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

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Pull From the Knee: Proper Technique and Application

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ABSTRACT

THE PULL FROM THE KNEE IS A WEIGHTLIFTING MOVEMENT DERIVATIVE THAT CAN BE USED IN THE TEACHING PROGRESSION OF THE CLEAN AND SNATCH EXERCISES. THIS EXERCISE EMPHASIZES POSITIONAL STRENGTH DURING THE TRANSITION PHASE AND THE TRIPLE EXTENSION OF THE HIP, KNEE, AND ANKLE JOINTS THAT IS CHARACTERISTIC OF WEIGHTLIFTING MOVEMENTS.

INTRODUCTION

Much evidence suggests that weightlifting movements are a superior method of training lower-body muscular power compared with power lifting (15), kettlebell (21), and jump training (38). As such, it should come as no surprise that weightlifting movements and their derivatives are popular exercises that are prescribed by many strength and conditioning practitioners (5,29). Recent literature suggests that weightlifting pulling derivatives that exclude the catch may provide a training stimulus that is comparable (3,4) or superior (31,36,37) to weightlifting derivatives that include the catch. As a result, recent literature has been interested in examining weightlifting pulling derivatives that eliminate the catch phase (6,9,10,28,30–33,35,37). It is clear that researchers and practitioners are interested in examining weightlifting pulling derivatives as a means of training. Given the importance of exercise technique with regard to the training stimulus and injury prevention (17,20), the proper coaching of exercises should not be overlooked.

TYPE OF EXERCISE

The clean pull from the knee (CPK) and snatch pull from the knee (SPK) are explosive lower-body exercises that can be used to train lower-body muscular power and strength at key positions during the transition and second pull of weightlifting movements. In addition, the CPK and SPK can be used as a part of the teaching progression for the clean and snatch. These exercises can be performed from a static position away of technique blocks or the safety bars of a power rack or with the bar lowered to a hang position at the knee.

MUSCLES INVOLVED

The CPK and SPK involve muscles that have been previously described during similar weightlifting movements (8–11,32,33):

- Static stability in the starting position: Erector spinae group (iliocostalis, longissimus, and spinalis), rectus abdominis, transverse abdominis, external obliques, internal obliques, quadratus lumborum, triceps brachii

(long head), deltoid, subscapularis, latissimus dorsi, brachioradialis, trapezius, splenius capitis, splenius cervicis, infraspinatus, serratus posterior inferior, rhomboid major, rhomboid minor, and the supraspinatus.
- Transition and second pull phases of the CPK and SPK: 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), 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 (biceps femoris, semimembranosus, and semitendinosus), gastrocnemius, soleus, tibialis posterior, flexor digitorum, peroneus longus, and the peroneus brevis.

BENEFITS OF THE EXERCISE

The SAID principle (Specific Adaptations to Imposed Demands) indicates that a relationship exists between an athlete's training choices and their resultant gains in performance (27). Thus, it is essential for practitioners to prescribe exercises for their athletes that will allow for the greatest transfer to their sport/event. The CPK and SPK are weightlifting pulling derivatives that allow athletes to efficiently transition to the proper peak power position and accelerate the external load using full body triple extension while eliminating the added stress of properly lifting the external load from the floor and catching the bar. Commonalities exist between an athlete's position in the CPK and SPK and sporting movements, such as the shot put, jump shot, tennis serve, max velocity sprinting, and bobsled start (25). Moreover, the static start of these movements may allow for a large transfer of training to benefit athletes who are required to produce high rates of force production and power from a static starting position (e.g., sprinters in track and field and American football linemen).

Although weightlifting movements typically result in a low injury rate, chronic training with full weightlifting movements involving the catch may result in a greater potential for injury (19,22). A second benefit of the CPK and SPK exercises is that they are less complex with regard to technique and may be used in the teaching progression of the full weightlifting movements. Specifically, these exercises eliminate the catch phase that is characteristic of the full clean and snatch exercises. The previous literature has suggested that the use of weightlifting movement derivatives that eliminate the catch phase may lower the potential for injury (31,34). Furthermore, it has been suggested that weightlifting movements that involve the catch may cause athletes to focus on dropping under the bar to perform the catch, rather than completing the triple extension of the hips, knees, and ankles (36,37). The failure to complete the triple extension movement may then lead to a decrease in the stimulus provided by the exercise.

