

MOVEMENT ASSESSMENT AND SCREENING

To identify common movement dysfunctions 5 simple movement tests can be utilised, the purpose is to prevent injuries and to improve physical function, muscle patterning and address muscle imbalances.

This guide is organised into parts:

1.1 Key areas of control

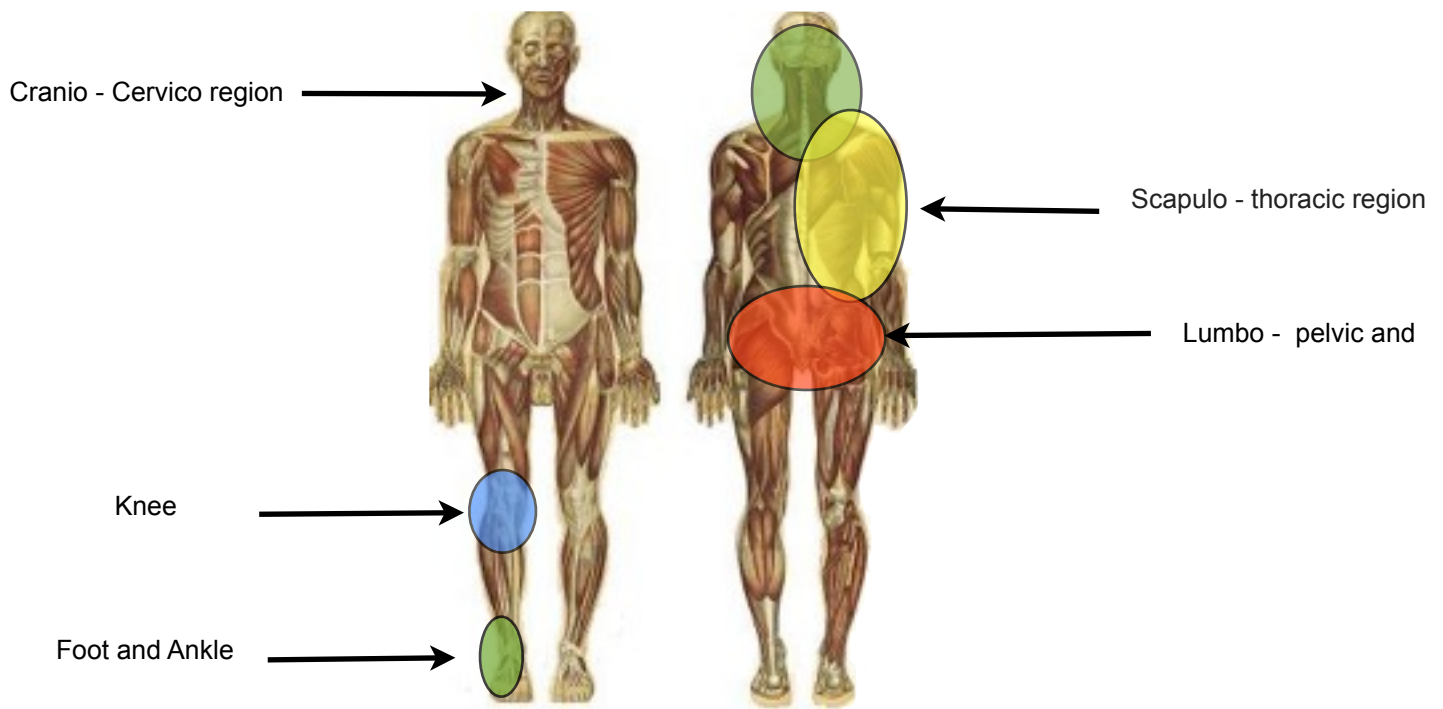
1.2 Movement Tests

1.3 Movement evaluation

1.4 Description of movement tests

1.1 5 key areas of control

There are 5 key areas of control that aid assessment of movement control and movement dysfunction. The prerequisite for good quality efficient movement is the ability of the body to maintain control and synergy of these areas without compensation and uncontrolled movement.



For simplicity the execution of all movement relates to these 5 areas and their gross and subtle interactions. The following simple assumptions can aid understanding.

