The Psoas and Iliacus: Functional Testing

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The psoas has segmental attachments posteriorly to all lumbar transverse processes, anteriorly at all lumbar vertebral bodies and to all lumbar discs except L5-S1 disc.\textsuperscript{1,2} Fibers that attach on the transverse processes are named the posterior fasciculi fibers. They range from approximately 3-5 cm in length. The fascicles that attach to the discs and bodies are called anterior. They are approximately 3-8 cm in length. The fascicles run inferolaterally to reach a central tendon, where they descend over the pelvic brim as it passes deep into the inguinal ligament and anterior to the capsule of the hip joint, sharing a common insertion with iliacus to the lesser trochanter of the femur.\textsuperscript{3} The tendon is separated from the pubis and the hip joint by a subtendinous iliac bursa. Along the pelvic brim, the lateral fibers of the iliacus and the fibers of the psoas come together. This is referred to as the conjoint tendon of the psoas major and the iliacus. Because the psoas muscle attaches to the anterior portion of the transverse processes of all lumbar vertebra and intervertebral discs, it can contribute to mechanical lumbo-pelvic-hip dysfunction and pain.

Proximally, fibers of the diaphragm and psoas are inter-related. The diaphragm’s medial arcuate ligament is a tendinous arch in the fascia of the psoas major. Distally, the psoas fascia is continuous with the pelvic floor fascia, especially the pubococcygeus.\textsuperscript{2}

Based on his anatomic studies, Bogduk does not believe the attachment of the psoas muscle has a long enough level to act as a prime flexor of the lumbar spine. Bogduk’s analysis indicates that in the standing erect posture the psoas exerts an extensor moment on the upper lumbar spine and a flexor moment on the lower segments. The major forces acting on the lumbar spine are compression and anterior shear forces. The psoas has a primary stability role at the lumbar spine for axial compression and it has minimal movement function on the lumbar spine.\textsuperscript{4}
Local Stability Function

Muscle stiffness to control segmental translation.
No or minimal length change in function movements.
Anticipatory recruitment prior to functional loading provides protective stiffness.
Activity is continuous and independent of the direction of movement.

Local Stability Dysfunction

Uncontrolled segmental translation.
Segmental change within cross-sectional area.
Altered pattern of low threshold recruitment.
Motor recruitment timing deficit.

In 1998, Dangaria and Naesh demonstrated that there is a significant decrease in the cross-sectional area of the psoas at a segmental level in patients with sciatica. The study determined there is an association between wasting of psoas and multifidus muscles observed on MRI scans in patients presenting with unilateral low back pain.

They took 50 consecutive patients presenting to a back pain triage clinic with unilateral low back pain lasting more than 12 weeks. They found the cross-section area of the psoas major was ipsilaterally decreased in unilateral lumbar-disc herniation. The reduction in the cross-section area (CSA) is positively correlated with the duration of continuous sciatica, rating of pain, self-reported function and the presence of neural compression.\(^7\)

The results and data analysis compared the CSA between the symptomatic and asymptomatic sides. There was a statistically significant difference in the CSA between the sides. There was a positive correlation between the percentage decrease in CSA of the psoas on the affected side and with the rating of pain, reported nerve root compression and the duration of symptoms. Hodges also had reported on an association between decrease in the CSA of multifidus and the duration of symptoms.

Atrophy of multifidus has been used as one of the rationales for spine-stabilization exercises. They concluded the evidence of coexisting atrophy of the psoas and multifidus suggests that a future area for study should be selective exercise training of the psoas.

**Exercises:** Clients who do not suffer from an isolated psoas or iliacus muscle with a local stability dysfunction (meaning the muscle is allowing joint instability) can perform the following bodyweight exercises:
- Perform sit-ups with the hips and knees flexed. The iliopsoas participates as strongly during sit-ups with the hips and knees flexed as when they are extended.
- Perform push-ups. The psoas is activated more than the abdominals during push-ups.
- Seated hip flexion. Maximum activity of the psoas occurs with resisted hip flexion. This maneuver can be performed with the use of resistance bands (seated or supine).

Also, make sure the client maintains a neutral lumbar spine. However, if compression and shear are the sources of your client’s pain, avoidance of these three exercises is necessary. Selective exercise training, described as low-load exercises would be indicated.

Yoshio, et al., concluded that the primary role of the psoas major was for lumbar stability and that the psoas major contributed very little to hip flexion. He explained that the primary role for the psoas major is at the hip for stability. This was achieved through maintaining the femoral head in the acetabulum. The psoas can be said to be clinically deficient if it fails to segmentally hold the vertebrae in place at the level of pain in patients who have segmental lumbar dysfunction (hypermobile segments).