Because the CPK and SPK eliminate the catch phase of their full movement alternatives, it is possible to overload the transition and triple extension movements to a greater extent than if the catch was performed. By doing this, the athlete may receive a greater training stimulus that may then transfer to an enhanced performance during their respective sport/event. Previous research has indicated that weightlifting pulling derivatives that eliminated the catch phase produced greater kinetic magnitudes and kinematic characteristics (i.e., joint velocities) as compared to weightlifting movements that included the catch phase (3,4,36,37). The primary rationale behind using these movements is that an athlete may be able to train with loads greater than those that could be used if the catch phase was included.

A final benefit of the CPK and SPK is the possibility of using these movements as potentiating modalities to create greater velocities, likely resulting in greater rates of force development as compared to other weightlifting derivatives. Previous strength-power potentiating complexes have used weightlifting pulling derivatives to enhance subsequent exercise (1,2,26). Owing to the decreased range of motion and ability to overload the triple extension movement, the CPK and SPK may be used as part of a strength-power potentiating complex.

STARTING POSITION–PREPARATION

- The coach or athlete should first set up technique boxes or the safety bars of a squat rack so that the bar is at the appropriate height relative to the athlete's anthropometrics. Specifically, the bar should be positioned directly in front of, but not touching, the knee cap just above the proximal attachment of the patellar tendon.
- After the bar has been positioned properly, the athlete should place their feet approximately hip width apart. The bar should be positioned above the midfoot, and the athlete's toes should be pointed slightly outward to maintain consistent foot positioning with other weightlifting derivatives (8–11,32,33).
- Once the athlete has properly positioned their feet, the athlete should position their hands and grip. The appropriate hand placement will be based on whether the athlete is performing the clean or snatch variation (12). It is recommended that athletes use the "hook grip" (fingers over thumb) for both the CPK and SPK exercises to prevent grip strength being a limiting factor of performance. In addition, because loads in excess of a maximum clean or snatch may be used during the

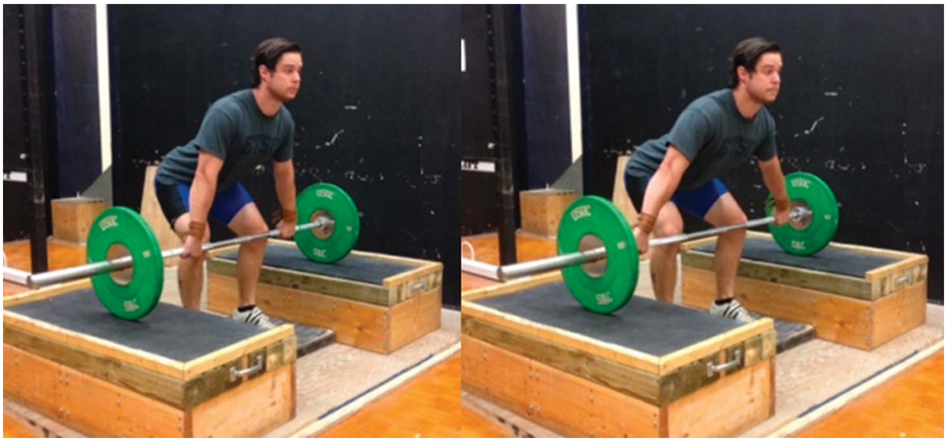

Figure 1. Starting positions for the clean pull from the knee (left) and snatch pull from the knee (right). Note: The starting position of the athlete may vary slightly based on their anthropometrics.

CPK and SPK, athletes may consider the use of lifting straps.

- After the acquisition of proper hand and grip placement, the athlete should flex forward at the hip while replicating a normal lordotic (i.e., concave) curve in their lumbar spine by isometrically contracting the erector spinae musculature to "raise" the chest. At the same time, the athlete should create and maintain a slight knee bend so that they feel a stretch in their hamstrings. The athlete's shins should be vertical and perpendicular to the floor, whereas their shoulders should be positioned ahead of the bar.
- The athlete should then be cued to internally rotate their shoulders (glenohumeral joint) and "turn their elbows out" to ensure that a stable arm position exists for the active pulling portion of the CPK and SPK. This will assist in preventing the elbow joint from prematurely bending during the pulling phase of the exercises.
- Athletes should be instructed to "sit on their heels" in the starting position to maximize their ability to produce the greatest possible forces through the platform during the initiation and continuation of the lift. This cue will also allow the athlete to maintain the correct foot pressure during the transition to the peak power position and also will allow greater control and improved bar speed.
- The starting positions of the CPK and SPK are displayed in Figure 1.