- The body is made links / chains where motor control and muscular capacities are necessary to maintain proper area relationships.
- There are 5 key areas in the body that are interconnected and provide synergies for normal movement.
- Each area must control against loads being applied to each area, where if any key area is unable to control against those loads the system is disrupted
- No movement is identical. Movements create unique loads at each key area.
- Posture and what we are exposed to effects the mobility, stability and force output of the system
- Movement requires proper mobility of all joints, where loss of mobility at one joint will effect the entire chain.
- Fatigue or poor work capacity will effect the function / response and subsequent pattern of other areas.
- Symmetry and compensation should be assessed

1.2 Movement Tests

During all the movement tests a movement evaluation of each athlete / individual should be conducted observing the 5 keys are identified above. The tests have been selected because they represent an incremental increase in load or because the tests place a unique demand on the athlete / individual. Examining the presence of a movement dysfunction across various movements can help clarify and gain information relating to:

- a) How the athlete / individual controls their body during movement
- b) Weak links in the body that increase the likelihood of injury
- c) When a movement dysfunction occurs noting the mode and type of movement.

The movement tests performed in this screening are:

- Squat
- Overhead Squat
- Lateral Squat
- Single Legged Squat
- Drop Jump

1.3 Movement Evaluation

The main criteria we used to evaluate athletic movements are:

- a) Presence of common movement dysfunction
(1 = yes, 0 = no movement dysfunction)

- b) The severity of present common movement dysfunction – see section below

- c) And the depth of the movement – see section below

Evaluating Severity

For specific movement dysfunctions it is important to evaluate the severity of the movement dysfunction. The severity scale is based on clinical experience, anecdotal evidence and where applicable based on research clinical outcome guidelines.

1 = **Mild**. Attention is necessary. The dysfunction is at the early stages and correction now will help the dysfunction from progressing.

2= **Moderate**. This dysfunction is concerning because if left unaddressed it **will** lead to problems. If there are current problems, this dysfunction may be the source of the problem.

3 = **Severe**. Attention is needed immediately. Pain that you are experience is the result of this dysfunction.

Evaluating Depth

Used to evaluate the depth of various movement tests:

- 1 = above quarter squat
- 2 = quarter squat
- 3 = below quarter squat
- 4 = parallel squat
- 5 = full squat

1.4 Description of Movement Tests

Squat

The squat is a basic movement quality that evaluates the athletes' ability to flex at the ankle, knee and hip while maintaining a neutral spine position and integrity of the key areas.

The movement standard for the squat is a parallel squat position while maintaining control and symmetry of the 5 key areas

Common movement dysfunctions with this movement are:

- a) **Dynamic Valgus**
- b) **Loss of neutral spine position:**
 - a. **thoracic collapse**
 - b. **pelvic shift**
- c) **Foot pronation with or without toeing out (collapse of the foot)**
- d) **Heel raise**
- e)

Dynamic Valgus

This finding represents the knees inability to maintain its dynamic integrity (position during movement) while under load. What can be seen is a collapsing medially of the involved knee representing poor control, weakness of the hip musculature, and/or poor foundational support from poorly controlled foot motion. The test movement is evaluated for severity according to the severity criteria.

- 0 = no dynamic valgus
- 1 = movement of the involved knee inwards
- 2 = movement of the involved knee towards the mid-line
- 3 = movement of the involved knee pass midline

Loss of neutral spine position

This test examines whether the athlete is able to maintain a neutral spine position during movement. There are two common movement dysfunctions associated with a loss of neutral spine position.

Thoracic Rounding

Thoracic rounding is a very common movement dysfunction indicating a mobility problem in the thoracic spine. Instead of maintaining a neutral spine position during a movement an athlete with thoracic rounding will flex or become rounded through their thoracic spine. The overhead squat is an excellent movement test to identify this common movement dysfunction.

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Pelvic Shift

In this loss of neutral spine position, movement dysfunction the pelvis shifts to one side. The side that the pelvis shifts towards is recorded. The presence of a pelvic shift is can also be associated with:

- a) Femoral rotation
- b) Spine bending and rotation
- c) Increased stress to the sacro-iliac joint
- d) Joint, Soft tissue and Myofascial restriction

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Toeing Out / Over pronation

Toeing out beyond 15 degrees is identified as a movement dysfunction. This finding is often associated with medial arch collapse or over-pronation (pes planus). Toeing out beyond 30 degrees is considered severe, and toeing out between 15 – 30 degrees is considered moderate.

