

MCGILL'S TORSO MUSCULAR ENDURANCE TEST BATTERY PROTOCOL

TRUNK FLEXOR ENDURANCE TEST

The trunk flexor endurance test is the first in the battery of three tests that assesses muscular endurance of the trunk flexors (i.e., rectus abdominis, external and internal obliques, and transverse abdominis). It is a timed test involving a static, isometric contraction of the anterior muscles, stabilizing the spine until the individual exhibits fatigue and can no longer hold the assumed position. This test may not be suitable for individuals who suffer from low-back pain, have had recent back surgery, and/or are in the midst of an acute low-back flare-up.

Equipment:

- ▶ Stopwatch
- ▶ Board (or step)
- ▶ Strap (optional)

Pre-assessment procedure:

- ▶ After explaining the purpose of the flexor endurance test, describe the proper body position.
 - The starting position requires the client to be seated, with the hips and knees bent to 90 degrees, aligning the hips, knees, and second toe.
 - Instruct the client to fold his or her arms across the chest, touching each hand to the opposite shoulder, lean against a board positioned at a 50- to 60-degree incline, and keep the head in a neutral position.
 - It is important to ask the client to press the shoulders into the board and maintain this “open” position throughout the test after the board is removed.
 - Instruct the client to engage the abdominals to maintain a flat-to-neutral spine. The back should never be allowed to arch during the test.
 - The personal trainer can anchor the toes under a strap or manually stabilize the feet if necessary.
- ▶ The goal of the test is to hold this 50- to 60-degree position for as long as possible without the benefit of the back support.
- ▶ Encourage the client to practice this position prior to attempting the test.

Assessment protocol and administration:

- ▶ The personal trainer starts the stopwatch as he or she

moves the board about 4 inches (10 cm) back, while the client maintains the 50- to 60-degree, suspended position.

- ▶ Terminate the test when there is a noticeable change in the trunk position:
 - Watch for a deviation from the neutral spine (i.e., the shoulders rounding forward) or an increase in the low-back arch.
 - No part of the back should touch the back rest.
- ▶ Record the client's time on the testing form.

TRUNK LATERAL ENDURANCE TEST

The trunk lateral endurance test, also called the side-bridge test, assesses muscular endurance of the lateral core muscles (i.e., transverse abdominis, obliques, quadratus lumborum, and erector spinae). This timed test involves static, isometric contractions of the lateral muscles on each side of the trunk that stabilize the spine. This test may not be suitable for individuals with shoulder pain or weakness and who suffer from low-back pain, have had recent back surgery, and/or are in the midst of an acute low-back flare-up.

Equipment:

- ▶ Stopwatch
- ▶ Mat (optional)

Pre-assessment procedure:

- ▶ After explaining the purpose of this test, describe the proper body position.
 - The starting position requires the client to be on his or her side with extended legs, aligning the feet on top of each other or in a tandem position (heel-to-toe).
 - Have the client place the lower arm under the body and the upper arm on the side of the body.
 - When the client is ready, instruct him or her to assume a full side-bridge position, keeping both legs extended and the sides of the feet on the floor. The elbow of the lower arm should be positioned directly under the shoulder with the forearm facing out (the forearm can be placed palm down for balance and support) and the upper arm should be resting along the side of the body or across the chest to the opposite shoulder.
 - The hips should be elevated off the mat and the body should be in straight alignment (i.e., head, neck, torso,

hips, and legs). The torso should only be supported by the client's foot/feet and the elbow/forearm of the lower arm.

- › *Modification:* If a client is unable to support his or her body weight while balancing on the feet, an alternative is for the client to rest on the side of the lower leg with both knees bent in the hook-lying position, thereby shortening the lever of the legs and increasing the surface area on which to balance. If this modification is used, be sure to perform subsequent assessments in the modified position so that the results are comparable. Because the original test battery was not performed using this modification, the scoring and reliability of results will vary.

- ▶ The goal of the test is to hold this position for as long as possible. Once the client breaks the position, the test is terminated.
- ▶ Encourage the client to practice this position prior to attempting the test.

Assessment protocol and administration:

- ▶ The personal trainer starts the stopwatch as the client moves into the side-bridge position.
- ▶ Terminate the test when there is a noticeable change in the trunk position
 - A deviation from the neutral spine (i.e., the hips dropping downward)
 - The hips shifting forward or backward in an effort to maintain balance and stability
- ▶ Record the client's time on the testing form.
- ▶ Repeat the test on the opposite side and record this value on the testing form.

