

Overhead Deep Squats: Understanding Movement and Function

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What are the most common imbalances patients present with? The obvious answer is musculoskeletal imbalances. This article discusses the functional assessment of stability and mobility to movement re-education. Assessment of the overhead deep squat for stability and mobility imbalances will improve your awareness of the patient's movement dysfunction. Training stability and providing manual mobilization and/or self mobilization are current concepts of movement dysfunction.

A restricted segment can cause a compensation that leads to uncontrolled and increased motion. The uncontrolled segment or region is the most likely site of the source of pathology and symptoms of mechanical origin. Common dysfunctions within the movement system occur when the ankle, hip or thoracic spine needs mobilization, or when the knee, lumbar spine or glenohumeral joint needs stabilization.

There is plenty of evidence to support the link between uncontrolled intersegmental translation or uncontrolled range of motion and the development of musculoskeletal pain and degenerative pathology. Motor control dysfunction within the ankle, knee, hips, lumbar region, thoracic region and shoulder contribute to insidious onset, chronicity and recurrence of pain.

We need to restore ankle dorsiflexion, hip flexion/extension and/or hip adduction/abduction, and thoracic flexion and extension, because there is a frequent relationship between the loss of range of motion at one or more motion segments, and the development of compensatory excessive movement at adjacent segments. Learning to refine mobility and stability will reduce asymmetries and limitations as a means of injury prevention. It is important to establish stabilization prior to strengthening. Evaluate flexibility limitations and asymmetries between the left and right sides of the body. An individual conceivably could overcome a deficit in range of motion in one joint by using more ROM at another joint to achieve the specified goal.

The body is a "kinetic chain" of interconnected parts. I recommend overhead deep squatting as the primary assessment to evaluate whether mobility or stability is required.

The overhead deep squat: The ideal criteria for a well-performed overhead deep squat are:

1. upper torso parallel with the tibia or toward vertical (back is relatively upright);
2. femur below horizontal;
3. knees aligned over feet;
4. both arms overhead with the dowel aligned over feet;
5. toes pointed forward; and
6. knees don't turn in or out.

Hypomobility at any joint in the lower extremity kinetic chain can challenge the motor-control mechanisms of the patient and lead to joint instability. Joint hypomobility can present as dysfunction of intra-articular motion, producing limitations of the accessory movements of roll and

glide between the joint surfaces. Limited range of motion also can occur in the myofascial system (extra-articular in nature). These two components are interrelated and often occur together. The abnormal displacement or restrictive barrier to movement changes the normal pattern of movement of the instantaneous axis of rotation (IAR). Movement around an abnormal axis of rotation imposes abnormal compression or impingement on some aspect of the joint tissues and produces altered proprioceptive input to the central nervous system. The motor-control system must adapt to maintain function. These faulty movements increase microtrauma in the tissues around the joint, which, if accumulative, lead to dysfunction and pain.

After an ankle sprain, hypomobility may occur at the subtalar joint, talocrural joint, distal tibiofibular joint, or proximal tibiofibular joint. Limited dorsiflexion after lateral ankle sprain has been attributed to tightness in the gastrocnemius-soleus complex, capsular adhesions developed during immobilization, and subluxations or any combination.

Ankle: The hypomobility of the ankle or tissue tightness can be observed during the overhead deep squat if the heel of the foot rises while descending from a neutral starting position. This is the result of limited soleus muscle motion (e.g., ankle dorsiflexion). Motion can be restored and maintained despite restricted arthrokinematic motion. Restoration of dorsiflexion and normal gait patterns occurs after anterior-to-posterior (manual or self) mobilizations of the talus in the mortise.

If the patient's toes turn outward while descending from the starting position, it means he or she may have weak, tight lateral gastrocnemius, hamstrings, weak inner thighs, and is at risk for Achilles tendonitis.

The progression of rehab to improve the foot dysfunction is to start the patient with ankle self-mobilization. The patient starts out in the double-leg stance. Take a single step forward onto a stool with the right foot. Ask the patient to flex the ankle and knee over the stool as far as they can go. Compare to the left side. The restricted side can be stretched and mobilized while on the stool by repetitively moving the knee over the foot. Altered movement of the subtalar joints and soft tissue tightness can be restored through self-repetitive range of motion maneuvers. Next, have the patient perform a wall stretch. With their hands against a wall, feet flat on the ground and one foot at least 18 to 20 inches behind the other, have them bend the front knee. Hold the static stretch for at least 30 seconds. Do this at least two times per leg. The next exercise involves standing on one foot, turned in 45 degrees with the heel hanging off a step. The patient's body weight is on the forefoot. Have them hold onto a wall or rail handle and let their body weight drop down. Instruct the patient to hold this stretch for at least 60 seconds.

Knee: If the knees drift inward while descending from the start position of the overhead deep squat it may mean the patient has weak glutes, tight inner thighs, and is prone to knee and low back problems. The patellofemoral joint may be influenced by the segmental interactions of the lower extremity. Abnormal motions of the tibia and femur in the transverse and frontal planes are believed to have an effect on the patellofemoral joint. The first progression for the knee is to use a foam roll on the adductor and abductor muscles. Firmly press and roll along the tight tissue for several minutes or until you feel a release of tight tissue. Have the patient perform a lunge at a 2 o'clock or 3 o'clock pose with the right leg and a 10 o'clock to 11 o'clock pose with the left leg. The patient should next perform side-lying leg raises. Do not allow the quadratus lumborum muscle to activate early. Raise and lower the top leg, keeping it straight. Isolate the TFL and glute medius. Only perform this on the side that drifts.

