



Key Movement Patterns: Assessment & Management

This protocol is based primarily on work done by the Czech neurologist, Vladimir Janda. It describes how to analyze specific movement patterns in order to identify biomechanical problems, such as muscle imbalances, which may have caused or contributed to a patient's pain or injury. These assessments can also be used to guide physical rehabilitation or to identify possible risk factors for future injury. In order to properly use these procedures, an adequate background understanding is necessary.

Structure vs. Function

Janda observed that in manual medicine there are two principle approaches to the treatment of musculoskeletal lesions. The first is from a structural point of view. This method utilizes examination procedures such as orthopedic testing, imaging and surgical exploration to identify or visualize damaged structures, such as muscles, ligaments or bones. These structures are then repaired through immobilization, surgery or rehabilitation. The utility of identifying and repairing structural lesions is well documented in the literature and is the foundation of medical education and practice. In the UWS 4-part diagnosis model, this structural assessment is referred to as the *pathoanatomical* diagnosis and is usually the primary diagnosis (e.g., disc herniation, sprain, strain, fracture).

The second approach is from a functional point of view. In cases where diagnostic testing is inconclusive or the structural approach to treatment is not curative, a functional problem may be the cause of the lesion. Even in cases where a structural injury has occurred, a functional deficiency may have predisposed the person to that injury. Functional pathology is defined as impairment in the ability of a structure or physiological system to perform its job. In the musculoskeletal system this type of impairment often manifests through reflexive changes and altered biomechanics and is often not as easy to diagnose and treat. It requires a different method of thinking and observation. Rather than relying on visualization of damaged structures, a clinician must understand the complex interactions of structures within systems. Functional abnormalities are identified, in part, through observation of specific movement patterns and are treated with manual therapy and corrective exercises. This functional approach allows clinicians to better understand the cause of the lesion rather than simply focusing on the lesion itself. In the UWS 4-part diagnosis model, this functional assessment is referred to as a complicating or contributing factor (e.g., inhibited deep cervical flexors, poor motor control, upper cross syndrome), and is attached as the last part of the diagnostic statement.

Example:

Shoulder impingement syndrome complicated by poor scapular stability.

Neither assessment approach is necessarily better than the other. In fact, in many cases both approaches should be taken in order to achieve the best outcome since both structure and function are involved. In this type of case the structural lesion is treated and, as soon as it is appropriate, functional assessment and corrective exercise are used to identify and treat the functional problem.

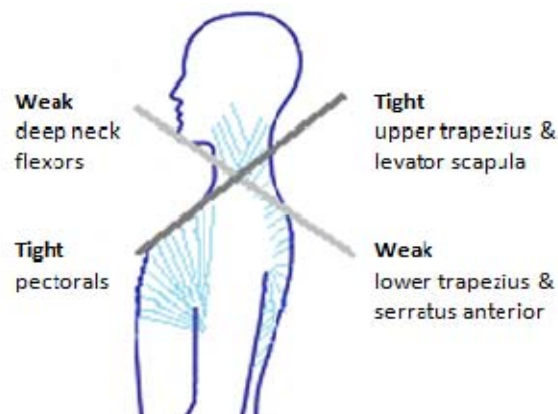
Muscle Imbalance

Muscle imbalance is a lack of equality, or an optimal ratio, of muscle length or strength between agonist(s) and antagonist(s). It can also refer to a lack of equality between muscles or muscle groups from one side of the body to the other, for example the right quadriceps being stronger than the left quadriceps. This lack of equality alters joint mechanics and is thought to be one of the causes of abnormal movement patterns and joint dysfunction.

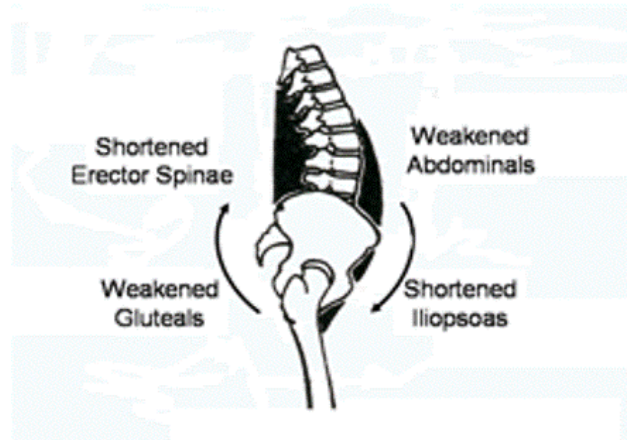
Muscle imbalance is generally thought to be the result of two possible causes: 1) repetitive movements and sustained postures (causing a mechanical overload) and 2) an error in the neurological programming. A programming error can result in functional changes based partly on a predisposition in certain muscle groups to become either short and tight (and sometimes weak as a result) or weak and inhibited. These changes in programming can lead to various degrees of functional instability. Since the causes can vary, a clinician needs to be aware of a patient's everyday activities, be able to recognize both static and dynamic postural abnormalities, and also be aware of muscle groups that may be predisposed to imbalance. Knowing the likely causes of the muscle imbalance will help guide corrective exercise and activity modification if abnormal movement patterns are observed.

Evaluation of Muscle Imbalance

In screening for muscle imbalance a clinician must look for both tight, shortened/over facilitated muscles and weak/inhibited muscles. Janda described two common patterns of muscle imbalance. The first pattern is what he called the **upper crossed syndrome** (AKA proximal crossed syndrome, shoulder crossed syndrome). It is characterized by tightness of the cervical extensors (levator scapulae, upper trapezius, suboccipitals) and pectoralis muscles. Other tight muscles to look for (although not always strictly considered part of the upper crossed syndrome) include the sternocleidomastoid muscles as well as the upper extremity flexors (biceps, brachialis, brachioradialis). Inhibited muscles include the deep cervical flexors, the middle and lower trapezius, and serratus anterior. In addition, the upper extremity extensors may be inhibited. The scalenes are frequently both weak and hypertonic as a result of forward head posture.



The second pattern is referred to as the **lower crossed syndrome** (AKA distal crossed syndrome, pelvic crossed syndrome). It is characterized by tightness of the hip flexors and spinal erector muscles along with weakness or inhibition of the gluteus maximus and abdominal muscles. Other associated tight muscles may include the hip adductors, hamstrings and gastrosoleus muscles. Other muscles in the lower extremity that are thought to have a tendency to inhibition include the vastus medialis obliquus and tibialis anterior (Janda 2007, Janda 1987).



Confirmation of muscle tightness/over facilitation* is assessed primarily through muscle length testing (i.e. diagnostic stretching noting range of motion, degree of resistance, and quality of end feel), and to a lesser degree direct palpation.

The evaluation for weak or inhibited muscles** is more complicated. Since production of movement comes from a group of muscles that combine together to create the movement, traditional methods of strength testing of individual muscles does not always provide sufficient or reliable information as to which muscles are inhibited. Evaluating the quality of movement (e.g., by observing key movement patterns) may provide better, or at least additional, information. Traditional isometric manual muscle tests are crude procedures that may not detect weakness even when significant weakness is present. Finally, a muscle may test strong but still display delayed contraction or other motor control issues. Focusing on the quality and not just the strength of a muscle test may be helpful. An inhibited muscle may demonstrate a brief delay before it “locks” into grade 5 resistance with a lower force muscle. Poor quality and control of movement can produce and/or perpetuate adverse stresses on joints and muscles (Murphy 2006). Although movement patterns can differ somewhat between individuals, typical normal and abnormal patterns have been postulated.

Janda described six basic movement patterns which can provide useful overall information about the quality of movement of an individual. They include **Hip Extension, Hip Abduction, Trunk Curl-up, Push-up, Cervical Flexion, and Shoulder Abduction.**

* In the context of this protocol muscle **tightness** refers to possible connective tissue shortening (e.g., forward head carriage associated with tight pectoralis muscles) while **overactive** refers to a muscle that contracts with inappropriate timing or to an inappropriate degree for the movement observed (e.g., leading to shoulder hiking when abducting the upper extremity).

** In the context of this protocol, muscle **weakness** refers to the muscle’s inability to generate appropriate force. If sufficiently weak, the weakness may be detected with standard muscle testing procedures. An inhibited muscle may test strong, but is “inhibited” in its timing or speed of contraction.

Before You Start

Some basic guidelines should be followed when performing these tests. Although there are many ways to perform these specific movement patterns, the purpose of this document is to standardize a baseline approach so that outcomes can be compared between practitioners.

