



The Exercise Technique Column provides detailed explanations of proper exercise technique to optimize performance and safety.

COLUMN EDITOR: Jay Dawes, PhD, CSCS\*D, NSCA-CPT\*D, FNSCA

# The Pull to Knee—Proper Biomechanics for a Weightlifting Movement Derivative

Brad H. DeWeese, EdD, CSCS, NSCA-CPT, USAW,<sup>1</sup> Ambrose J. Serrano, MA, CSCS, USAW,<sup>1</sup> Steven K. Scruggs, USAW,<sup>2</sup> and Matthew L. Sams, MS<sup>2</sup>

<sup>1</sup>United States Olympic Committee, Lake Placid, New York; and <sup>2</sup>Department of Kinesiology, Leisure, and Sport Sciences, East Tennessee State University, Johnson City, Tennessee

## SUMMARY

THE PULL TO KNEE IS AN EXERCISE THAT ALLOWS AN ATHLETE TO BECOME EFFICIENT IN PRODUCING FORCE WITH AN OVERLOAD STIMULUS, AS WELL AS IT IS A TEACHING MODALITY FOR THE INITIAL PULL FROM THE FLOOR IN WEIGHTLIFTING. THIS MOVEMENT EMPHASIZES THE PRECURSOR MOVEMENT LEADING INTO THE DOUBLE KNEE BEND POSITION.

## TYPE OF EXERCISE

The pull to knee is a total body exercise that promotes efficiency of training by allowing an athlete to take part in a strength training movement that mimics the first pull of the clean or snatch in a manner that reinforces proper biomechanics. In addition, this task-specific movement can possibly play

a role in improving an athlete's ability to perform the first pull of the complete weightlifting movements through the addition of an overload stimulus. Finally, the pull to knee can be used as a teaching modality for the clean and the snatch, emphasizing the precursor movement leading into the double knee bend position/power position.

## MUSCLES INVOLVED

Isometric actions of the following muscles are created for the stabilization of the acetabulofemoral, glenohumeral, and radiohumeral joints:

Erector spinae group (iliocostalis, longissimus, and spinalis), deep spinal muscles (rotators, interspinales, multifidus, and intertransversarii), rectus abdominis, transverse abdominis, external obliques, internal obliques, quadratus lumborum, triceps brachii (long head), deltoid, subscapularis,

latissimus dorsi, extensor carpi radialis, brachioradialis, trapezius, splenius capitis, splenius cervicis, infraspinatus, serratus posterior inferior, rhomboid major, rhomboid minor, and the supraspinatus.

Ascending portion of the pull to knee includes the following:

Upper extremities: trapezius, splenius capitis, splenius cervicis, levator scapulae, rhomboid minor, rhomboid major, serratus posterior superior, posterior deltoid, teres minor, teres major, erector spinae group (iliocostalis, longissimus, and spinalis), deep spinal muscles (rotators, interspinales, multifidus, and intertransversarii), rectus abdominis, transverse abdominis, external obliques, and internal obliques.

Lower extremities: quadriceps group (rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius), gluteus maximus, hamstrings group

## Exercise Technique

(biceps femoris, semimembranosus, semitendinosus), gastrocnemius, soleus, tibialis posterior, flexor hallucis longus, flexor digitorum, peroneus longus, and peroneus brevis.

### BENEFITS OF THE EXERCISE

- The pull to knee emphasizes posterior muscular development, thus enhancing proficiency in the weightlifting movements by allowing an athlete to become stronger and more stable in the positions required for the initiation of the first pull.
- The pull to knee can improve technical efficiency of the first pull in weightlifting movements by instilling proper biomechanics into the athlete's training program.
- This partial movement provides a novel stimulus for athletes learning the weightlifting movements. Furthermore, it also accompanies the short-to-long, or partial-to-full range of motion, approach to training these movements.

### STARTING POSITION: PREPARATION

- The athlete should approach the bar on the platform with feet positioned approximately hip width apart. The bar should be situated just above the midfoot while the feet are pointed slightly outward.
- Once the foot position has been established, the athlete should squat down in order to grip the bar. The appropriate grip for the exercise can be either a clean grip or a snatch grip, depending on the emphasis. With either grip position, the athlete should use the "hook grip" (fingers over thumb).
- After the appropriate grip has been established, the athlete should position their shoulders above and slightly over the bar while the back remains concave (Figure 1).
- The hips should be raised slightly higher than the knees with shoulders raised even higher than the hips. The starting position may change dependent on the anthropometrics of the athlete but should be a guideline to



Figure 1. Starting position using clean grip.

follow to allow for proper initiation of the movement (Figure 2).

- Before the athlete begins to pull the barbell from the ground, he or she should have the sensation of remaining tight in the torso by taking a deep inhalation, which will result in an inflated chest. Additionally, the athlete should preserve the concave curvature of the spine to maintain the appropriate hip angle to maximize the force produced into the platform.



Figure 2. Lateral view of starting position.

### ASCENDING PHASE: EXECUTION OF THE MOVEMENT

- The initial movement should begin with a sensation of pushing the knees back (extension).
- The hips should rise minimally and should move back with the knees. This keeps the angle created by the torso and the floor constant throughout the duration of the movement (Figure 3).
- The emphasis should be for the athlete to maintain the concave curvature in the spine by flexing the posterior musculature to "raise" the chest along with extension at the knee (Figure 4).
- The trajectory of the bar from the movement should be vertical while also moving back in concert with the shins, which will eventually allow the athlete to transition into the second pull past the knees at midhigh. This movement pattern can be cued by asking the athlete to move the bar "up and in."
- Once the bar reaches the pinnacle of the movement (at or just below the patella), the athlete may drop the bar to the floor and proceed to reposition themselves for the next repetition.
- For beginner athletes performing this exercise, the authors recommend to



Figure 3. Front view of finish position.



Figure 4. Lateral view of finish position.

stand up between repetitions to prevent any unnecessary posterior musculature fatigue. The pull to knee may also assist in neuromuscular

facilitation for the starting position and initiation of the first pull.

#### PRACTICAL APPLICATION

The pull to knee exercise should be considered for selection during the general preparatory phase because this quality is often one of the first to be developed during an annual plan. Specifically, the pull to knee is a suitable choice for this phase because it complements the aforementioned short-to-long approach for mastering technical movements, such as weightlifting. Additionally, the emphasis of training during this period should be developing and refining sport-specific movement patterns, potentiating increased training intensities and volume load in future blocks. The pull to knee is a multijoint exercise engaging large muscle groups that aids in preparing an athlete for more complex pulling movements.

Once an athlete has established a good baseline of strength and technique for this movement, it could be considered for an overloaded stimulus. This increased muscular strength level

would allow the athlete to become more comfortable pulling heavier loads from the floor while maintaining the ideal back alignment and hip hinge mechanics during the first pull.

---

**Brad H. DeWeese** is the head sport physiologist at the United States Olympic Training Center.

---

**Ambrose J. Serrano** is the assistant sport physiologist at the United States Olympic Training Center.

---

**Steven K. Scruggs** is a graduate student in the Department of Kinesiology, Leisure, and Sport Science at East Tennessee State University and a volunteer strength and conditioning coach at the United States Olympic Training Center.

---

**Matthew L. Sams** is a graduate-student in the Department of Kinesiology, Leisure, and Sport Science at East Tennessee State University and an intern strength and conditioning coach at the United States Olympic Training Center.