The Barbell Step Up

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The step up is a commonly used exercise in the conditioning of athletes. Many coaches from sports involving running and jumping believe that the step up is an effective leg strengthening exercise due to the fact that, as in these activities, hip and knee extension takes place on one leg at a time.

Start position and preparation

The barbell is placed behind the neck and rests on the traps and shoulders, as in the back squat.

Execution

One foot is placed flat footed onto a box or bench (drive up leg) and the other foot remains on the floor (trail leg) *(Figure 1)*.

The knee and hip of the drive up leg are extended simultaneously to full extension *(Figure 2)* and the foot of the trail leg is placed on the box next to the drive up foot *(Figure 3)*.

Stepping off of the box can be achieved in two ways:

1. Step down by flexing the knee and hip of the drive up leg and place the foot of the trail leg on the floor. Return to the starting position by placing the drive up foot on the floor next to the trail leg foot.
2. Step down by flexing the knee and hip of the trail leg and place the foot of the drive up leg on the floor. Return to the starting position by placing the trail leg foot on the floor next to the drive up foot.

Continue the exercise set by either keeping the same drive up leg for the desired repetitions or alternate drive and trail leg.



Figure 1.



Figure 2.



Figure 3.


Figure 4.


Figure 5.


Figure 6.

Technical considerations

The step up exercise is useful to develop strength and movement control during unilateral hip and knee extension if it is executed with the correct technique. The following aspects of the step up need to be considered when coaching the exercise:

• Knee and hip alignment

Maintaining knee and hip alignment of the drive up leg *(Figure 4),* will ensure appropriate strength and coordinative development of the musculature around the knee and hip joints and pelvic region (in particular the gluteal and quadriceps muscle groups). It is common to see individuals lose this alignment by allowing the knee to drop inwards, the hip to move laterally and for the pelvis to tilt (Figure 5). If this happens, the following coaching tips can be used:

1. Establish a lower box height where the individual demonstrates control throughout the movement. Only increase the height once the movement is mastered at the lower box height.

2. Use a lighter weight. Only increase the weight once the movement is mastered at the lower weight.

3. Ensure that the individual is focusing on posture – keeping their hips high and chest up. Get the individual to think about staying tall and pushing the box through the floor.

4. Slowing the first movement down gives the individual the opportunity to focus on building up a lot of tension in their quadriceps, to drive up and to control any undesired movement at the hip and pelvis.

Technical issues with this exercise typically go wrong at the start of the movement. The initial movement of extending the hip and knee to lift the trail leg off the floor should be very controlled. If the individual perfects the very first movement they will have initiated the correct coordination and will be more likely to complete the full step up with proper technique.

• Lagging hip extension

From the side, observe the upward movement of the hips relative to the bar. If the hips rise faster than the bar and there is a delay of the hips moving forward, then hip extension lags behind knee extension. The reason for this may purely be technical and due to the individual's lack of awareness of the movement pattern. Alternatively, it could be a result of weak quadriceps and gluteus muscle groups. In either case, consider the following coaching tips:

1. Encourage the individual to 'stay tall' and to keep their chest up.

2. As with one of the solutions for misalignment of the hip and knee, reduce step height and barbell mass to make execution of the exercise easier. Only increase step height and/or barbell mass once execution is perfected at a lower step height and/or barbell mass.

• Inappropriate trail leg contribution

The goal of the step up is to develop strength ability during unilateral knee and hip extension. To maximise this training effect, the initiation of extension should result from the force applied by the drive up leg. However, many individuals will initiate the movement by pushing off the ground with the trail leg. This action is difficult to avoid, but obviously the greater the trail leg pushes off, the less the drive up leg has to do, thus reducing the training effect. It is important to be aware of the contribution of the trail leg as the barbell mass increases. Often, as the barbell mass increases, individuals will push off with more of their trail leg, which could potentially cause the amount of load seen by the drive up leg to remain the same. To avoid this, in addition to simply observing and attempting to understand the trail leg contribution, a consistent lift off strategy for the trail leg can be adopted:

1. Prior to lift off the athlete should fully extend the knee of the trail leg, simultaneously contracting the quadriceps and rising up onto the toes of the trail leg (Figure 6).

2. This trail leg position should be maintained as the drive leg initiates the movement (this will avoid flexing the knee and ankle).

3. Alternatively, at the start, rather than raising onto the toe of the trail leg, maintain the flat footed position and as the movement is initiated by the drive up leg, maintain a dorsi flexed ankle and lift the foot off the ground without rising onto the toe.

- Step up height

Although the manipulation of step height should take place during the development of step up technique, the step height is an exercise variable that will dictate how the muscle groups are loaded. As the box height is lowered, the relative contribution from the quads increases, and as the box height increases the relative contribution from the gluteal muscle groups increases. However, form should not be compromised in order to change exercise emphasis. If there is a need to give the exercise more of a gluteal emphasis and the athlete has poor form at the desired step height, then gradually increase the step height from where they can maintain good technique towards this desired height.

Variation

There are a number of variations to the standard step up described in this article. It is beyond the scope of this article to describe them, but with each one there are important technical considerations as well as unique reasons as to their inclusion in a training program. Rather than simply adopting a step variation because the reader has seen other coaches/athletes using it, the reader should seek to establish the relevance of a variation and gain a complete understanding of its execution and its application within a program before prescribing it.

In conclusion, the step up is a useful exercise for the development of a number of key aspects of the coordination and control of unilateral knee and hip extension. It is effective for strengthening both the quadriceps and gluteal muscle groups under the conditions of unilateral knee and hip extension. These training effects will be maximised if the execution of the step up is mastered, thus effort should be taken to coach technique and to modify the difficulty of the exercise in terms of barbell mass, step height, reps and sets to ensure appropriate development of technique.

