hamstrings but should be avoided if the patient is
having radicular pain into the extremities.\textsuperscript{7} The flat-footed squat, in addition to serving as a strengthening exercise, prevents “extension-related contractures.”\textsuperscript{7}

Not all Williams flexion exercises are appropriate for patients with sciatica, however. For example, the traditional sit-up should be modified into the curl-up exercise (Figure 2) for safer performance. The long-sit reach might need modification if the joint capsule is swollen or inflamed, because posterior pelvic tilt might place undue stress on the posterior annulus.\textsuperscript{28}

Posterior lumbar-disk protrusion has traditionally been treated with extension-based rehabilitation.\textsuperscript{28} The degree of disk herniation, however, might also determine the effectiveness of the prescribed movement. Moderate to severe herniation tends to respond better to flexed postures than to extension because the posterior annulus becomes impinged between vertebrae as the spine extends.\textsuperscript{29}

If centralization occurs during movements into spinal extension, the patient has good potential for recovery with extension-based activities. Specific extension exercises described by McKenzie begin in the prone position. The patient begins lying flat in the prone position and progresses to prone on elbows (Figure 3) and, ultimately, the prone press-up position.\textsuperscript{6}

Spinal- or core-stability exercises are becoming increasingly popular and can be progressed from begin-

\begin{figure}[h]
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\includegraphics[width=0.8\textwidth]{modified_curl_up}
\caption{Modified curl-up. According to McGill,\textsuperscript{28} the patient extends one lower extremity to stabilize the pelvis.}
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\includegraphics[width=0.8\textwidth]{prone_press_up}
\caption{Prone press-up described by McKenzie.\textsuperscript{6}}
\end{figure}

ning to advanced activities. The reader is referred to the July 2005 issue of Athletic Therapy Today, which covers the topic in more detail. It is interesting that Kavcic et al. noted that no single muscle or muscle group is responsible for spinal stability and that multiple exercises should be included to optimally train trunk musculature (see the sidebar).\textsuperscript{30}

According to McGill, nonspecific, general exercise recommendations for LBP should include the following principles.\textsuperscript{28} First, pain should be respected. Clinicians should not adopt the “no pain, no gain” attitude with LBP patients,\textsuperscript{28} but it is unreasonable to expect that minor discomfort will not present itself during the exercise session. A rule of thumb is that minor discomfort is acceptable as long as it does not progress to a pain that curtails exercise or modifies the proper exercise performance, thereby adversely affecting the recruitment of intended muscle groups. Second, the patient may perform exercises for the lumbar spine on a daily basis. Next, aerobic conditioning, especially walking, might benefit those with LBP and should be included whenever feasible. Fourth, avoid full spinal range-of-motion activities early in the day because of the relatively higher intradisk fluid content in the morning associated with diurnal fluid fluctuations. Another guideline is to emphasize endurance first and then strengthening of the spinal musculature. This order is commonly followed for most orthopedic conditions during rehabilitation, but it is especially important for LBP patients because of the postural responsibility of the various muscle groups surrounding the low back region. Consistency is paramount, and patients must understand that improvement might not occur for 3 months or longer, depending on their particular case. Finally, McGill states that there is “no such thing as an ideal set of exercises for all individuals.”\textsuperscript{28(p764)}

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Spinal-Stability Exercises, From Kavcic et al.\textsuperscript{30}  \\
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- Abdominal curl-ups  \\
- Side bridges  \\
- Sitting activities on a gym ball  \\
- Four-point kneeling with contralateral upper and lower extremity raising (“bird dog” exercise)  \\
- Supine bridging with and without single lower extremity extension  \\
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traditional flexion- and extension-based programs. There is evidence that patient-appropriate exercise intervention, and the patient’s proper assessment is requisite in determining the proper treatment of LBP with therapeutic exercise. A clinician’s experience and the patient’s reaction to various exercises that usually determine which exercises are most beneficial for that particular case.

**Summary**

There are many different clinical opinions concerning proper treatment of LBP with therapeutic exercise. A proper assessment is requisite in determining the appropriate exercise intervention, and the patient’s response should guide the clinician with respect to exercise selection. There is evidence that patient-preferred movement patterns and nonspecific exercise programs are beneficial for LBP patients in addition to traditional flexion- and extension-based programs.

**References**


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