1. They should not be done on patients in the acute stage of injury or during a peak episode. Patients in acute pain are likely to display temporary antalgic patterns rather than more habitual muscle imbalances. The purpose of these assessments is not to identify painful motions, but rather identify aberrant motor patterns, reflecting altered interplay between agonists and stabilizers (e.g., upper trapezius and lower trapezius) or agonists and their synergists (e.g., gluteus medius and TFL). In some instances capsular changes or blockages within the joint itself may contribute to the aberrant pattern.
2. In order to get more complete information, an evaluation of posture and gait should be performed prior to testing. It may also be useful to know if the joint or muscle has had a prior injury which might affect the movement pattern.
3. The area of evaluation should be adequately exposed to allow for proper observation.
4. Movement pattern testing should be done with minimal verbal cues in order to accurately test an individual's *habitual* way of performing the movement. If cues are too leading, it becomes a test of the individual's ability to learn how to follow instructions rather than how the individual habitually performs it. Once the habitual movement has been observed, however, one option is to ask the patient to perform the movement again, this time drawing their attention to the aberrant pattern and asking them to consciously correct it. Inability to do so suggests a more difficult case.
5. Interpreting aberrant movement patterns is often range-dependent (e.g., first 20° of hip extension, first 45° of hip abduction, first 60° of shoulder abduction).
6. One useful option is for the patient to perform the movement over three or more trials. Another option is to first have the patient perform the movement at their own chosen speed, and then repeat more slowly to allow the practitioner to observe the movement more clearly.
7. The clinician should observe both sides for comparison when applicable.
8. Muscle or limb trembling during the movement is considered a positive finding, indicating weakness or fatigue.
9. The practitioner may use changes in movement patterns as an outcome measure (although the responsiveness of these tests has not been studied).

Rehabilitation strategy

There is no evidence-based, best practice approach available for correcting a muscle imbalance. However, there are some expert-based strategies.

The overall rehabilitation strategy, in part, targets inhibited/ weak muscles by removing potential inhibitors and then retraining the muscle. Short, tight, overactive muscles are generally addressed by muscle relaxation procedures (e.g., PIR, MET, foam roller) or muscle stretching procedures (e.g., hold relax, pin and stretch).

Movement inhibition requires a more complex approach. 1) The aberrant movement may be associated with mechanical blockage of the joints directly involved in the movement pattern or by reflex inhibition associated with joint dysfunction affecting agonists. In these cases, joint manipulation may be indicated. 2) Muscle inhibition is also thought to be associated with the presence of myofascial trigger points in the agonists themselves (e.g., gluteus maximus inhibition may be secondary to trigger points in the gluteus maximus) (Simons 1999). A variety of trigger point therapies may be applied to the weak/inhibited muscle. 3) Muscle inhibition has also been reported to be associated with tight/overactive antagonists. A common treatment approach would be muscle relaxation or stretching techniques applied to the antagonist (e.g., stretching the adductors in patients with inhibited gluteus medius).

If these active treatments restore the movement pattern, no further correction may be necessary. However, the weak agonist may require additional training to restore motor control, endurance and strength. A convenient mnemonic, ACE, is used in this protocol to outline the steps in this phase of rehabilitation.

A = Activation. Activate the muscle by various goading techniques and verbal and tactile cues to make the patient consciously aware of the muscle that needs to be re-trained.

C = Control. Prescribe an exercise requiring the patient to use the muscle, placing great emphasis on motor control and repeating the motion with good form, avoiding recruitment.

E = Endurance. Begin increasing repetitions to build endurance and increasing resistance or difficulty to build strength and further augment control.

Hip Extension Movement Pattern

For a video demonstrating this key movement, click: [Hip Extension Movement Pattern](#)

This test is indicated for patients with low back pain. It has also been suggested that deficiencies in movement patterns and motor regulation play a major role in causing musculoskeletal dysfunction, so it has also been used as a tool to evaluate a patient's risk of developing future low back pain or other musculoskeletal dysfunction. Ankle sprains and neck pain have also been described as indications for this test (Janda 2007). In the case of ankle sprains, it has been suggested that the gluteus maximus may become inhibited (therefore affecting the movement pattern). In the case of neck pain, this movement pattern is used to assess the potential contribution of faulty low back function to increasing the load penalty on the cervical joints. For example, suboptimal hip extension may result in compensatory contracting of cervical muscle groups and contribute to neck or shoulder symptoms.

Procedure

The patient lies prone with the arms at the sides and the feet hanging off the end of the table to allow for neutral leg rotation. The head is in a neutral position. The patient is asked to lift the leg toward the ceiling. The practitioner can have the patient repeat this movement, raising his/her leg more slowly about 6 inches off of the table to allow for easier detection of early recruitment or aberrant patterns.



Interpretation

It is thought that deviations in the lumbar spine, as well as recruitment of upper back musculature during prone hip extension are signs of impaired motor control or functional instability in the lumbar spine (Murphy 2006). It also may be associated with poor or delayed gluteus maximus contraction.

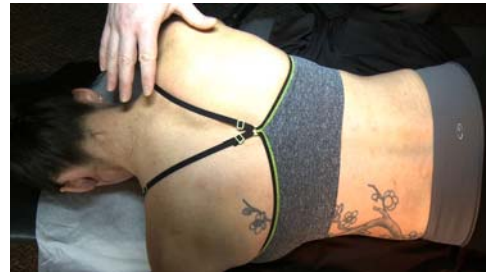
Indications of an abnormal movement pattern would include trembling **during the first 20 degrees of movement**, decreased extension range of motion, early hyperlordosis, lateral or rotational deviations of the lumbar spine, recruitment of upper back/cervical musculature, and an inability to maintain extension of the knee. Rotation of the lumbar spinous processes toward the side of hip extension, lateral shift of the lumbar spine toward the side of hip extension and extension of the lumbar spine/anterior pelvic tilt are the most common deviations described (Murphy 2006). Inability to maintain knee extension during the test would indicate that the hamstrings are predominating over the gluteus maximus (Janda 2007). Decreased hip extension range of motion may indicate tight hip flexors or hip joint dysfunction.

INTERPRETATION SUMMARY

Faulty movement	Interpretation	Correlate with
Trembling Early hyperlordosis Lateral or rotational deviation pelvis/lumbar spine	Possible functional instability	Other signs of instability (e.g., prone instability test, instability catch, ASLR (Vleeming's), other signs of poor motor control)
Decreased hip extension	Possible inhibited g max	Muscle test <ul style="list-style-type: none"> Gluteus maximus lurch during gait Genu valgum during one leg squat
Early knee flexion	Tight/overactive hamstrings	SLR
Upper back/cervical muscle contraction	Possible functional instability and overactive cervical muscles (e.g., upper trapezius, levator scapula)	Length testing of upper trapezius and levator scapula, shoulder abduction movement pattern



Knee flexion suggesting overactive hamstrings



Overactive upper trapezius/levator scapula

Historical Perspective- The original interpretation of this test focused on a proposed activation pattern of the involved muscles: hamstrings, gluteus maximus and erector spinae. Some authors even describe lightly palpating these muscles during the test in order to assess the pattern of activation (Reinman 2009). Janda suggested that a normal pattern of activation is hamstrings followed by gluteus maximus followed by the contralateral erector spinae followed by the ipsilateral erector spinae, but also taught that the clinician should observe for deviations in the lumbar spine, indicating overactive low back musculature (Janda 2007). Although some practitioners continue to subscribe to this interpretation (Janda 2007, Reinman 2009) recent evidence suggests that the proposed pattern is not valid. Many of the early adapters have consequently abandoned assessing the exact sequence of muscle firing (Janda 2007, Murphy 2006).

Correlate with the Following Observations

- Decreased gluteus maximus bulk and a lower gluteal fold (suggesting atrophy and inhibition)
- Increased hamstring bulk (which may be associated with increased tightness)
- Observation of horizontal grooves or creases across the lumbar paraspinal muscles (thought to suggest multifidus atrophy and potential local segmental instability)
- Anterior pelvic tilt (perhaps signaling tight low back extensors and hip flexors)
- Increased or asymmetrical paraspinal bulk in the thoracolumbar region or lumbosacral instability (signaling possible extensor tightness) (Liebenson 2007)
- Decreased hip extension (i.e., trailing limb posture) at terminal stance during gait (suggesting inhibited gluteus maximus)

Rationale and Evidence

It has been theorized that this test simulates hip extension during the terminal stance of gait (Janda 2007), therefore providing information about muscular function in the lumbopelvic region during a person's daily activities. In patients with low back pain, it has been shown that there are differences in the motor control of the lumbopelvic musculature (Bruno 2007, Hodges 2001, Hodges 1999, Hodges 1998, Hodges 1996, Hungerford 2003, Leinonen 2001, Newcomer 2002, O'Sullivan 1997, Silfies 2005) suggesting that improper and inefficient motor control may serve as a perpetuating factor in these patients.

