The Back Squat

The back squat is one of the most functional exercises among the repertoire of compound lifts. The high axial position of the resistance places significant demands on key spinal stabilizers as the center of gravity is elevated while the muscles of the hip and knee act to coordinate acceleration and deceleration. The squat yields significant benefits for several applications, including strength, power, and muscle hypertrophy. When performed with correct form, the action at the acetebulum (hip) and the knee create force couples that strengthen hip and knee extensors while stabilizer contribution secures the axial and upper appendicular skeleton. When this system functions efficiently, ground reaction force is effectively transferred into the bar and the skeleton moves in proper alignment.

Proper squatting technique allows the body segments to correctly coordinate the force generated from movement segments and allows for significant collective force development. Weakness or dysfunction (poor stabilization and flexibility) prevents the muscles from working together properly and therefore any strong single segment may be ineffective at transferring the energy through the next aspect of the kinetic chain. This is commonly seen at the trunk. Stronger hip and knee muscles often become imbalanced with the trunk, which becomes clearly evident when a posterior pelvic tilt occurs at full range of motion. Although lack of flexibility is a common contributor to poor technique, weak spinal stabilizers are a more common contributor to loss of pelvic stability. Additionally, leg presses, leg extensions, and other exercises may strengthen the quadriceps to a point of imbalance when compared with the hip extensors (evidenced by inward knee movement and excess back extension).

The squat can be used to connect the movement segments with muscle balance and improve force couple management but only when all systems are functional. When the action is properly coordinated progressive resistance can lead to notable strength gains throughout the body particularly at the hip/trunk relationship. Bodybuilders should emphasize proper squat technique to take advantage of the heavy anabolic response associated with >75% 1RM loads. This also holds true for power athletes as the action of the knee, hip, and trunk are vital to generating power for running, jumping, and swinging. A common error is to assume just squatting heavy means improved power. Actually an over-emphasis on loading can promote slower recruitment patterns and compromised technique. The actual benefit of the squat for sports and function stems from the connecting factors of the closed chain, axial loaded position which makes the muscle groups function more synergistically.

Although a seemingly rudimentary movement, most exercisers and non-exercisers perform the lift incorrectly. The potential strength of the muscle segments are not optimally utilized when any part of the chain is weak and/or the action is performed with improper biomechanics. An interesting aspect of human movement is that the simple combination of simultaneous hip and knee flexion for

most people often leads to tibial translation (knee crosses toe). This occurs because the natural tendency of human movement is to flex the hips and knees moving the pelvis directly downward over the base of support. Since the pelvis moves downward, the femur in turn must move forward creating an undesirable knee position as energy is directed into the balls of the feet, this may be to improper technique or inadequate hip extensor activation. This action explains why most people perform incomplete movements and perpetuate tibial translation. The proper technique requires initial hip flexion with the eccentric action of the hip extensors driving the hips and glutes posteriorly while the knees flex in a coordinated fashion. The goal is to maintain the tibia over the heels with limited dorsi flexion so the resistance is perpendicular to the ground similarly to a building's weight directed straight down into its foundation. Some exercisers make the error of placing plates or lifts under the heels of the feet, presumably (and incorrectly) to direct the resistance into the heels. The heel lift actual forces energy forward and places increased stress on the knees and greater need for (biomechanical compromised) compensation.

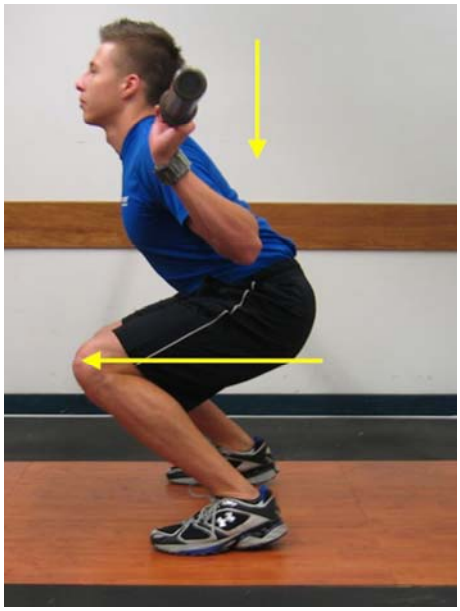
The first step to teaching the back squat is to ensure proper movement technique is accomplished without resistance. Exercisers must learn to center the gravity over the base of support with proper tibial position. A good teaching cue is to have new exercisers (or old ones who perform the exercise incorrectly) to place their heels against a box and push the hips backward to keep the knees from moving beyond the upper shoe laces. The goal is to decelerate to 90 degrees of knee flexion or functional range (neutral/anterior pelvic tilt maintained) without falling back. A knee translation check is to ask the exerciser to tap their toes at any phase of the movement. If they cannot tap their toes have them move the hips back as the pelvis is too far forward. Counter balance can be used initially but should be removed. When a person can perform the exercise with arms overhead without falling they can be progressed forward.

When resistance is added to the upper back it should be located across the shelf formed by the posterior deltoids and the superior border of the scapula while retracted – not on the neck. During the descent, the hips should move back and downward so that the spinal position is roughly parallel to the tibial position. The back should not be rounded nor should the action be compensated with extra hip flexion due to limited knee flexion (forward lean). Spotting the technique should occur at the lateral anterior aspect of the rib cage so that the spine is properly managed. Spotting from the hips is incorrect because it does not properly protect spinal position.

Common Errors: Potential Causes

Posterior Pelvic Tilt – weakness in trunk stabilizers/ tightness in hip extensors

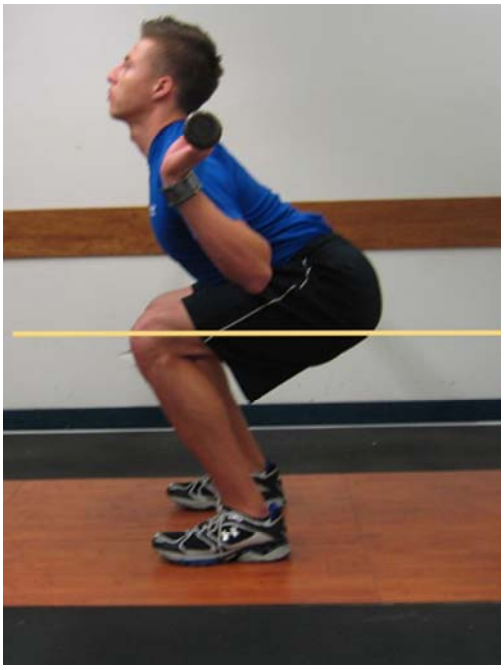
Knees Cross Toe – pelvis is not moved posteriorly/weight is shifted anteriorly



Knees Move Inward – weakness in hip extensors/tightness in adductors

Heels Move Inward – tightness in plantar flexor

Incomplete Range of Motion – resistance too heavy/improper instruction/localized tightness



Excess Hip Flexion – weakness in trunk/tightness in hips