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What's All the Buzz About Spinal Stability? Part Two: Assessment and Training

By Craig Liebenson, DC

Reactivating spine pain patients is a key to early recovery from acute and subacute episodes,^{9,13} prevention of recurrences,⁸ and treatment of chronic pain.¹⁰ Part one of this series reviewed the biomechanics of spinal instability and simple preventive measures patients can take to spare their tissues from repetitive strain.¹¹ This article will present the basic stages of a spine stability "core" exercise program.

1. Introductory Training - Graded Exposures to Grooved Stability Patterns

The introductory level of self-care advice includes biomechanical advice about how to avoid low back irritation during ADLs. Behavioral medicine or sports psychology tenets of "paced activity" and the relationship between hurt and harm should be discussed.^{2,6,7} Many LBP patients have excessive fear-avoidance beliefs or catastrophizing behaviors that promote a passive, symptom-driven approach, excessive pathoanatomic diagnostic testing, and a poor prognosis.¹² At the other end of the spectrum are individuals who are overly aggressive, which can lead to a "boom or bust" mentality.

The middle path is best exhibited by the modern emphasis on quota-based "graded exposures" to feared stimuli.¹² This operant conditioning model progressively demonstrates to patients that hurt does not necessarily equal harm, and that activity - contrary to the patients' beliefs - is actually beneficial.⁴ The activities chosen should be mutually agreed upon and should either reduce mechanical sensitivity (MS) or centralize symptoms, while being carried out to quota (a prescribed dosage). An example is a McKenzie exercise of spinal extension in a sciatica patient, which centralizes leg symptoms to the low back (**figure 1**).

Exercises should improve the patient's abnormal motor control (AMC). Most patients have poor kinaesthetic awareness of how to produce and/or control motion of their problem area. The patient learns to "discover" how to move and "cen-trate" an important region such as the lumbopelvic, scapulothoracic, or

cervicocranial. The hip hinge and cat-camel are examples of exercises that teach this motor control (**figures 2 and 3**).

Trunk muscle coactivation by an abdominal bracing technique has been shown to increase the margin of stability when performing activities.^{6,18} Abdominal bracing involves coactivation of muscles in 360 degrees around the lumbar spine. Abdominal hollowing, which has been popularized by Australian researchers, is a very similar method. Bracing requires a light contraction of about 5 percent to 10 percent of a patient's maximum voluntary contraction ability. This is similar to being tickled or bearing down slightly.¹⁸⁻¹⁹ However, the key is that the breath is not held during the brace, and abdominal contraction is not entrained to a certain phase of respiration.

1. Isolation of Specific Stability Patterns

Once a patient's functional range (range of motion without MS or AMC) begins to expand, it is necessary to further "groove" functional patterns by increasing the intensity of training, so as to achieve gains in endurance. McGill and colleagues have demonstrated that both muscle output and spinal load can be measured for a variety of exercises.^{1,15-16} Muscle output is determined as a percentage of maximum voluntary contraction ability (MVC) and spinal load as a measure of spinal compression and shear forces. Ideal exercises are those that have a high ratio of muscle challenge to spinal load.