Murphy et al found good interexaminer reliability ($k = 0.72$ for left leg and 0.76 for right leg) in detecting deviations of the lumbar spine during the prone hip extension test (e.g., hyperlordosing lumbar, pelvic rotation) (Murphy 2006).

On the other hand, in a recent review of the literature regarding muscle activation patterns during the prone hip extension test, the only consistent finding in individuals both with and without low back pain was that the gluteus maximus is generally the last muscle to activate. There were no other consistent activation patterns observed. In patients with low back pain, altered lumbopelvic kinematics, or ankle sprain, the gluteus maximus was significantly delayed compared to control groups, suggesting that the timing of gluteus maximus activation may be an important indicator of motor control during hip extension (Jarosz 2010). Although this may be the case, these findings were from electromyographic studies. Interexaminer reliability for assessment of muscle activation patterns through palpation or observation has not been tested.

Corrective Strategies

There is no evidence-based, best practice approach available to correcting this muscle imbalance. However, there are some expert-based strategies.

1. Remove potential causes of inhibition

- **Joint Manipulation.** The thoracolumbar junction, lumbar spine and sacroiliac and hip joints should be evaluated and adjusted/mobilized as needed.
- **Stretching/relaxation techniques.** Restoration of muscle balance and proper motor control may require stretching/relaxing of the hip flexors and hamstrings if they are found to be tight.
- **Trigger point therapy.** Regional musculature (starting with gluteus maximus) should be evaluated for trigger points and treated accordingly.

2. The ACE approach: Activate, teach control, build endurance

Activate

- **Contracting the muscle.** In patients with low back pain, motor relearning of inhibited muscles may be more important than strengthening (Akuthota 2004); therefore, having the patient perform repetitive prone or side lying hip extension as an exercise to “groove” a motor pattern may be beneficial. In such cases emphasis is placed on quality of movement and patients are warned to stop the exercise when they fatigue, begin to shake, or break form. Training options include inserting a pillow under the abdomen initially or having the patient palpate and monitor their extensor muscles while performing hip extension in an effort to minimize the contraction compared to the gluteus maximus. Another option is to stabilize the spine using abdominal hollowing (as opposed to abdominal bracing) while performing the exercise. Studies have shown a decrease in anterior pelvic tilt and an increase in gluteus maximus activity when using abdominal hollowing during prone hip extension (Oh 2007, Chance-Larsen 2009).

Control

- **Sensory-motor training** should also be included in the program, especially single leg stands. It is interesting to note that Janda’s own approach would forego specific exercise tracks and, after stretching tight muscles and facilitating inhibited muscles in the lower crossed syndrome, immediately proceed to balance pad/board activities as the main stay of the exercise component.



*“Grooving” a pattern is based on the concept that careful repetition while maintaining a strict form can re-train neural pathways governing a particular motion.

Endurance and strength

- A general lumbar stabilization program should be initiated. (See CSPE Protocol: [Low Back Rehabilitation](#)). If indicated, exercises should be emphasized which aid in the facilitation and strengthening of the gluteus maximus. These exercises include quadruped and bridge tracks, progressing to single leg squats and lunges. Both concentric and eccentric contractions should be emphasized. (See CSPE Protocol: [Low Back Rehabilitation](#), Appendix IV.)

Hip Abduction Movement Pattern

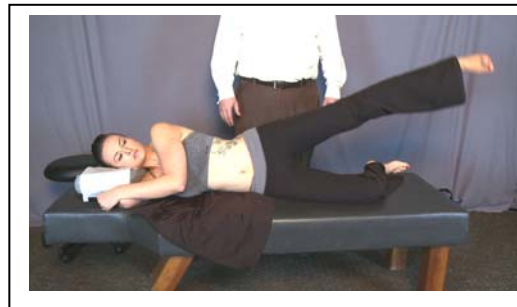
For a video demonstrating this key movement, click: [Hip Abduction Movement Pattern](#)

The hip abduction movement pattern test is indicated for individuals with chronic or subacute back pain, particularly those who develop back pain with prolonged standing (Nelson-Wong 2009). In addition, several studies have shown lack of motor control of the hip in the frontal plane to be associated with anterior and lateral knee pain (Ireland 2003, Powers 2003, Fredericson 2000).

Procedure

The patient is side lying with the bottom leg in a flexed position and the top leg extended in a neutral position in line with the trunk. The pelvis is perpendicular to the table without any obvious pelvic rotation. The patient is instructed to lift the leg toward the ceiling (Janda 2007, Page 2010).

Optional procedures: The practitioner may ask the patient to repeat the movement multiple times to confirm any abnormality and to see if it becomes more pronounced with fatigue. Additionally, the patient may be asked to correct the abnormal movement to see how much is habitual and how much may be secondary to significant muscle imbalance.



Interpretation

An abnormal movement pattern seen **within the first 45 degrees of abduction** would include cephalad shift of the pelvis at the initiation of movement, hip flexion/extension or external rotation, rotation of the pelvis, or decreased abduction range of motion.

INTERPRETATION SUMMARY

Faulty movement	Inhibited/weak	Overactive/tight
Cephalad shift of the pelvis at the initiation of movement (first 45 degrees)	gluteus medius	quadratus lumborum
Hip flexion	gluteus medius	TFL
Hip extension (sometimes combined with external rotation)	gluteus medius	piriformis
Limited abduction	gluteus medius	adductors
Pelvic rotation	gluteus medius	TFL - (better line of pull for overactive TFL)



Correlate with the Following Observations

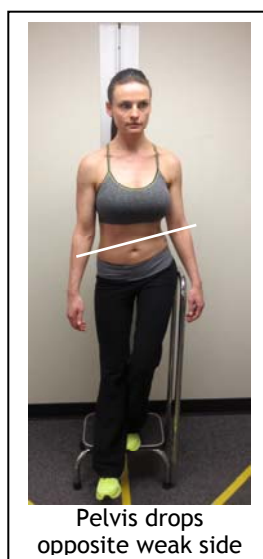
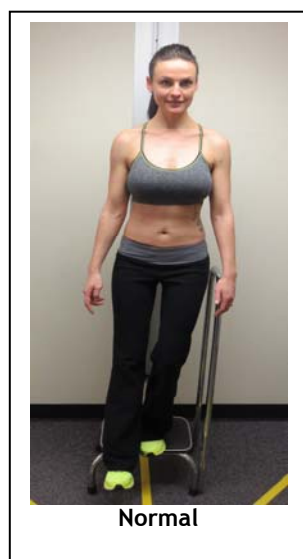
Low Back

The practitioner may also look for specific indicators that could trigger application of the test and correlate with results.

- Hip hiking observed during gait or myofascial trigger points found in the quadratus lumborum (indicating possible compensation for weak hip abductors)
- Increased lateral shift or rotation of the pelvis during gait (indicating a possible lack of motor control or muscle imbalance)
- Lateral shift of the pelvis, genu valgum or Trendelenburg sign on a single leg stance (Janda 2007), single leg squat or lunge, indicating hip abductor weakness

Hip and knee

Poor motor control during a step down test (e.g., lateral flexion of the torso toward the ipsilateral side), pelvic drop on the contralateral side, valgus collapse of the knee on the ipsilateral side.



Rationale and Evidence

During the loading response phase of the gait cycle, the gluteus medius, gluteus minimus, TFL, and the upper fibers of the gluteus maximus contract eccentrically to stabilize the pelvis in the frontal plane. This counteracts adduction forces preventing hip drop and lateral shift of the pelvis (Page 2010). The hip abduction test gives information about the quality of lateral muscular pelvic brace and thus indirectly about the stabilization of the pelvis during gait. Alterations in the normal movement pattern can lead to excessive stresses in the lumbosacral and hip joints during standing and gait and can alter joint mechanics throughout the lower extremity leading to increased stresses in those joints as well (Janda 2007, Page 2010). Nelson-Wong et al found the hip abduction test to be a good predictor of individuals at risk for developing low back pain with prolonged standing (Nelson-Wong 2009).