Low-load exercise facilitation of psoas is directed to the spinal neutral postures and segmental axial compression and spinal rotatory control, not hip flexion movements. Specific segmental psoas facilitation will improve lumbar segmental control.

**Action of psoas:** The local stability role of psoas is to longitudinally pull the head of the femur into the acetabulum, with the spine fixed and supported in neutral alignment to produce axial compression along its line of pull.

**Training of psoas:** This can be practiced side-lying, incline sitting, supine, prone or standing; for example, while supine with the lumbar lordosis passively supported in neutral by the patient’s hands, a folded towel and the legs comfortably apart. If side-lying (with the dysfunctional side up), both legs are flexed with the spine and pelvis in neutral alignment in terms of tilt and rotation. The top leg is supported horizontal, with the spine, pelvis and upper trunk all neutral. Have the client shorten the leg or "pull the hip into the socket" or "suck the hip into the socket." This will create a barely perceptible movement and yet will be felt by the client. This can be performed for 10-second holds and 10 repetitions.

**Testing of the iliacus and hip capsule:** Have the client stand against a wall, with heels (feet) apart, and shoulders and head touching the wall. Normal is the ability to posterior tilt to touch the small of the back.
against the wall. If the client cannot posterior tilt by flattening their back onto the wall with the feet apart and the hips and knees straight, but can do so with knees bent and the hip flexed, the restriction could be shortened iliacus or the anterior hip capsule. By bending the knees and unlocking the hips, this unloads the tension from the iliacus and the anterior hip capsule and allows the pelvis to posterior tilt.

**Iliacus/hip capsule correction:** The abdominal and gluteal muscles are contracted to posterior tilt the pelvis and flatten the back onto the wall. While maintaining the posterior tilt and flat-back position, the knees are slowly straightened (hips extended) to slide the body up the wall.

At the point that the back cannot be held on the wall, cease sliding up and actively restabilize onto the wall. Hold this position for 20 to 30 seconds, and repeat the maneuver three to five times. To isolate the right or left side of a weak iliacus muscle, ask the client to raise one leg at a time while maintaining a flat back against the wall. If an asymmetry exists, spend time on the weaker side.

Clinical application to this information is that the "overhead bilateral arm pull" test, as used in the Sacro-Occipital Technique (SOT) to test for a short or tight psoas, does not often correlate to the modified Thomas test.

Hip flexor muscle-length tests are performed by using the modified Thomas test.

**Test:** Patient is supine, with buttocks at the end of the table. The patient flexes one knee and holds the knee to the chest with both arms. The free leg hangs down to the floor. The position of the lumbar spine is flat on the table, not arching into extension or flexion.

**Observe:** If the patient has tight hip flexors, the thigh/hip will rest in some flexion or the lumbar spine will extend to allow the leg to rest on the bed. The modified Thomas test assesses the hip flexors, rectus femoris, quads and ITB muscle lengths. Patient is in the same position as the Thomas test, but should start by standing at the end of the bed and roll back onto it with one knee held to the chest while the other leg dangles off the end of the bed. Check that the lumbar spine is not extended.

Observe the degree of the hip flexion. If above neutral, either hip flexors or rectus femoris are tight. To differentiate, ask the patient to extend their knee. If it falls into more hip extension, the rectus femoris is tight. Also observe for increased tautness in the rectus femoris.
Check relative position of abduction/adduction at the hip and observe lateral structures. The thigh should lie in the neutral position, as if the client was standing. An abducted position indicates that ITB could be tight. On visual analysis, the ITB may present a groove in the lateral thigh. This would support overactive/tight ITB findings.

Check the knee flexion. Ask the patient to flex their knee further. A normal muscle length in quads will allow 90 degrees or more of knee flexion in this position. Watch for compensatory hip flexion. Tibial position also can indicate tightness in the ITB, especially in the distal components. It will be in external rotation if tight. Check the position of the tibial tubercle.

Another take-home value from this article: The supine straight-leg raise used for nerve tension signs also is affected by iliopsoas activity.

**Test:** Patient performs an active straight-leg raise test (utilizing hip-flexor muscles). Positive for neural tension is radicular pain into the leg before 60 degrees of hip flexion.

**Retest:** At the point of symptoms, the therapist supports the weight of the patient’s lower extremity while instructing the patient to totally relax their musculature. If the symptoms are alleviated or eliminated, this finding suggests the problem is the effect of shear or compression on the spine from the contraction of the hip flexors and not a true entrapment of the nerve (tethered nerve).

**References**

6. Barker KL, Shamley DR, Jackson D. Changes in the cross-sectional area of multifidus and psoas in


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