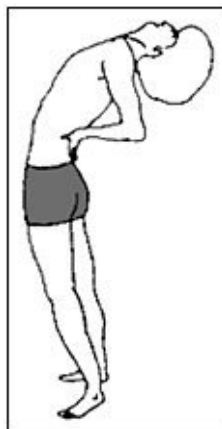


Figure 1: McKenzie back extension

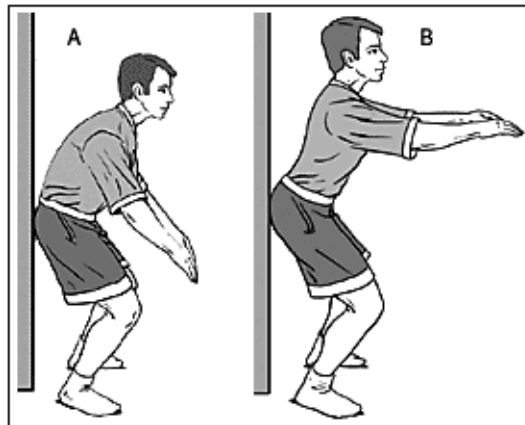


Figure 2: The hip hinge - a) incorrect; b) correct

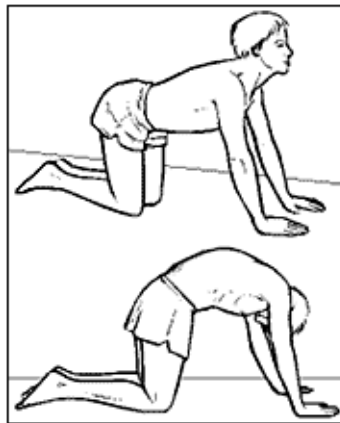


Figure 3: The cat-camel

Exercise science principles guide the selection of exercise intensity, frequency and duration. Motor control or stability training requires an emphasis on endurance, rather than strength.^{17,20,22} For this reason, the **intensity** of training is submaximal. As an example, a typical prescription would involve eight to 10 repetitions of slow movements with prolonged hold times (five to six seconds/repetitions, or about two breaths). A **frequency** of twice a day with a **duration** of up to three months is often required to remediate chronic spinal pain.¹⁴

McGill has developed the concept of "the big 3" in isolating and training stability patterns for the low back region.¹⁸ Such training encompasses low-load exercises with wide margins of safety/stability for the anterior, lateral and posterior musculature. Generally, loads under 3000N of force are considered safe for acute/subacute exercise training. Routine ADLs involve about 2000N and the NIOSH limit for repetitive tasks is 3300N.¹¹ **Table 1** shows the load profiles for a variety of low back exercises. Exercises with wide margins of stability should be performed after limbering up - and not immediately upon arising or after

prolonged sitting.^{5,23,24} Good form or coordination is a prerequisite for such training.²¹

Table 1 - Lumbar Spine Load Profiles for Common Exercises and Activities^{1,17-18}

Safe in Acute LBP

- Quad single-leg raise - 2000-2300N (one side of lumbar extensors at 20 percent of maximum)
- Side bridge on ankles - 2600N
- Curl-up - 2000N

Unsafe in Acute LBP

- Sit-ups bent knee - 3300N (730 lb.)
- Sit-ups straight knee - 3500N
- Roman chair exercise > 4000N (890 lb.)
- Prone superman - up to 6000N (over 1,300 lb.)

The quadruped position is used to train the back muscles. Once the quadruped single leg reach is mastered, movement in the opposite arm can be added (**figure 4**).



Figure 4: Quadruped arm/leg reach

The lateral musculature is trained with the side bridge (**figure 5**). The abdominals can be trained with the supported dead bug (isometrically) (**figure 6**) and then progressed to a partial curl-up with spinal neutral control (slight lordosis) (**figure 7**).



Figure 5: Side bridge - a) start position;
b) final position



Figure 6: Dead bug



Figure 7: Trunk curl-up

	<p>Troubleshooting</p> <p>If a neighboring area of the spine is stiff, instability of the lumbar spine can result. Reduced mobility in the mid-thoracic, hip, knee and ankle during a squat or lunge is a common finding. Appropriate stretching of the mid-thoracic spine or hip flexors will help spare the spine (figures 8 and 9).</p>
<p>Figure 8: Lunge/psoas stretch</p>	<p>Figure 9: T4 stretch with foam roll</p>

1. Integration - Functional Integrated Training (FIT)

Unless functional training occurs, there is no guarantee that the individual will be stable during "real world" challenges. Examples of functional training include squats, lunges, pushing, pulling, catching, carrying, etc.

(figures 10 and 11). Individuals engaged in demanding sports or occupations may require the addition of unstable surfaces such as balance boards and gymnastic balls to intensify the stability challenge.



Figure 10: Angle lunge with arm reach

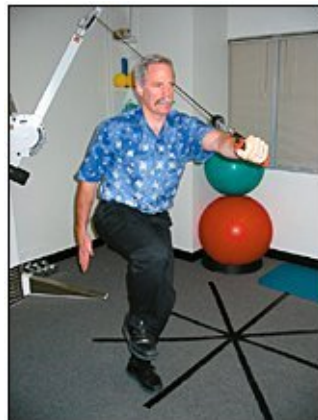


Figure 11: One-leg squat with arm reach (pulley machine courtesy of FreeMotion Fitness)

Conclusion

Stability training is appropriate for sedentary, deconditioned individuals as well as fit athletes. In the acute phase, the margin of error is great, so exercises with wide margins of stability should be prescribed. As they recover or face increased motor system challenges in their daily lives, patients need exercises which can stabilize them in riskier situations. Since these exercises have lower margins of stability, the clinician must determine patients' readiness and need for them.

At each stage of spine stability, training appropriate movement patterns that stabilize the spine should be "grooved." Endurance and motor control are more important than strength and power in low back injury prevention. Flexibility/mobility are important, but primarily for surrounding areas above and below the lumbar spine.

It is not hard for chiropractors to integrate rehabilitation into their practices. A step-wise approach has been developed which is both effective and efficient.

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