TRANSITION TO THE PEAK POWER POSITION

- Before initiating the CPK or SPK from the static starting position, the athlete should create a "tight" torso by creating tension in the muscles of the midsection by inhaling deeply. The athlete should also maintain the lordotic curvature of their lumbar spine to maintain the appropriate

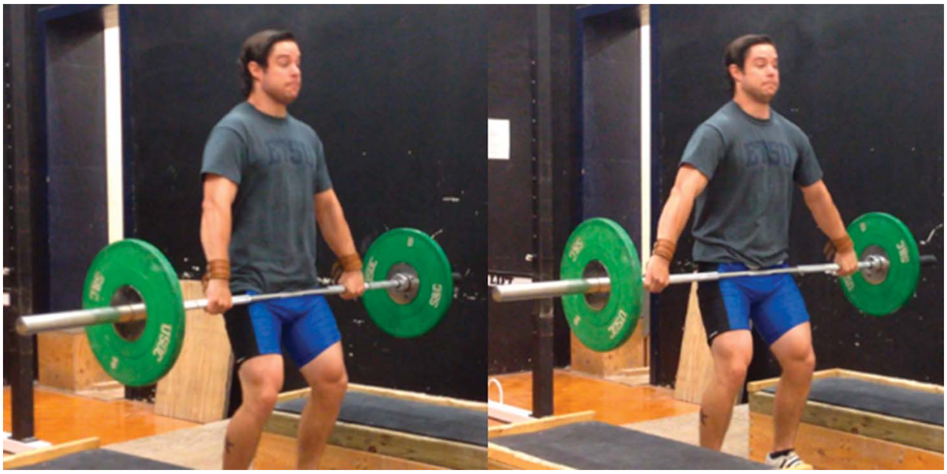

Figure 2. Power positions for the clean pull from the knee (left) and snatch pull from the knee (right). Note: The position of the barbell may vary slightly based on the athlete's anthropometrics.

hip angle to maximize the force produced into the platform.

- After achieving the set starting position, the athlete should initiate the CPK and SPK by engaging their hamstrings, glutes, and erector spinae muscles to begin to move to the bar vertically.
- During the transition phase of the CPK and SPK, the athlete must transition the bar to the peak power position (9,13,18) to maximize the force and power produced during the later second pull phase of the movement. The transition of the bar from the starting position to the peak power position is accomplished by the athlete by extending their back while simultaneously moving the hips and knees forward at the same instant and tempo. At this point, the athlete should be moving into a dorsi-flexed position at the ankle joint.
- During the transition phase to the peak power position, the path of the bar should always be moving vertically "up and into" the body.
- The bar should remain as close as possible to the body without touching the thighs until reaching the peak power position (Figures 2 and 3). This will allow the athlete to continue to accelerate the bar without additional frictional influences to slow it down.

Figure 3. Side view of the power position of the clean and snatch pulls from the knee.

SECOND PULL

- The final phase of the CPK and SPK begins as the athlete reaches the power position. As the athlete transitions to the power position, they should use the momentum created during the first pulling action from the knee to build up the intensity into an explosive pull.
- On reaching the power position, the bar should make a "brushing" contact with the thighs before the triple extension movement occurs. The athlete should continue to engage their erector spinae musculature and keep their elbows extended and externally rotated to prevent early bending of the elbows during the pull.
- At this point, the athlete should perform the triple extension movement by explosively extending their hips, knees, and ankles. Simultaneously, the athlete should shrug their shoulders to maximize barbell velocity (Figure 4).
- In addition to the shrug, the athlete should be taught to slightly flex the wrists to keep the barbell close to their body.
- After the pull, the athlete should control the bar's descent to the mid-thigh position. The athlete can then either lower the bar onto the technique boxes or power rack, or lower the bar to the hang position at the knee in preparation for the next repetition.

COMMON MISTAKES OF THE PULL FROM THE KNEE

- The athlete may begin the movement without their shoulders properly positioned and a rounded back, which may result in an improper transition to the peak power position and may place excess stress on the athlete's lower back.
- The athlete may not shift to a fully upright position with the shoulders, hips, and midfoot in line before beginning the second pull, causing