TRUNK EXTENSOR ENDURANCE TEST

The trunk extensor endurance test is generally used to assess muscular endurance of the torso extensor muscles (i.e., erector spinae and multifidi). This is a timed test involving a static, isometric contraction of the trunk extensor muscles that stabilize the spine. This test may not be suitable for a client with major strength deficiencies, where the individual cannot even lift the torso from a forward flexed position to a neutral position, a client with a high body mass, in which case it would be difficult for the personal trainer to support the client's suspended upper-body weight, and individuals who suffer from low-back pain, have had recent back surgery, and/or are in the midst of an acute low-back flare-up.

Equipment:

- ▶ Elevated, sturdy exam table
- ▶ Nylon strap
- ▶ Stopwatch

Pre-assessment procedure:

- ▶ After explaining the purpose of the test, explain the proper body position.
 - The starting position requires the client to be prone, positioning the iliac crests at the table edge while supporting the upper extremity on the arms, which are placed on the floor or on a riser.
 - While the client is supporting the weight of his or her upper body, anchor the client's lower legs to the table using a strap. If a strap is not used, the personal trainer will have to use his or her own body weight to stabilize the client's legs.
- ▶ The goal of the test is to hold a horizontal, prone position for as long as possible. Once the client falls below horizontal, the test is terminated.
- ▶ Encourage the client to practice this position prior to attempting the test.

Assessment protocol and administration:

- ▶ When ready, the client lifts/extends the torso until it is parallel to the floor with his or her arms crossed over the chest.
 - *Modification:* If a client is unable to support his or her body weight while hanging off the edge of a table, an alternative is for the client to lie prone on the floor and come into spinal extension, thereby eliminating the need for a table and strap (or for the personal trainer to hold the client's legs). The client should be instructed to keep the thighs in contact with the floor throughout the duration of the assessment. If this modification is used, be sure to perform subsequent assessments in the modified position so that the results are comparable. Because the original test battery was not performed using this modification, the scoring and reliability of results will vary.
- ▶ Start the stopwatch as soon as the client assumes this position.
- ▶ Terminate the test when the client can no longer maintain the position.
- ▶ Record the client's time on the testing form.

TOTAL TEST BATTERY INTERPRETATION

Each individual test in this testing battery is not a primary indicator of current or future back problems. Stuart McGill has shown that the relationships among the tests are more important indicators of muscle imbalances that can lead to back pain compared to looking at the individual results of each test because the torso extensors, flexors, and lateral musculature are involved in virtually all tasks. In fact, even in a person with little or no back pain, the ratios can still be off, suggesting that low-back pain may eventually occur without diligent attention to a solid core-conditioning program. McGill suggests the following ratios indicate balanced endurance among the muscle groups:

- ▶ Flexion:extension ratio should be less than 1.0
 - For example, a flexion score of 120 seconds and extension score of 150 seconds generates a ratio score of 0.80
- ▶ Right-side bridge (RSB):left-side bridge (LSB) scores should be no greater than 0.05 from a balanced score of 1.0 (i.e., 0.95 to 1.05)
 - For example, a RSB score of 88 seconds and an LSB

score of 92 seconds generates a ratio score of 0.96, which is within the 0.05 range from 1.0

- ▶ Side bridge (either side):extension ratio should be less than 0.75
 - For example, a RSB score of 88 seconds and an extension score of 150 seconds generates a ratio score of 0.59

Demonstrated deficiencies in these core functional assessments should be addressed during exercise programming as part of the foundational exercises for a client. The goal is to create ratios consistent with McGill's recommendations. Muscular endurance, more so than muscular strength or even range of motion, has been shown to be an accurate predictor of back health. Low-back stabilization exercises have the most benefit when performed daily. When working with clients with low-back dysfunction, it is prudent to include daily stabilization exercises in their home exercise plans. After completing all elements of McGill's torso muscular endurance test battery, personal trainers can use the figure below to record the client's data.

Date: _____

<p>Trunk flexor endurance test</p> <p>Time to completion: _____</p>
<p>Trunk lateral endurance test</p> <p>Right side time to completion: _____ Left side time to completion: _____</p>
<p>Trunk extensor endurance test</p> <p>Time to completion: _____</p>

Ratio of Comparison	Criteria for Good Relationship Between Muscles
Flexion:extension	Ratio less than 1.0
Right-side bridge:left-side bridge	Scores should be no greater than 0.05 from a balanced score of 1.0
Side bridge (each side):extension	Ratio less than 0.75

Flexion:extension ratio: _____ Rating: <input type="checkbox"/> Good <input type="checkbox"/> Poor
Right-side bridge:left-side bridge ratio: _____ Rating: <input type="checkbox"/> Good <input type="checkbox"/> Poor
Side-bridge (each side):extension ratio: _____ Rating: <input type="checkbox"/> Good <input type="checkbox"/> Poor