Toeing out has complex implications to the knee, hip and the lumbo-pelvis and key area control

Heel Raise

Heel raise is a movement dysfunction that occurs anytime a heel(s) comes off the ground during any movement test. If this occurs record the side. There are many reasons why the heels raise, such as Achilles tightness, a loss of ankle joint mobility, and plantar fascia tightness.

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Overhead Squat

The overhead squat is a basic movement that evaluates spine mobility and shoulder mobility (GH mobility) during a squat. Like the squat and single legged squat the movement standard for the overhead squat is a parallel position while maintaining key area control. An over head bar broom handle is used.

Due to holding a bar overhead many of the movement dysfunctions present during the squat will be amplified during the overhead squat. Note there may be some unique dysfunction(s) present in this movement that were not present with the squat. Common movement dysfunctions with this movement are:

- a) Thoracic rigidity as indicated by the forward position of the bar / broom handle
- b) Loss of depth compared to squat because of spine rigidity
- c) Toeing out
- d) Pelvic lateral shift
- e) Body rotation
- f) Inability to correct the ideal position of the bar due shoulder restriction.

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Lateral Squat

The lateral squat is a very important basic movement screen for coronal plane athletes such as skiers. The movement standard for the lateral squat is an upright chest position with a full depth lateral lunge. Common movement dysfunctions with this movement are:

- a) Inability to maintain an upright chest position (Thoracic collapse)
- b) Loss of neutral spine position
- c) Inability to keep heel on the ground
- d) Excessive knee valgus collapse or varus compensation

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Single Leg Squat

The single leg squat is a movement assessment that helps to predict knee injuries, such as tendopathies, patellofemoral pain, and even non-contact ACL injuries.

The movement standard for the single leg squat is a parallel single leg squat with perfect form or control of the 5 key areas. The single leg squat has been chosen, because it is vital movement for running, cutting, changing directions, agility and many more athletic qualities.

The lower the athlete is able to perform a single legged squat the better. The significance of depth relates to joint mobility, stability and the strength of the athlete.

Common movement dysfunctions with this movement are:

- a) Contralateral pelvic drop
- b) Loss of neutral spine position
- c) Inability to keep heel on the ground
- d) Excessive knee valgus collapse
- e) Pelvic rotation
- f) Excessive Lumbar flexion
- g) Compensatory overactivity of Lumbar muscles ie QL and ES in an attempt to support integrity of the another key area

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Drop Jump Screen Test

This test examines the athletes reactive ability and complete body control. This test has extensive research validation and is linked to the prediction of non-contact ACL injury risk.

It may involve the use of video analysis to assess three key areas of the lower extremity (ankle, knee and hip) and the relative distances between them during landing from a 35cm box and take-off to achieve maximum reactive jump.

The difference between this and vertical jump test is the exposure to forces approximately 2.5 – 4 times a person's body weight prior to jumping. How an athlete lands is very important as it indicates their ability to control forces and use that energy to jump higher.

A significant risk factor of injury has been highlight in the research at this phase of movement (land to take off).

- a) Inward movement of one or both knees
- b) Loss of neutral spine position (thoracic collapse, pelvic rotation or shift)

c) Foot pronation with or without toeing out (collapse of the foot)

These movement dysfunctions are energy leaks indicating that the athlete can't control the forces they are exposed to during the test. Factors that control against these movement dysfunctions are awareness, muscular coordination, and strength and power.

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Common patterns of dysfunction related to key areas

Foot and Ankle

Pes Planus

The most common type of dysfunction in the foot that can lead to energy leaks is a pes planus. Pes planus, or flat feet, a very common finding and variant among the general population. When dynamically tested, individuals with pes planus will exhibit turning out of their feet and a collapse of the main arch of their feet (longitudinal arch). This finding can also contribute to the other findings within the movement screen.

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Limited Dorsiflexion

This finding represents a limitation ankle joint's range of motion, specifically, reduction in dorsiflexion, meaning that the limited dorsiflexion creates a lack of range and causes compensation somewhere else in the kinetic chain to get to the same depth of a squat.

Often compensation occurs at the lumbar spine or pelvis; predisposing the athlete to injury due to overuse or the athlete may not be able to achieve the same range of movement while performing a sports specific movement. This relates to reduction in performance or overload of the proximal key area.

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External Foot rotation

This finding represents turning out of the foot while under dynamic load. This may be a result of poor foot posture stemming from over pronation or pes planus.