Various studies have found decreased knee pain and increased function after hip abductor strengthening (Ferber 2011, Sled 2010, Beers 2008), suggesting that hip abductor weakness may be a common contributing factor in patients with knee pain. For example, patellofemoral knee rehabilitation programs that targeted hip abductors have shown improved results over programs that limited exercises to the quadriceps and hamstrings (Fukuda 2011, Dolak 2011, Tyler 2006).

Davis et al found good interrater (ICC=0.70 (95% confidence interval [CI]: 0.56, 0.84) and 0.59 (95% CI: 0.43, 0.76) and intrarater (ICC=0.74 on average) reliability for the active hip abduction test (Davis 2011).

Corrective Strategies

There is no evidence-based, best practice approach available to correcting this muscle imbalance. However, there are some expert-based strategies.

1. Remove potential causes of inhibition

- **Joint manipulation.** The thoracolumbar junction and lumbar spine and the sacroiliac and hip joints should be evaluated and adjusted/mobilized as needed. Particularly in the case of lower extremity pain, the knee and ankle/foot joints should also be evaluated and adjusted/mobilized as needed.
- **Trigger point therapy.** Regional musculature (starting with gluteus medius) should be evaluated for trigger points and treated accordingly.
- **Stretching/relaxation techniques.** Restoration of muscle balance can begin with stretching/relaxing of the quadratus lumborum, TFL, piriformis and hip adductor muscles if they are found to be tight. PIR or CRAC may be used to address these tight overactive muscles (e.g., piriformis, TFL, QL).

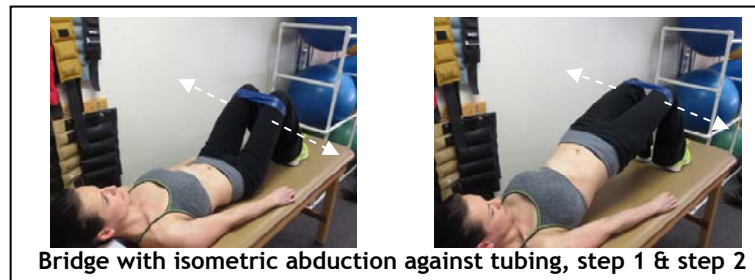
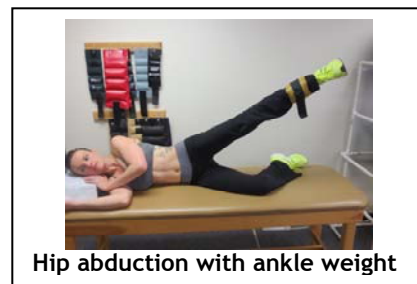
2. The ACE approach: Activate, teach control, build endurance

Activate

- **Clam and open chain.** Exercise should first focus on activation of the gluteus medius. It is generally best to begin with an open chain, non-weight bearing exercises (e.g., clam exercise). Sahrmann suggests that if the patient has significant weakness of the gluteus medius, hip abduction exercises can be done in the prone position to reduce the force of gravity (Sahrmann 2002). Both concentric and eccentric contractions should be incorporated, when possible

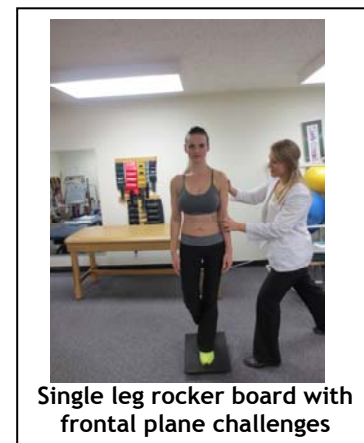
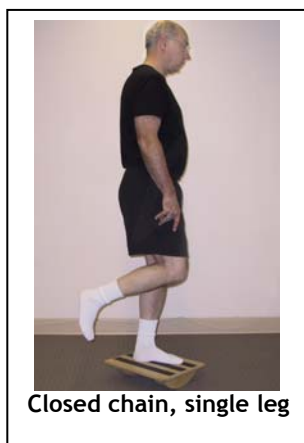
emphasizing concentric contractions at first. It is theorized that this exercise strengthens the posterior gluteus medius fibers more specifically (Sahrmann 2002).

Examples of open chain exercises for the hip abductors



Control

- **Single leg stands and lunges.** Single leg exercises not only increase the the overall demand on the muscle, but they also incorporate a motor control element. They should at first be performed on a stable surface. Sensory-motor training should also be included in the program, especially single leg stands on balance pads, rockers boards or similar equipment. While on a labile device, perturbations in the frontal plane can facilitate a reflexive response of a gluteus medius that is inhibited or weak.



Endurance and strength

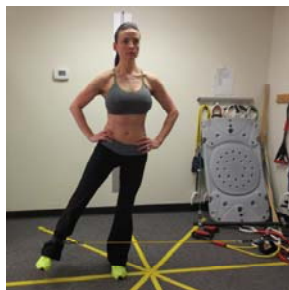


Closed chain exercise
(limited weight bearing)



Closed chain, single leg exercises for the hip abductors

- **Closed chain, increase reps.** Increasing the number of repetitions (10-15) for any of the single leg exercises above will increase endurance (especially the single squat). Standing hip abduction and hip extension with resistance bands is another weight bearing exercise that has been described as effective in strengthening hip abductors and decreasing pain in runners with patellofemoral pain syndrome (Ferber 2011).



Hip abduction with tubing. In the last picture, the g medius on the weight bearing leg is being targeted.



Hip abduction with band
or tubing

For more information on many of these exercises, see CSPE Protocol: [Low Back Rehabilitation](#).

Trunk Curl-Up Movement Pattern

For a video demonstrating this key movement, click: [Trunk Curl-Up](#)

The trunk curl up movement pattern test is indicated for patients with subacute or chronic low back pain.

Procedure

The patient lies supine with feet flat on the table and knees bent to about 90 degrees (i.e., a “hook lying” position). The patient is instructed to curl up until the shoulder blades come off the table. Initially the examiner observes the patient’s spontaneous pattern of sitting up. The examiner can then place his or her hands under the patient’s heels while the movement is repeated. The examiner monitors the downward pressure of the patient’s heels during the movement.



Optional

Have the patient repeat up to 10 times, holding the last curl up for 30 seconds.

Interpretation

In the first part of the test the clinician should observe for trunk flexion versus hip flexion. In the presence of weak abdominals and overactive iliopsoas the flexion movement of the trunk is minimal and the movement will be performed mostly through flexion of the hips. In addition, the back may remain straight and the pelvis will be observed to tilt anteriorly. If the heels lift off the clinician’s hands or the pressure of the patient’s heels against the clinician’s hands is not maintained before the scapulae are lifted from the table, this is also a sign that the iliopsoas is dominating the movement (Jull 1987). It should be noted that hyperlordotic patients may have a false positive since more effort is required for them to curl up.

A secondary observation is whether the patient’s chin pokes forward while doing the curl up, suggesting inhibited abdominal muscles or overactive SCM muscles bilaterally.

If asking the patient to perform multiple repetitions, observe to see if the patient begins to lose motor control and whether the psoas substitution or chin poking becomes more prominent.

INTERPRETATION SUMMARY

Faulty movement	Inhibited/weak	Overactive/tight
Back remains straight, pelvis tilts anteriorward	Abdominal muscles	psoas
Decreased heel pressure	Abdominal muscles	psoas
Increased heel pressure	Abdominal muscles	psoas
Chin protrusion	Abdominal muscles	SCM
Shaking	Abdominal muscles	adductors

Correlate with the Following Observations

In cases where functional stability of the spine appears to be of concern, it may be useful to perform various tests in order to better evaluate individual muscles or movements (Page 2010). The assessment should include abdominal strength and endurance.

Authors describe using a variety of different tests to evaluate abdominal strength. The sit up or a static trunk flexor test can be used to evaluate the upper abdominals (described as the upper rectus abdominis and internal obliques) (Liebsenson 2007, McGill 2002). A double leg lowering test has been suggested to evaluate the lower abdominals (lower rectus abdominis, external obliques) (Kendall 1993). However, Lehman and McGill found there is no accurate way to isolate the upper and lower abdominal muscles during various exercises (Lehman 2011). See CSPE protocols [Low Back Rehabilitation](#) (see p. 12) and [Low Back Leg Endurance](#) (see p. 5).



