LOW BACK PAIN (LBP) is a major limiting factor among athletes. LBP impedes sports performance by disrupting normal movement patterns during activity and can cause prolonged absence from practice and competition. Although the etiology of LBP remains quite ambiguous, spinal instability has been identified as a possible cause. Spinal instability involves decreased spinal stiffness and excessive motion between loaded vertebrae, which usually results in pain. Fortunately, a minimal degree of trunk musculature tension is needed to maintain spinal stability and decrease pain; however, muscle contraction must be continuously maintained. An inability of the stabilizing muscles to contract for a long period of time can increase the risk of injury to the low back, which suggests that fatigue resistance is more important than strength.

There is abundant literature pertaining to the association between muscle endurance of the anterior and posterior trunk and its association with LBP. Even though the spine requires stabilization in all directions, the literature is sparse concerning the association of lateral trunk muscle endurance with LBP. Because a destabilizing force can come from any direction, endurance of the lateral trunk flexors on both sides is important. Bilateral asymmetry of fatigue resistance of the right and left lateral trunk flexors may present an elevated susceptibility to low back injury. Testing and training the lateral trunk flexors for overall endurance and bilateral asymmetry may be important for spinal stabilization and prevention of LBP.

Lateral Trunk Flexors

The lateral trunk flexors (Table 1) act unilaterally in the frontal plane to side-bend the trunk by pulling the rib cage toward the hip, and they act bilaterally to stabilize the spine. A large number of muscles act to laterally flex the trunk and thus play a significant role in spinal stability. McGill has shown that muscle activation is most pronounced in the lateral trunk flexors when an axial load is placed on the spine.

Lateral Trunk Flexor Endurance

Lack of muscle activation in any plane can result in movement between two adjacent vertebrae, which may result in overloading of static stabilizers and LBP. Because the combination of instability of a spine segment and poor endurance of the trunk musculature...
is a significant contributor to LBP, fatigue resistance in all planes of motion is essential. Cocontraction of numerous muscles is required to maintain spinal stability. The muscles surrounding the spine act like antenna guy-wires to increase the spine’s ability to withstand both compressive and tensile forces. If any one of the guy-wires is loosened, the structure will fail at a lower load level. McGill has suggested that the numerous spinal stabilizers act in synchrony to support the lumbar spine and that the performance capabilities of a given muscle must be in balance with those of the other dynamic stabilizers to achieve optimal spinal stability.

**Bilateral Asymmetry**

Bilateral asymmetry develops from single-sided repetitive loading that produces difference in endurance between the muscles on the right and left sides of the trunk. Any athlete in a sport involving single-side repetitive loading of the trunk (e.g., pitchers, quarterbacks, golfers, hockey forwards, soccer forwards, and bowlers) is at risk for development of LBP. Because these athletic positions require repetitive, single-side mechanical loading, adaptive changes occur on the dominant side that ultimate result in bilateral asymmetry. Postsurgical microdiscectomy patients also exhibit a high incidence of paraspinal muscle asymmetry. Whether the asymmetry is a cause or is a result of the injury and subsequent surgery is not known, its existence suggests that bilateral asymmetry needs to be evaluated and corrected.

If a lateral guy-wire is loosened on the opposite side of a tight lateral guy-wire, the supported structure would fail at a lower load than that which could be withstanded with both lateral guy-wires having the same level of tension. If muscles on one side of the trunk fail to produce the same amount of tension as those on the opposite side, the side that is weak and/ or lacks endurance will lack dynamic support. If the static support system of the spine (i.e., ligaments and discs) is required to resist a greater proportion of the load imposed on the weaker side, structural damage may result.

### Testing and Training the Lateral Trunk Flexors

A program for prevention or treatment of LBP should include testing and training of all trunk muscles. Exercises that are commonly used to test and train the lateral flexors include (a) lateral flexion on a back hyperextension machine, (b) standing side bends, (c) hanging hip hikes, and (d) side bridges. Only the side bridge and standing lateral flexion have been tested for effectiveness and safety. When examined through electromyography, the side bridge exercise had 3-4 times greater activation of the lateral flexors than standing side bends. Also, the side bridge exercise produced a relatively low spinal load of 2,585 N. The side bridge is a simple exercise to perform and no equipment is needed (Figure 1).

When conducting the side-bridge test the athlete lies on an exercise mat on his or her side with the legs extended. The elbow is placed directly under the shoulder and one foot is on top of the other foot. The contralateral arm should be positioned across the chest with the hand placed on the opposite shoulder. The hips are lifted off of the mat to maintain a straight alignment of the spine and lower extremities. The test should begin when the straight-alignment position is attained and should be terminated when a deviation from the position occurs. When testing fatigue resistance of the lateral trunk flexors, the side-bridge should be held until fatigue occurs. When training the lateral trunk flexors, the side-bridge position should be held for a shorter period of time, with repetitive performance of the exercise. The test should be terminated if pain is experienced, if the athlete cannot achieve the straight-alignment position, or a fatigued state has been reached.

### Table 1. Muscles and Their Corresponding Functions of the Trunk

<table>
<thead>
<tr>
<th>Flexors</th>
<th>Extensors</th>
<th>Lateral Flexors</th>
<th>Rotators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectus abdominus</td>
<td>Iliocostalis</td>
<td>Quadratus lumborum</td>
<td>External oblique</td>
</tr>
<tr>
<td>External oblique</td>
<td>Longissimus</td>
<td>External oblique</td>
<td>Internal oblique</td>
</tr>
<tr>
<td>Internal oblique</td>
<td>Spinalis</td>
<td>Internal oblique</td>
<td>Iliocostalis</td>
</tr>
<tr>
<td>Psoas major</td>
<td>Multifidus</td>
<td>Iliocostalis</td>
<td>Longissimus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Longissimus</td>
<td>Semispinalis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intertransversarii</td>
<td>Multifidus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rotatores</td>
</tr>
</tbody>
</table>
A minimum of five minutes of rest should be allowed before testing the opposite side. Normative performance ranges from 90 to 100 seconds for healthy males and 70 to 80 seconds for females. To assess bilateral symmetry, the dominant side hold-time should be divided by the nondominant side hold-time. A value greater than 1.05 or less than 0.95 indicates a significant degree of asymmetry. For example, a right side value of 90 seconds divided by a left side value of 85 seconds equals 1.06. Because these normative for side-bridge endurance were derived from a healthy general population, athletes may exhibit longer hold-times. The bilateral symmetry ratio should be similar, which may be a better indicator of dynamic spinal stability.

**Conclusion**

The lateral trunk flexors play a major role in dynamic spinal stabilization but are often overlooked when testing and training athletes for prevention of low back pain. A side-bridge exercise appears to provide the best method for testing and training fatigue resistance of the lateral trunk flexors.

**References**


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