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Knee

Dynamic Valgus

This finding represents the knee's inability to maintain its dynamic integrity (position during movement) while under load. What can be seen is a collapsing medially of the involved knee representing poor control, weakness of the hip musculature, and/or poor foundational support from poorly controlled foot motion.

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Sagittal Control

This concept represents the importance of muscular control of the knee whilst under dynamic load. What may be seen is a series of oscillations of the knee while the athlete attempts to control knee movements such as a single leg squat. This can represent poor muscular control and coordination of the knee, hip and foot musculature.

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Lumbo - pelvis and Hip

Lumbar hyper flexion and extension

The correct way to perform a squat is to initiate the movement from the hip not the low lumbar spine. Athletes who cannot perform this movement tend to favor bending through their lumbar spines and are predisposed to developing lumbar spine pain, poor performance and pathology. As a compensation they load the lumbo - pelvic key area rather than dissipating load and shear through the correct sequence, ie legs and lower kinetic chain, instead using their legs they use their spines and other inappropriate key

areas to lift. Correcting this movement yields tremendous improvements for patients or athletes in terms of low back pain and performance.

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Hip Mobility

This finding represents hip range of motion in flexion, extension, internal and external rotation, and all combined movements of the ranges. Tightness in the hips lead to compensatory stress, strain and shear into other joints and key areas that can lead to overload and musculoskeletal conditions.

Therefore to be able to achieve full athletic potential combined with staying injury proof hip mobility is a key concept.

Hip Strength Quality

This finding examines the strength and ease of movement the athlete or patient displays during the various movements assessed. It is seen during low load testing as the depth the individual is able to achieve for example during the squat, lunge, and single leg squats. During high load conditions it is the individuals' ability to absorb forces through the muscular system and to develop power (rate of force development)

Increased Spinal compression and shear

What this means is that the spine is unable to support itself due to poor core and synergistic musculature in that key area. Using the analogy of a tent the spine requires guide ropes to tightly hold the tent pole upright otherwise shear forces will result in poor dissipation of stress / load from that area.

This finding tends to become apparent while perform any bending movement.

Pelvic Control

Pelvic control reflects the patient's ability to dynamically maintain a stable pelvis (foundation) while performing various movements. Dysfunctions are seen as aberrant movements of the pelvis; shifting, tilting, hiking and rotating. These dysfunctions occur largely because of an inability to maintain neutral spine control and are linked to the findings throughout the other anatomical sites, such as your ankle and foot. The impact of poor pelvic control relates to its' central position in the body. The pelvis is the transfer point for forces generated in the hips combined with force contributions from other key areas of the body.

Pelvic control is essential. If the individual is an athlete the demands for pelvic control are much higher and are reflective of the demands of the sport. For example it well known that hip and leg contribution to throwing velocity and tennis serve velocity is over 50 percent. This is only possible through pelvic control. Many athletes that fail to develop the Lumbo-plelvic key area fail to make up the power elsewhere, possibly overloading the elbow and shoulder.

Scapulo-thoracic Humeral

Thoracic Collapse

This finding indicates that the patient is not hinging from the hips resulting in a back dominant initiation of movement leading to thoracic or mid back collapse. Essentially, the mid-back often times follows the lead of the low back; if the low back is controlled in the sagittal, coronal and frontal plane, then the same will be seen in the mid-back.

Thoracic Rigidity/Hyperkyphosis

This finding is the opposite of the thoracic collapse. It represents the inability of the athlete to maintain a "chest up" position while under load and undergoing specific movements, irrespective of the stability of the low back.

Scapular Winging

Poor dynamic control of the scapulae . This finding may indicate that the athlete is dominant through the anterior chain.

Internal GH Rotation

Internal glenohumeral rotation represents a finding that is often associated with hyperkyphosis and scapular winging. This can also predispose the Athlete to chronic rotator cuff injuries leading to pain and poor function.

Cranio-Cervical Junction

Anterior Head Carriage

This represents the general finding found in almost all people to some degree or another. This finding can represent poor muscular control of the deep muscles of the neck.

Lateral Shift

Lateral shift of the head on your shoulders may represent a muscle imbalance present at your shoulder, neck, or upper back. It may also represent a favored motor pattern.

Rotation

Rotation is very similar to the finding of lateral shift and is often found in conjunction with it. Rotation may also represent a favored motor pattern that can indicate muscle imbalance.