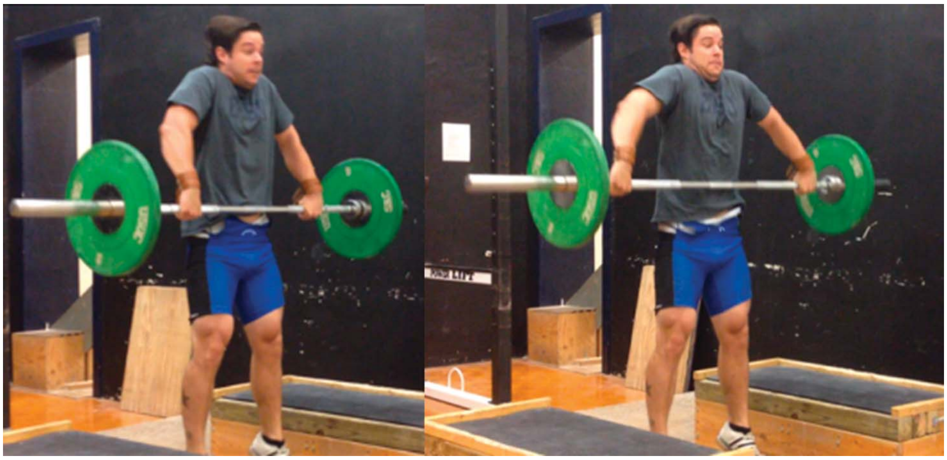

Figure 4. The second pull of the clean pull from the knee (left) and snatch pull from the knee (right).

the chest and shoulders to remain ahead of the bar.

- The athlete may not allow the hips and knees to shift forward once the barbell passes the knees (transition phase), likely resulting in a forward pulling motion instead of a vertical pulling motion.
- The athlete may begin the second pull phase too early. Specifically, the athlete will begin the second pull by performing the triple extension motion when the bar is visually too low on the athlete's thigh. This would result in the athlete not properly reaching the necessary power position for maximum force production.
- The athlete may "dip" before beginning the triple extension movement.
- The athlete may push their hips too far forward during the transition and second pull instead of continuing to drive vertically through the midfoot, likely resulting in a looping of the bar away from the athlete's body.
- The athlete may transition their body weight to their forefoot too early, likely resulting in the improper vertical transference of force through the midfoot before the triple extension movement during the second pull.
- The athlete may bend their arms before beginning the second pull, which may prevent maximum transference of generated force to the bar.
- The athlete may not complete the full triple extension movement of the hips, knees, and ankles, ultimately preventing maximum vertical force production.
- The athlete may complete the shrugging motion before the full triple extension movement.
- The athlete may not aggressively shrug at the top of the second pull, preventing maximum bar velocity. Although failing to aggressively shrug at the top of the second pull may not impact lower-body power development, it may impact the transfer of the pulling technique of the CPK and SPK to their catching derivatives.

PRACTICAL APPLICATION

The CPK and SPK weightlifting movements can be implemented in many different training blocks. However, the sets and reps schemes will be determined based on the priority of the training block. For example, the CPK and SPK can be used in a strength-endurance block with a higher repetition range (3 × 10) and lighter-to-moderate loads (7,23,24). Because exercise technique may falter due to fatigue associated with higher repetitions, practitioners implementing the CPK and SPK in a strength-endurance block should consider using cluster sets of 2 or 5 repetitions (14). Loads ranging 80–100% of the power clean and snatch maximum may be prescribed for the CPK and SPK during a strength-endurance training block. These loading recommendations are based on the decreased displacement of the load that is characteristic of the CPK and SPK compared with the power clean and snatch. The prescription of the CPK and SPK during this training phase may improve the athlete's technique for subsequent training phases with heavier loads and enhance their power-endurance abilities. Practitioners should consider the athlete's abilities before prescribing the CPK and SPK in a strength-endurance block as proper technique may be compromised as a result of fatigue.

Strength and conditioning practitioners may also consider implementing the CPK and SPK into maximal strength and strength-power training blocks using reduced volumes (3 × 5–3 × 3) and increased loads (7,23,24). Because the CPK and SPK exercises do not require the athlete to catch the load after the second pull, practitioners may prescribe loads in excess of 100% of the athlete's maximum clean and snatch. Using a similar weightlifting derivative, Comfort et al. (6) indicated that loads of 120–140% of an athlete's maximum power clean resulted in increases in force production and rate of force development. During a maximal strength or strength-power phase of training, the CPK and SPK can be used to reinforce technique before transitioning to future training blocks in which the full weightlifting movements may be prescribed.

Finally, the CPK and SPK can be implemented into an explosive speed or maintenance block. When prescribing the CPK and SPK during this phase of training, the primary goal is to enhance power output. This can be accomplished through reduced loads and intensities (3 × 3, 3 × 2, and 2 × 2) (7,23,24). Although no previous studies have examined the effect of load on kinetic and kinematic measures during the CPK or SPK, previous research has indicated that peak power output during the midthigh pull occurred at loads of 40–60% of an athlete's maximum power clean (6,16). Owing to the similarities of the CPK and SPK to the midthigh pull, it is likely that similar loads may be prescribed. However, the loads prescribed should be based on the athlete's proficiency and strength. For example, weaker or less technically proficient athletes should focus on improving peak power through lighter loads, whereas heavier loads may be prescribed for a stronger, more technically proficient athlete.

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