Hip: If the patient can keep the feet straight ahead or have only slight external rotation, plus the heels stay flat on the floor while squatting, but they cannot achieve the depth of getting the femurs below the horizontal, they may have tightness where the TFL attach into the glutes. The hip joints

may be restricted. The rehab progression is to start with manual mobilization of the hips. Teach the patient how to perform hip range of motion on their own. Part of this solution is simply to do repetitive squats. Over time and many repetitions, the patient will break up the tissue tightness and be able to squat lower and lower.

If you suspect a patient is having a hip extension firing problem during gait, with the hamstrings dominating the movement pattern, rocker sandals can help retrain the gluteus maximus. There are a number of ways to "wake up" the gluts while squatting: for example, weight shift toward the heels, bridges up and down with a therapy band around knees to provide resistance to abduction; side steps with a band around the ankles; or bridges on a gym ball with alternate heel raises. Tight hip flexors will inhibit the gluteus, so these need to be evaluated for length.

For a stronger gluteal contraction, perform the Tucker test, the purpose of which is to help recruit a deeper and stronger contraction of the gluteal group. Test: Place a quarter on the outside of the patient's clothes between the buttocks at the level of the anus, and have the client hold it in place with a strong gluteal contraction. Assess: Can the patient contract the gluteals strong enough and continuously while performing the bridge exercise up and down so the quarter does not drop to the floor? Relate: In order to hold the quarter in place, the patient must concentrate on performing a strong gluteal contraction. This forces the continuous contraction of the gluteus and initiates a co-contraction of the abdominals. Progression: Have the patient perform the overhead deep squat with the quarter held in the buttocks.

Lumbar: If the patient's back bends into flexion while performing the overhead deep squat, it may mean they have tight hip flexors, a weak core and poor posture. This is such an important diagnostic tool. Why is this point so important? The lumbar spine may be more flexible relative to the hips in flexion due to lengthened erector spinae and shortened hamstrings. This can lead to a hamstring strain, but more importantly, the muscles that control excessive lumbar flexion (lumbar erector spinae) have more "give" than the muscles that limit hip flexion (hamstrings).

Consequently, during trunk flexion the lumbar spine gives more easily than the hips and excessive flexion occurs in the lumbar spine relative to the amount and time of flexion at the hip joints, resulting in compensatory lumbar flexion and a potential lumbar flexion stability dysfunction. The patient complains of flexion-related symptoms in the lumbar spine. You can see how this will translate to their everyday life. See if you can detect the following possible flexion movement dysfunctions in the low back when the patient forward leans while performing the overhead deep squat:

1. Shortened back extensor mobilizer muscles (longissimus and iliocostalis): The pelvis shifts more than 4 to 5 inches posteriorly during forward bending and the spine demonstrates limited flexion.
2. Shortened hamstrings: The hips demonstrate less than 70 degrees of hip flexion during forward bending.
3. Lengthened gluteus maximus: The hips demonstrate more than 90 degrees of hip flexion during forward bending.
4. Lengthened back extensor stabilizer muscles (superficial multifidus and spinalis): The spine demonstrates excessive flexion during forward bending.

The progression of rehab is to use the foam roll on the anterior and lateral sides of the hips. Work out as much tissue tightness as you can on the foam roll. To stretch the hip flexors, teach your patient to do a lunge with an arm raised overhead. The precise steps are as follows: Leading with the right foot, the patient performs a lunge while raising the left arm overhead and rotating the upper body to the left. Instruct the patient to hold this pose for 30 seconds and to perform at least two stretches on each side. The most important solution for this movement dysfunction is to control

movement at the site of the instability. This concept is a process of sensory-motor re-programming to regain proprioceptive awareness of joint position, muscle activation and movement coordination. This training is beyond the scope of this article. However, you can start by teaching clients to co-contract the multifidus and transverse abdominus muscles.

Thoracic: During the overhead deep squat, the patient presentation of lack of mobility in the thoracic spine may include the inability to get the dowel directly over the feet. I usually find the arms way out in front of the feet. These patients lack thoracic extension. You will feel restricted motion on palpation of the thoracic spine into extension. The patient may have an obvious forward-drawn posture, anterior head and shoulder carriage (slumping) and/or an increased kyphosis. The rehab solution for this dysfunction is mobilization. The foam roll will allow for self mobilization into extension. The repetition of performing self-mobilization of the thoracic spine into extension, while the patient performs the overhead deep squats, is an exercise in and of itself. Another self-mobilization maneuver involves asking the patient to sit on a chair facing the wall, leaning the forehead on crossed arms against the wall. The patient's knees and toes touch the wall. Taking deep breaths in and out, on the exhalation the patient forces thoracic extension movement, repeating the process about 10 times. I often find the thoracolumbar junction, T6 and above, as the key joints to manipulate to create flexibility.

Shoulder: The gleno-humeral functions. Stability is sacrificed to a large degree to achieve this mobility. During the overhead deep squat you will observe the patient pushing the dowel behind their back instead of over the head. To correct the instability in the shoulder we need to correct the length-tension relationship, improve muscle endurance and coordination of the rotator cuff muscles. These muscles act in a manner to generate a force balance to maintain centering of the joint throughout the range of motion.

Assessment of the overhead deep squat provides analysis of stability and mobility. An exercise program based on the assessment can be implemented to achieve stability and mobility. Stability is only tested reliably under low-load situations. Mobility is based on the ability to pass or fail the ideal criteria of the overhead deep-squat posture. The benefits of having good stability function of both the local and global stabilizer muscles, as well as good joint flexibility, are improved low-threshold motor control and reduced mechanical musculoskeletal pain.

Resources

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