Analysis of the Conventional Deadlift

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The deadlift involves many of the large muscle groups in both the lower and upper body. It is also a relatively simple movement to perform, making it an ideal movement to include in a beginner's strength and conditioning program. The deadlift is commonly performed by powerlifters and weightlifters. Thus a proper understanding of this lift is important to both competitive strength athletes and beginners.

This article analyzes the major muscle groups involved in the conventional deadlift and describes some of the basic training considerations.

Anatomy

The 3 major muscle groups involved in the deadlift are the muscles of the knee, hip, and lower back. In the knee, the vastus medialis, vastus lateralis, vastus intermedius, and rectus femoris (collectively known as the quadriceps) undergo a concentric contraction as the movement is begun. The vastus lateralis, a large muscle located halfway down the outside of the thigh, is attached to the upper end of the femur.

The vastus medialis is located on the inner side of the thigh and is partially covered by the rectus femoris. The vastus medialis originates at the upper end of the femur on the medial side. The rectus femoris runs down the front of the thigh and originates on the ilium bone of the pelvic girdle. The vastus intermedius lies between the lateralis and medialis and attaches to the femur on the anterior side.

These 4 muscles come together at the patella bone. The patella itself is a free-floating bone that attaches to the tibia via the patella ligament. This method of attachment gives better leverage to the action of the knee extensors named above.

In the hip joint, the gluteus maximus and hamstrings begin to contract as knee extension is being completed. The gluteus is a very large muscle that originates at the crest of the ilium, along the fascia of the lumbar area, and at the sacrum and side of the coccyx. The hamstring is actually composed of 3 muscles: the biceps femoris, semitendinosus, and semimembranosus.

The biceps femoris has two sections. The longer section is attached to the pelvic girdle at the ischium; the shorter one attaches at the middle of the femur. The lower end of both sections attaches to the upper tibia and the head of the fibula. The semitendinosus and semimembranosus run from the ischium to the medial condyle of the tibia.

In the lower back, the erector spinae, intertransversarii, interspinals, rotatores, and multifidus muscles undergo concentric contraction in order to bring the spine to an erect position.

The erector spinae are actually 4 muscles: the iliocostalis thoracis, iliocostalis lumborum, longissimus dorsi, and spinalis dorsi. These 4 muscles intertwine along the spine from the neck to the sacrum on the back and both sides of the spine.

Deeper in the spine the intertransversarii, interspinals, rotatores, and multifidus attach from vertebrae to vertebrae and func-
tion as stabilizers for the vertebrae and disks.

Isometric contraction occurs in the muscles of the shoulder girdle as well as the bicep and forearm in order to hold the bar in a stable position while raising it from its resting position to mid-thigh. In the shoulder the trapezius, latissimus dorsi, teres minor, subscapularis, infraspinatus, supraspinatus, and anterior, medial, and posterior deltoid are all involved in stabilizing the upper body, and to some extent in retracting the shoulder as the movement is completed.

In the upper arm the biceps brachii, brachialis, and brachioradialis are engaged in isometric contraction throughout the deadlift. Similarly, in the lower arm the flexors and extensors are engaged in isometric contraction to keep the bar from slipping out of the hands.

## Kinesiology

The conventional deadlift movement is begun by placing the feet approximately shoulder width apart, toes slightly out, with the balls of the feet directly under the bar. Using an alternating grip—one hand with palm up, one hand palm down—grasp the bar by bending at both the hip and knee. The grip should be slightly wider than shoulder width.

To set up for the initial pull, the pelvic girdle should be in line with or slightly below the knees. The back should be flat and stabilized at about a 45° angle to the floor. The movement is begun by simultaneous hip and knee joint extension. The knee joint extends and moves slightly to the rear. The hip extends due to the action of the hamstrings, moving the pelvic girdle up and forward. The bar should contact the thigh about one fourth of the length of the femur above the patella.

It is imperative that the spinal erectors contract to keep the back as flat as possible as the movement progresses. Failure to do so will cause excessive rounding of the back, pulling the vertebrae apart, stretching ligaments, and possibly tearing muscles.

The head is tilted upward at this point to stimulate the trapezius and spinal erectors most effectively. Knee and hip joint extension continue until the bar has reached mid-thigh. The movement is completed by bringing the spine to a fully erect position, with the head looking forward and the shoulders back. The deadlift movement should be complete when standing in a natural posture, not with the spine hyperextended.

Mistakes are common in the execution of the deadlift, most notably dragging the bar up the shins, starting with the bar too far away from the shins, or hitching the bar up the thigh.

Athletes are often taught to keep the bar close to the body during the deadlift, but care must be taken not to have the bar too close to the shin when initiating the movement or the bar will be dragged across the shin. This creates drag force on the bar and often results in rounding of the back.

The opposite problem occurs when the knees are extended too fast, pushing the pelvic girdle up and toward the rear and leaving the bar 6 to 10 inches away from the shin. This problem can also result in rounding of the back.

Hitching is usually caused by a premature hyperextension of the spine, which pulls the bar into the thighs. This action makes the final part of the movement difficult to complete, and athletes will slightly re-bend the knees and extend them again quickly, thus resulting in the hitching movement of the bar.

All of these errors can lead to injury, so teaching proper form is important.

## Training Considerations

The deadlift puts a great deal of stress on many large muscles in the body. Therefore a strength base should be established in the muscles of the knees, hips, and low back before adding the deadlift to a strength program. If squats and other pulling movements are included in a regimen, deadlifts may be done once a week.

Some athletes rest as much as 9 or 10 days between deadlift sessions. Many coaches prefer to keep the number of reps per set for deadlifts lower than for other exercises, similar to the set and rep schemes used for power movements such as cleans.

When performing deadlifts, athletes should wear shoes with a good sole to prevent slipping. Heavy weights may require the use of a weightlifting belt. A belt helps to increase intra-abdominal pressure, which supports the spinal erectors and helps the athlete maintain proper posture. Chalk or straps can also be used with heavier weights to prevent the grip from becoming a problem.

Proper execution of the deadlift requires strong antagonist muscles. This means the rectus abdominus and obliques should be developed to prevent postural problems during the exercise. Adequate flexibility should be maintained to allow the athlete to start the movement in the proper position and to prevent excessive strain on the less flexible muscle groups.

## Summary

The deadlift places a stress on many of the muscles in the body. Yet it is a relatively simple exercise to teach, which means it can b-
taught effectively to the beginning strength athlete. The deadlift can be used as the initial pulling movement in a part-whole method to teach more complex pulling exercises such as the power clean. A good progression would be the deadlift, followed by the high pull, hang cleans, and finally, cleans from the floor.

There are several variations of the deadlift, but it is beyond the scope of this article to analyze each one. However, this analysis of the conventional deadlift should help the strength and conditioning professional understand its application within a well-rounded strength program. ▲

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