Rationale and Evidence

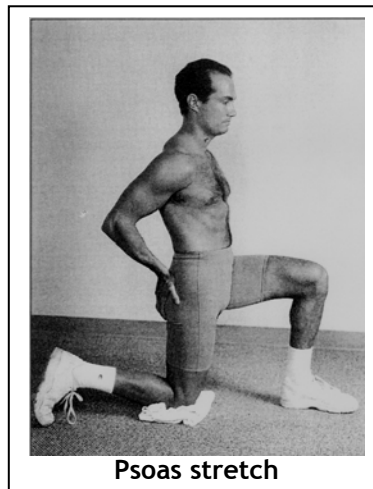
Examination of the patient's ability to sit up from the supine position allows the clinician to examine the relationship between the iliopsoas and the abdominal muscles. Imbalance between these muscles may be a sign of poor motor control in the lumbopelvic hip complex. It may also serve as further confirmation of at least one component of an apparent lower cross syndrome (Jull 1987). There is no known reliability or validity for this test.

Corrective Strategies

There is no evidence-based, best practice approach available for correcting this muscle imbalance. However, there are some expert-based strategies.

1. Remove potential causes of inhibition

- **Joint manipulation.** The thoracic and lumbar spine and the sacroiliac and hip joints should be evaluated and adjusted/mobilized as needed.
- **Stretching/relaxation techniques.** Restoration of muscle balance and proper motor control may require stretching/relaxing of the iliopsoas and erector spinae muscles if they are found to be tight.



Psoas stretch

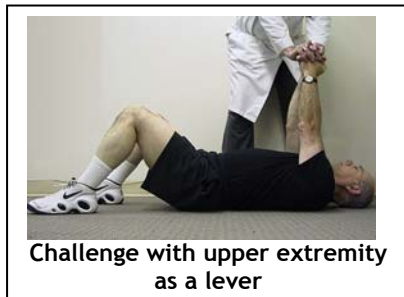
- **MFTP techniques.** The abdominal muscles should be evaluated for trigger points and treated accordingly.

2. The ACE approach: Activate, teach control, build endurance

A general lumbar stabilization program should be initiated. (See CSPE Protocol: [Low Back Rehabilitation](#)). In this case, exercises should be emphasized which aid in the facilitation and strengthening of the abdominal muscles. No single exercise has been shown to strengthen all of the abdominal musculature equally. Since all the abdominal muscles have some degree of function in stabilization of the spine but vary in their role depending on posture and movement, a variety of abdominal exercises targeting these muscles should be implemented. In general the transverse abdominis, internal oblique and external oblique muscles have the greatest role in providing stability during transitional movements. The rectus abdominis is primarily a spinal flexor and generally has a smaller role in functional stability of the spine (Page 2010, Akuthota 2004).

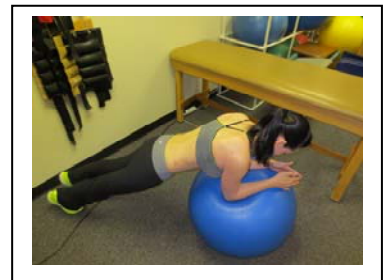
Activate

- **Isometric challenges.** Early activation can be as simple as abdominal bracing activities. It may include isometric challenges as the patient tries to hold positions or resists the practitioner.



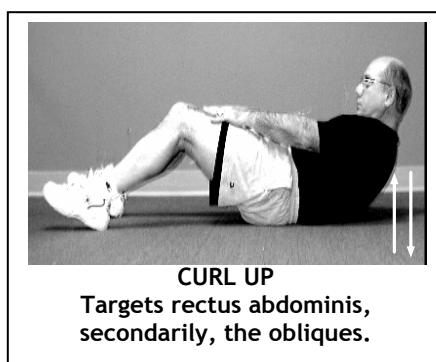
Control

- **Stirring the pot.** Motor control training can be incorporated by performing an exercise where the patient traces circles in a “stirring” motion with the forearms while keeping the spine held in neutral.



Endurance and strength

- **Curl up, Dead bug, Side bridge.** Since it mimics the dysfunctional movement, the curl-up track may be particularly useful in patients found to have weak/inhibited abdominal muscles during this movement pattern. The dead bug (with and without ankle weights) and, especially, side bridge tracks also target the abdominal muscles.



Shoulder Abduction Movement Pattern

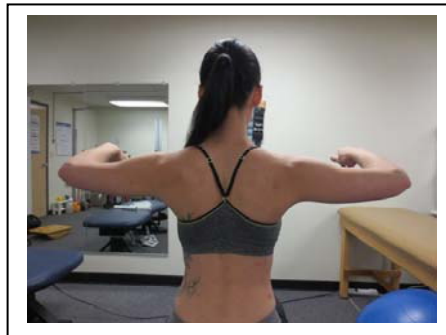
For a video demonstrating this key movement, click: [Shoulder Abduction](#)

The shoulder abduction movement pattern test is indicated for patients with upper back pain, shoulder pain or neck pain. It may also be useful for patients with headaches or for those who have suffered a whiplash injury. Observations such as forward head carriage with protracted shoulders or scapular winging (indicating possible weakness or inhibition of the mid and lower trapezius or serratus anterior) are also indicators for this test (Janda 2007, Page 2010).

Procedure

The patient is seated or standing with arms at the sides and the elbows flexed to control unwanted rotation. The patient is instructed to abduct the arms. Generally several repetitions are performed in order to get an adequate assessment of the patient's habitual pattern of movement. The test can be performed either one arm at a time or both arms at the same time. The examiner observes for coordination of the shoulder girdle muscles. The movement of each shoulder should be compared to the other. Having the patient abduct both arms at the same time allows the examiner to more easily compare the two sides. Performing the test one arm at a time may allow the examiner to better observe whether the patient laterally bends the trunk to the contralateral side, which would also be an indication of a faulty movement pattern. In some cases it may be beneficial to have the patient perform it both ways in order to get a better perspective on that individual's movement patterns.

Note: During this procedure the practitioner should be standing behind the patient and the patient's back must be exposed as much as possible.



Interpretation

Shoulder abduction in the frontal plane consists of abduction of the glenohumeral joint, upward rotation of the scapula and elevation of the scapula. Elevation of the scapula should not occur until about 60 degrees of abduction. Scapular elevation at the initiation of movement or before 60 degrees of abduction indicates possible over activity of the upper trapezius and levator scapula and possible weakness or inhibition of the middle and lower trapezius. Winging of the scapula may indicate weakness or inhibition of the serratus anterior. Contralateral side bending of the trunk to initiate the movement indicates probable weakness of the rotator cuff or deltoid and over activity/shortness of the contralateral quadratus lumborum (Janda 2007). Scapular movement should be relatively equal bilaterally (Yoshizaki 2009). Significant differences from one side to the other may indicate a lack of muscular coordination or muscle imbalance and should be assessed further for strength and mobility.

INTERPRETATION SUMMARY

Faulty movement	Inhibited/weak	Overactive/tight
Elevation of shoulder during first 60 degrees of abduction	Middle & lower trapezius	Upper trapezius & levator scapula
Winging of inferior angle	Serratus anterior	Pectoralis major & pectoralis minor, rhomboid major and minor
Contralateral flexion of the trunk	Weak shoulder abductors	Quadratus lumborum



Correlate with the Following Observations

Position of the scapula should be observed as part of a postural exam and during the movement pattern. Significant asymmetry (e.g., elevation, depression or rotation) or excessively protracted or retracted scapulae may be an indicator of dysfunction. Forward head carriage, forward rolled shoulders and internally rotated arms may also be signs of poor positioning of the scapulae which may lead to faulty shoulder mechanics. Winging or tipping of the scapula may indicate weakness or inhibition of the serratus anterior (Janda 2007).

Rationale and Evidence

The shoulder abduction test examines the coordination of the shoulder girdle muscles (deltoids rotator cuff, upper trapezius and levator scapula) and the scapular stabilizing muscles (lower trapezius, rhomboids, serratus anterior). Normal scapulohumeral coordination plays a major role in efficient shoulder function. Scapular position and motion are closely integrated with arm motion to accomplish most shoulder movements. Improper position or movement of the scapula is thought to lead to excessive stresses on various shoulder structures. Uncoordinated movement of the scapula (often described as scapular dyskinesis) has been implicated as a contributing factor in a variety of shoulder conditions (e.g., impingement, rotator cuff injury, labral injury, multi-directional instability) (Kibler 1998, Kibler 2010). Scapulohumeral rhythm may also have significant implications for the spine. Crosbie, et al, showed that humeral, scapular and thoracic segments demonstrate consistent, synchronous interactions, therefore aberrant movement in one may have an effect on the movement of the others as well (Crosbie 2008).

