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Simple and Inexpensive Active Care in Your Office

The Spinal Stabilization System

By Craig Liebenson, DC

Joints, muscles and the central nervous system work together to maintain spinal stability. According to Panjabi, "The neural subsystem receives information from the transducers, determines specific requirements for spinal stability, and causes the active subsystem to achieve the stability goal."¹ The human locomotor system is inherently unstable. According to Winter, "Because 2/3 of our body mass is 2/3 of body height above the ground we are an inherently unstable system, unless a control system is operating."²

The body has a typical way of reacting to sudden load. According to Wilder, "the muscles will respond rapidly to stabilize the body, i.e., they will try to maintain balance and posture."³ The muscles responsible for maintenance of posture or proximal stability during movement are listed in the following table.

Table 1

What are the key stabilizers?

- quiet stance -- ankle dorsiflexors/plantarflexors;²
- a to p perturbations of stance of gait -- hip flexors/extensors;²
- m to l perturbations of stance or gait -- hip abductors/adductors;²
- multifidus -- its fatigue correlates with static trunk extensor fatigue;^{4,5}
- transverse abdominus -- it contracts before other muscles during a variety of tasks;⁶
- quadratus lumborum -- is significantly active in greater variety of ADLs than other muscles tested.⁷

How Is Stability Assessed?

A variety of measurable characteristics of spinal stability have been correlated with back problems. Some require sophisticated high-tech and often time-consuming evaluation procedures. However, others can be reliably performed in a busy chiropractor's office with little expense of time or money.

Balance Control

Chronic low back pain (LBP) patients could be differentiated from normal subjects by: poor control of A to P sway on a rocker board and poor balance in 1 leg standing test.⁸

Simple test: 1 leg standing test with eyes closed. Positive test if patient cannot complete 20 seconds.

Reaction Time

Psychomotor speed and postural control are associated with LBP. Upper limb reaction times were longer in LBP patients than normals. Postural control on a force platform was disturbed for women LBP patients but not men. Reaction times improved with non-specific rehabilitation, but postural control did not.⁹

Back pain patients have a different response to sudden loading than normal subjects. Increased peak muscle activity, slower reaction time, especially on the painful side, and a greater number of bursts of muscle activity after perturbation.³ Loading reactions were found to improve after treatment. Rehabilitation in chronic LBP improved reactions. Forty minutes of sitting negatively influenced reactions. Five minutes of walking after sitting improved reactions.

Coordination

An isoinertial test of trunk motion coordination compared normal subjects to chronic LBP patients. During isoinertial testing of trunk flexion/extension as fatigue sets in, motion occurs along a progressively more erratic path.¹⁰

Impaired muscle stabilization has been demonstrated to be associated with lower back pain. Delayed activation of transverse abdominus during arm movements distinguishes LBP patients from normals.¹¹

Assessment of gait has been shown to reveal findings of incoordination which differentiate LBP from normal subjects. Chronic LBP patients were differentiated from normals by increased muscle activity during the swing phase of gait over normals ipsilateral side as pain.¹²

Static and Dynamic Endurance

Poor static trunk endurance is predictive of recurrent LBP and 1st time episodes.^{13,14} This is a test of multifidus and superficial erector spinae.¹⁴ Less than 60 seconds endurance places one at risk.

Simple test: Horizontal trunk extensor static endurance test. Positive result if patient cannot maintain horizontal position for at least 60 seconds.

Quadriceps weakness correlates with stoop lifting replacing squat lifting.¹⁵ Simple test: Repetitive squat endurance test. Positive result if patient cannot perform at least eight repetitions.

Multifidus atrophy

Unilateral, segmental atrophy of the multifidus occurs in acute LBP patients. It does not resolve spontaneously.¹⁶ Muscle recovery occurs following stabilization exercises

Measurable improvements of balance and static and dynamic endurance are possible without any high-tech equipment. All that is required is to gain the sufficient expertise in the skills of physical capacity testing. This is presently being taught in the LACC rehabilitation program by Dr. Steven Yeomans.

Training Approaches to Improve Stability

The goals of training are to improve balance, reaction time, coordination, static and dynamic endurance, and multifidus size. Neuromuscular facilitation techniques which promote coordination, proximal stability, balance control, and reaction speed are all incorporated into the training program. For endurance training, exercises at 40% of the maximum voluntary contraction ability are utilized during slow repetitions.

Each exercise should be performed in what Dennis Morgan has termed the "functional range."^{17,18} This is the range which is asymptomatic and stable for the task at hand. Specifically, this "functional range" will be coordinated, have a good center of rotation, and involve co-contraction of proximal postural agonist/antagonist muscles. Tools of value for training stability include balance boards and gymnastic balls.

Examples of stabilization training specific exercises for the multifidus might include: prone single leg extension, quadruped single leg extension, and superman exercises. Measurable increases in static back extensor endurance should be achieved by training the multifidus.

Spinal stabilization training is an inexpensive, time efficient method of bringing active care into your practice. Patient exercise manuals and 20 minute home exercise video routines have been created to ease the transition.¹⁹ A workbook with the measurable physical capacity tests described above is also available by S. Yeomans.¹⁹ There is no substitute for gaining the knowledge and skill to know how, when and why to give stabilization exercises. This is being taught by colleges such as LACC and CMCC which offer training in spinal stabilization care. At LACC a standard has been established so that the participant/teacher ratio for skills courses is maintained at no greater than 14:1.

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[IMAGE]

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