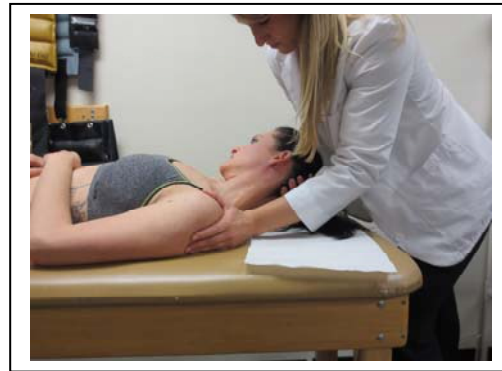
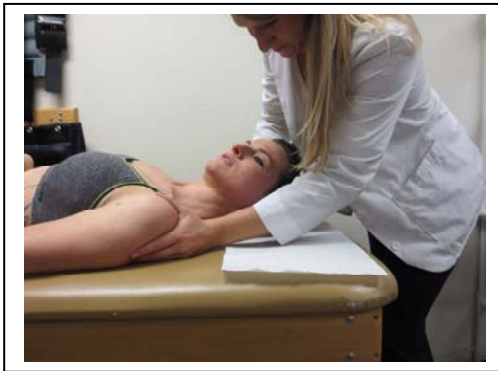
Reliability and validity for this test, performed as Janda described it, has not been tested. However two studies found fair inter-rater ($k = 0.31, 0.42, 0.40$) and moderate intra-rater ($k = 0.59$ and 0.49) reliability for the assessment of scapular movement patterns with various shoulder movements (Kibler 2002, Uhl 2009).

Corrective Strategies

There is no evidence-based, best practice approach available for correcting this movement pattern. However, there are some expert-based strategies.

1. Remove potential causes of inhibition

- **Joint manipulation.** The glenohumeral, sternoclavicular and acromioclavicular joints as well as the cervical and thoracic spine should be evaluated and adjusted/mobilized as needed. The scapulothoracic articulation should also be evaluated for restriction of movement and mobilized as needed.
- **Stretching/relaxation techniques.** Restoration of muscle balance and proper motor control may require stretching/relaxing of the pectoralis minor, levator scapula, upper trapezius and the glenohumeral internal rotator muscles if they are found to be tight.



- **MFTP techniques.** The shoulder girdle and scapular stabilizing muscles should be evaluated for myofascial trigger points and treated accordingly.

2. The ACE approach: Activate, teach control, build endurance

The key emphasis is often directed at the lower trapezius.

Activate

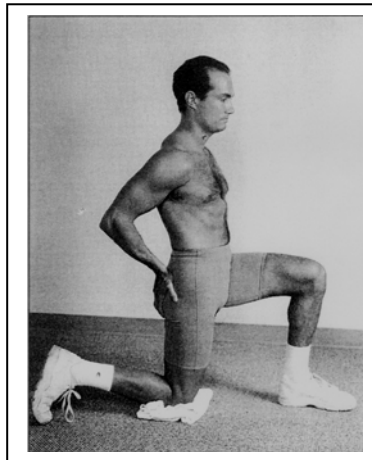
- **Wall angel.** The lower trapezius can be activated by direct stimulus while the patient attempts to perform a “wall angel” exercise.
- **Taping.** Taping is a modality that may also be of benefit when working to correct a faulty movement pattern of the scapula. Various studies have shown an increase in the activation of the scapular stabilizing muscles during shoulder exercises with taping of the scapula. The tape is thought to help by facilitating muscles and increasing proprioception. The specific type of tape or method of taping seems to be unimportant. Both Leukotape and elastic therapeutic tape



(Kinesiotape) have been tested, using various application techniques, with similar results (Lin 2011, Hsu 2009, Kumar 2012).

Control

- **PNF cross patterns.** Functional movement and sensory-motor training may also be helpful to improve the coordination of the shoulder and scapular muscles. PNF upper extremity cross patterns (D1 and D2) mimic basic functional movements and help to improve the coordination of the entire kinetic chain (See CSPE Care Pathway, [Shoulder Impingement Syndrome](#), Figure VIII for a description of PNF cross patterns and methods of sensory-motor training for the upper extremity).
- **Lumbar core.** Kibler proposes that control of core stability leads to control of three-dimensional scapular motion and therefore an integrated rehabilitation regimen, in which the larger muscles of the lower extremity and trunk are utilized during the treatment of the scapula and shoulder, may be more beneficial than rehabilitation of the shoulder alone (Kibler 2010). Hip and trunk flexion help facilitate scapular protraction, whereas hip and trunk extension along with trunk rotation aid in facilitating scapular retraction. If strength or flexibility deficits exist within the lumbopelvic hip complex, they should be addressed before treating the scapula and/or shoulder (Kibler 2010).



Endurance and Strength

- **Scapular exercises.** Corrective exercises should focus on facilitation/strengthening of the scapular retractors and stabilizers (e.g., serratus anterior, lower trapezius, middle trapezius). The external rotators should also be assessed for strength and exercises prescribed as needed. See CSPE Protocol [Shoulder Exercises](#), CSPE Protocol [Serratus Anterior Training Track](#), and CSPE Protocol [Scapular Training Track](#) for examples of exercises for the individual muscles and muscle groups.

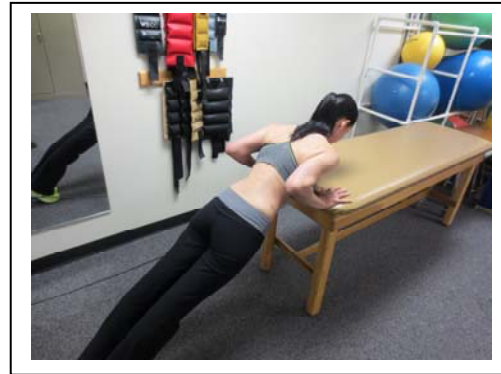
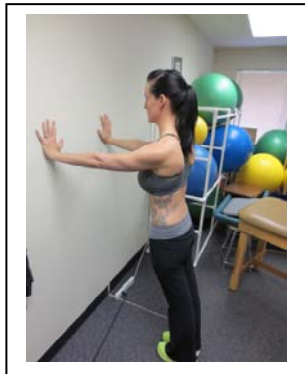
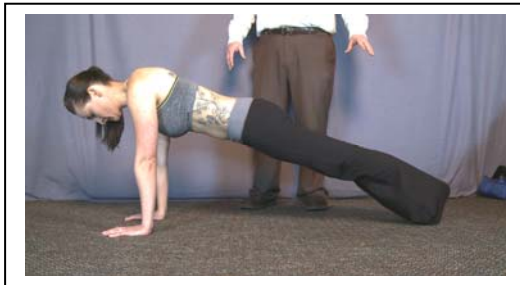
Push-Up Movement Pattern

For a video demonstrating this key movement, click: [Push-Up Movement Pattern](#)

The push up movement pattern test is indicated for patients with shoulder girdle, neck or thoracic pain. Observations such as forward head carriage with protracted shoulders, elevated or retracted scapulae, or scapular winging (indicating possible weakness or inhibition of the mid and lower trapezius or serratus anterior) are also indicators for this test (Janda 2007).

Procedure

The patient lies prone in a push-up position, is instructed to perform a push-up, and then slowly returns to the starting position. Since this test can be somewhat challenging, it can also be performed from the knees with the legs bent, leaning against an incline or upright pushing against a wall. The examiner observes the movement of the scapulae during both the push-up and lowering movements. The patient's cervical spine, lumbar spine and pelvis should also be observed.



Interpretation

When performed properly, the scapula abducts and upwardly rotates but does not elevate the shoulder during the push-up or lowering movements. The lowering of the body from a full push-up position may be more sensitive in detecting excessive scapular movement due to the eccentric loading of the muscles. Scapular elevation or downward rotation as well as shoulder shrugging may indicate over activity of the upper trapezius and levator scapula, and/or inhibition of the lower trapezius. Excessive scapular abduction or excessive rotation may indicate weakness or inhibition of the middle and lower trapezius or rhomboids. Scapular winging or excessive scapular adduction may indicate a weak or inhibited serratus anterior. Inability to perform a push-up without hyperextension of the lumbar spine or hip flexion may indicate a lack of spinal stability in the sagittal plane (Janda 2007, Page 2010, Cook 2006).

INTERPRETATION SUMMARY

Faulty movement	Inhibited/weak	Overactive/tight
Elevation of shoulder or scapula during push up	Middle & lower trapezius	Upper trapezius & levator scapula
Excessive scapular abduction	Middle, rhomboids, & lower trapezius	
Scapular winging	Middle trapezius or serratus anterior	
Hyperextension of lumbar spine	Weak shoulder abductors	

Rationale and Evidence

This test examines the quality of dynamic scapular stabilization. It yields information similar to the shoulder abduction test, but may be more useful in determining weakness/inhibition of the serratus anterior due to the loading involved. The force-coupling relationship between the serratus anterior and the middle and lower trapezius is imperative for proper scapular movement and stability. Improper position or movement of the scapula is thought to lead to excessive stresses on various shoulder and spinal structures (Janda 2007, Kibler 2010). The test also examines the patient's ability to stabilize the spine in the sagittal plane during closed chain upper body movements. Many daily activities require the trunk stabilizers to transfer force symmetrically from the upper extremities to the lower extremities and vice versa. If the trunk does not have adequate stability during these activities, kinetic energy will be dispersed creating added stresses on various structures and increased potential for micro traumatic injury (Cook 2006). Validity and reliability for this procedure has not been tested.

Correlate with the Following Observations

The position of the scapula should be observed. Significant asymmetry or excessively protracted or retracted scapulae may be an indicator of dysfunction. Forward head carriage, forward rolled shoulders and internally rotated arms may also be signs of poor positioning of the scapulae which may lead to faulty shoulder mechanics. Winging or tipping of the scapula may indicate weakness or inhibition of the serratus anterior (Janda 2007).

Corrective Strategies

Due to the similarity in the dysfunctional movements and muscle imbalances discovered with this test and the Shoulder Abduction Test, the corrective strategies are roughly the same. Therefore, please see the corrective strategies section above for therapeutic exercise prescription for a patient with abnormal movement during this procedure. (See CSPE Protocol [Serratus Anterior](#) and CSPE Protocol [Scapular Training Track](#)).

Head Flexion Movement Pattern

For a video demonstrating this key movement, click: [Head Flexion Test](#)

The head flexion movement pattern test is indicated for patients with subacute or chronic neck pain, headaches, or with a whiplash injury. In the acute phase of a recent injury, assessment of the pattern should be delayed. Other possible observed indications may include prominence of the sternocleidomastoid (SCM) (indicating possible over activity of this muscle) and forward head posture (indicating possible weakness of the deep cervical flexors or over activity of the SCM) (Janda 2007).

Procedure

The patient is supine with the head in a neutral position. The examiner asks the patient to slowly raise the head towards the chest. If the movement pattern is unclear, slight resistance of 1 or 2 fingers may be applied by the examiner against the patient's forehead.

Interpretation

The examiner should observe for chin protrusion or shaking during the movement. A normal movement pattern would include maintaining craniocervical flexion throughout the test. If chin protrusion is observed during the movement, this suggests that the SCM and possibly the anterior scalenes are dominating the movement and that the deep cervical flexors may be weak and/or inhibited. Over activity of the suboccipital muscles may also contribute to this faulty pattern. Shaking during the movement may indicate general weakness of the neck flexors.



Correlate with the Following Observations

Observe for forward head carriage in the standing *and* seated position and chin poking during transition movements (e.g., getting out of a chair or off the adjusting table). The patient may demonstrate weakness with the Jull test or craniocervical flexion test. Length testing the SCMs may reveal short tight muscles.

Rationale and Evidence

This test allows a practitioner to assess the interplay between the primary deep neck flexors (longus capitis, longus colli, rectus capitis anterior) and their synergists (SCM, anterior scalene). Various EMG studies have demonstrated a disturbance in synergistic cervical flexion movement in patients with idiopathic neck pain and in patients who have suffered a whiplash injury (Falla 2003, Falla 2003, Jull 2000). In these patients, impairments in the strength and endurance needed by the deep neck flexors for segmental control and support may be compensated by increased activity in the superficial SCM and anterior scalene. This has shown to be particularly true in patients with recurrent headaches (Jull

2000, Jull 2004, Janda 1994, Murphy 2000). There have been no published clinical trials assessing the validity and relativity of this movement pattern.

Corrective Strategies

There is no evidence-based, best practice approach available to correcting this muscle imbalance. However, there are some expert-based strategies.

1. Remove potential causes of inhibition

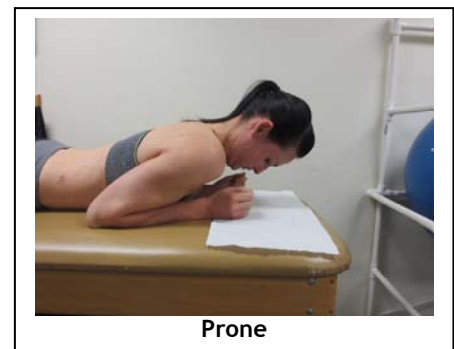
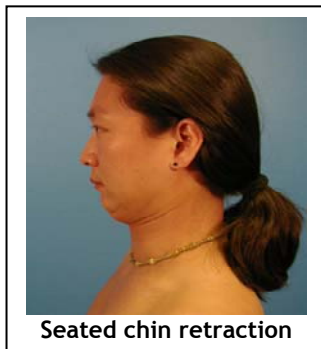
- **Joint manipulation.** The occiput and upper cervical spine as well as the cervicothoracic junction and thoracic spine should be evaluated and adjusted/mobilized as needed. In a small observational study, Sterling et al. (2001) found that cervical spine mobilization appeared to activate deep flexor activity while simultaneously decreasing SCM EMG activity.
- **Stretching/relaxation techniques.** Restoration of muscle balance and proper motor control may require stretching/relaxing the SCM, scalenes, and/or suboccipital muscles as well as other cervical extensor muscles if they are found to be tight.
- **MFTP techniques.** The deep cervical flexor muscles should be evaluated for myofascial trigger points and treated accordingly.

2. The ACE approach: Activate, teach control, build endurance

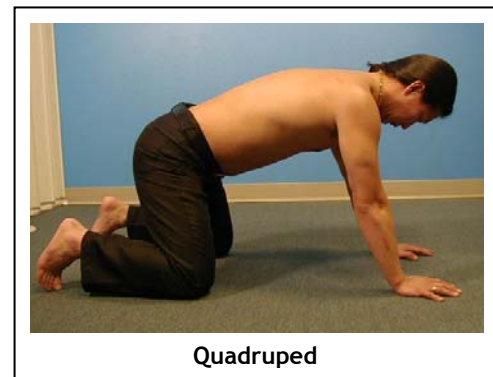
In order to improve muscular endurance and motor control, corrective exercises should focus on facilitation and strengthening of the deep cervical flexors. Murphy also suggests that along with strengthening the cervical musculature, a cervical stabilization program should also include scapular, lumbar and pelvic stabilization exercises as needed (Murphy 2000). (See CSPE Protocol [Lumbar Rehabilitation Program](#)).

Activate

- **Chin retraction.** Chin tucks can be performed beginning in the seated or supine position and progressing to the prone position as the deep flexors become more active. The patient is instructed to tuck the chin as far as possible focusing on posterior translation. Although not visible, this results in the upper cervical spine maximally flexing and the lower cervical spine maximally extending.



- In the prone position the same neck movement is performed but with the patient lying on a bench or bed with his or her head hanging over the edge. This can also be done lying prone on the floor with patient supported on his or her elbows or in a quadrant position or in a quadruped stance (Page 2010, Murphy 2000).

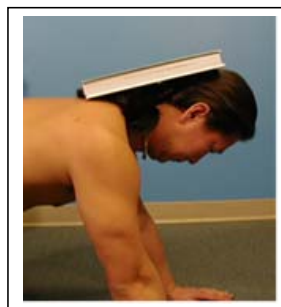


- **Brüegger relief position.** If anterior head carriage or other postural deficiencies are observed, the patient should be instructed on proper posture. Having the patient perform Brüegger relief position at regular intervals throughout the day can help improve overall posture while also activating the deep cervical flexors. (See [Appendix I](#))



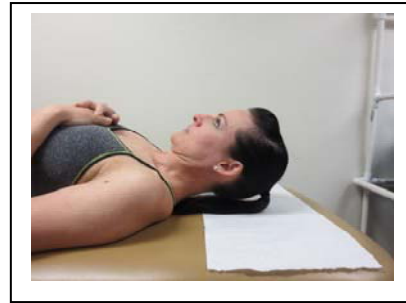
Control

- **Balance challenges.** A motor control element can be included by creating a balance demand while performing the chin retraction exercises. For example, in the quadruped position, the patient can balance a book on his head while holding the chin retraction. The training challenge can be further increased by incorporating arm and then leg movements.



Endurance

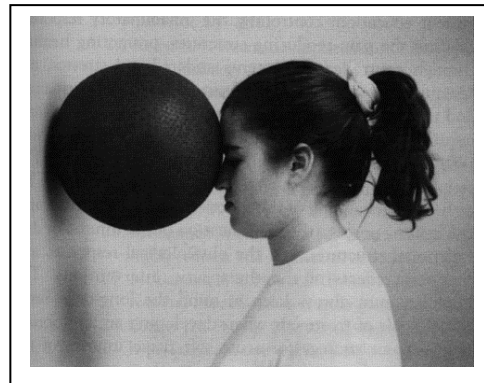
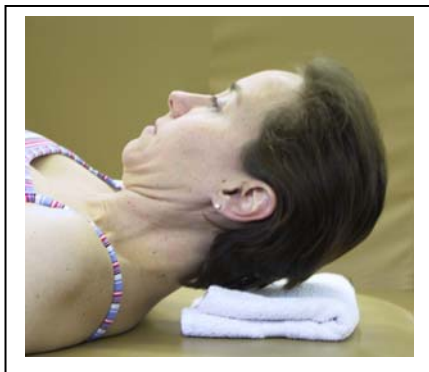
- **Chin retraction & isometric neck hold.** Endurance can be promoted by having the patient practice holding a supine chin retraction while raising the head slightly from the surface, twice a day, working toward 10 or more seconds without shaking.



- **Chin retraction against gravity.** Isotonic exercises can be performed by increasing the number of repetitions (10-20) for chin retraction exercises against gravity (e.g., the prone or quadruped).



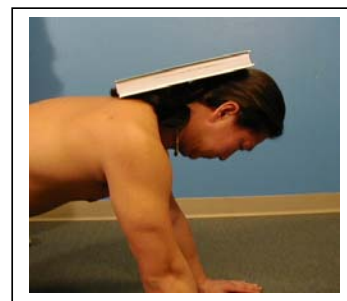
- **Repetitive flexing and holds ball roll.** Simple neck flexion exercises and ball rolling exercises can also build endurance.



- **Craniocervical flexion exercise.** Liebensen (2007) suggests a craniocervical flexion exercise in the supine position using a stabilizer cuff under the head. This is similar to the craniocervical flexion test but is used as a rehabilitation exercise for improving motor control and muscular endurance. Patients monitor one of their SCMs, attempting to perform the exercise with *minimal* contraction. This acts as a biofeedback mechanism to prevent excessive substitution by the SCM and helps them isolate firing of the deep neck flexors. (See [Appendix II](#))



- **Neck quadruped track.** Murphy has created a specific, progressive, quadruped exercise track which emphasizes activation, motor control and endurance (Murphy 2000). (See Appendix III)



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Authors: Shawn Hatch, DC
Ron LeFebvre, DC

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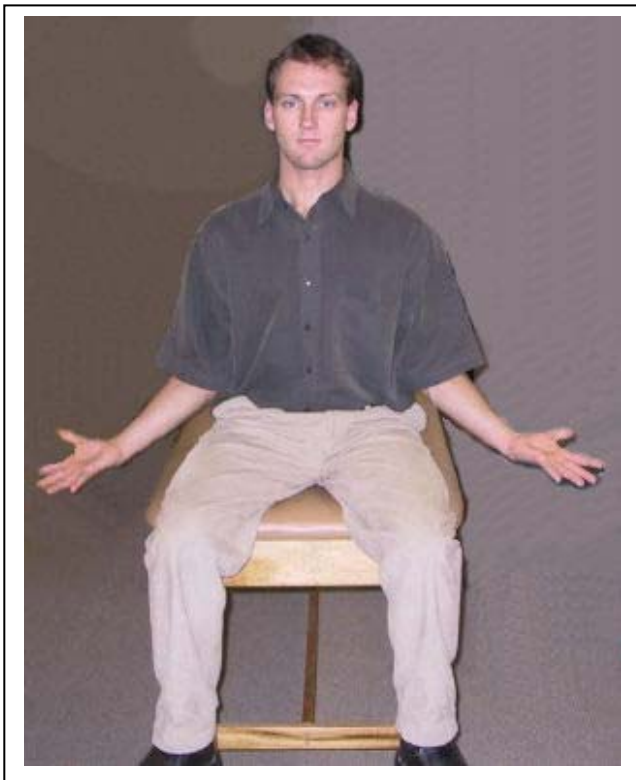
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APPENDIX I: Brüegger Relief Position

The Brüegger relief position can be used as a postural awareness and rest position, useful for low back conditions. The patient should be instructed to take brief, periodic breaks throughout the day (for perhaps 10 seconds, every 20-30 minutes) and settle into this stylized posture.

Instructions are as follows:

- Sit at the edge of a chair, with the legs slightly abducted, the feet and knees turned out, and the hip at an open angle (greater than 90 degrees).
- The pelvis is tilted forward and the stomach allowed to “pooch out,” establishing a hollow in the low back which encourages maximum lordosis.
- The sternum is lifted up and out, which will have the automatic effect of allowing the shoulders to settle back without strain.
- The arms are allowed to rest on the thighs, preferably in slight external rotation.
- Lastly, the chin is gently tucked in and the head held high and erect.



APPENDIX II: Craniocervical Flexion Exercise

This is an exercise to promote neuromotor coordination and the holding capacity of the deep neck flexors.

The set up

The patient lies supine with knees and hips bent, feet flat on the table. The head is in a neutral position (the neck is not flexed or extended, i.e., the longitudinal plane of the neck is parallel to the table). An inflatable air-filled pressure sensor (Stabilizer, Chattanooga South Pacific) is placed suboccipitally behind the neck. The edge of the bladder should be against the occiput and inflated to 20 mmHg. The patient looks at the pressure gauge. The patient should gently press his/her tongue against the roof of the mouth just behind the teeth with teeth apart and lips closed (this is reported to help prevent recruitment of jaw muscles or muscles attached to the hyoid).



Stage 1: Motor control

Watching the pressure gauge, the patient very slowly flexes the upper cervical spine with a gentle head nodding action and holds the position steady at 22 mmHg. The patient palpates the superficial neck flexors (SCM, anterior scalene and hyoid muscles) and tries to minimize the activity of those muscles.

If the patient can do this without recruiting, s/he continues to perform a controlled head nod pushing the needle up 2 mm intervals, holding 10 seconds at each interval. The goal is to eventually work up to 30 mmHg and 3 repetitions of the entire exercise.

The patient should stop if...

- ⇒ the patient substitutes neck extension or chin retraction for the head rotation (i.e., “nodding”) action
- ⇒ the patient lifts the head and cannot attain or maintain the target pressure
- ⇒ the movement cannot be performed slowly (the patient picks up speed)
- ⇒ there is palpable superficial muscle activity
- ⇒ at each step when the patient returns to the starting position, s/he cannot maintain the pressure at 20 mmHg (unable to fully relax the muscles)

APPENDIX III: Quadruped track

The quadruped tract, adapted by Murphy (2000), is an exercise sequence that incorporates many of the strategies outlined in the rehabilitation section of these notes. The patient holds sustained chin retraction throughout a quadruped exercise track.

A) Quadruped static hold.

The patient is on all fours, chin retracted, abdominal hollowing. Hold for 30 seconds without losing form or shaking.



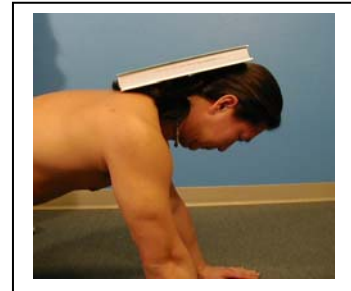
B) Quadruped book balance.

Same as above, but the patient balances a book or some other weight on the head.



C) Quadruped chin retraction.

Same as above but the patient does repetitive chin retractions with 2 second holds.



D) Quadruped arm raise.

Same as above but patient slowly alternates arm raising. (May eventually do cross crawl with arm and opposite leg.)

