

Strength Exercises for Improved Running Biomechanics

Many gait abnormalities seen during running are the result of compensations for previous injuries, faulty postural alignment, or muscular imbalances that have induced compensatory movement. In these cases, it is almost impossible for a runner to simply “fix” the way they run based on awareness of the problem. Instead, they have to train the various regions of the body how to “feel” what a proper movement is like and then condition the involved muscles to be able to carry out proper movement repetitively.

What this means is regardless of the body region you are targeting, strength exercises should progress to be as specific to the movement of “proper” running as possible. Exercises should not only work the same muscles in similar movement patterns, but should also use the nervous system in a similar manner. This will enhance the likeliness that any strength and stability gains will translate directly to improved running. Exercises can be designed to target the running motion in several ways:

(A) Engage muscle groups in a similar type of contraction

Specific muscles groups tend to work either **concentrically** (shorten as they contract), **eccentrically** (lengthen as they contract), or **isometrically** (maintain the same length as they contract) during running. Although most muscles act in all three ways at different points in the stride, the trick is to identify their dominant action, or how they work during their most forceful points.

Let's take a look at the hamstring muscles as an example, which work quite complexly during running. It is known through EMG studies that the hamstrings are most active from the end of

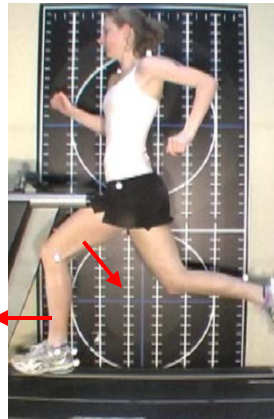
terminal swing, to the point of initial foot contact.[5] At this phase in the stride the hamstrings are first lengthened as the low leg swings forward in front of the body. At the opposite attachment site into the pelvis, the hamstrings will then pull at the hip joint to create a “pull back” force on the leg. As the leg pulls back under the body, the hamstrings will maintain a similar length as the stretch from the low leg is balanced out by the shortening action from the hip.

In effect, the hamstrings actually work somewhat isometrically (very little change in overall length), as they effectively transfer the force from the forward swing of the low leg into “pull-back” force at the hip.

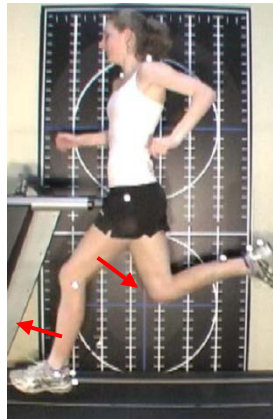
Hamstring action during terminal swing phase of running



As the knee drives forward the hamstrings are un-stretched



Low leg swings forward, creating stretch in the hamstrings. The hamstrings then pull at the other end where they attach on the pelvis.



As the knee continues to straighten, the hamstrings (in addition to the gluteus maximus) use this stored energy pull the leg back.



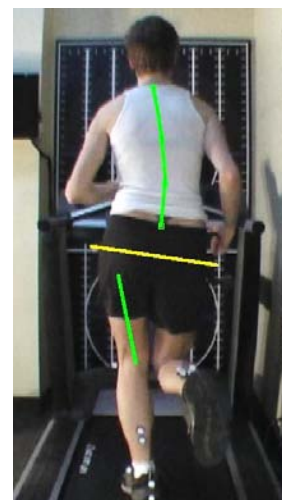
The hamstrings continue to pull the leg back right through initial contact.

It is interesting that, many healthcare practitioners and coaches still prescribe concentric hamstring exercises such as hamstring curls to runners and sprinters with chronic hamstring injury. The better option would be to incorporate strength exercises similar to the one seen on page B-21 which work the hamstrings in more of an eccentric/isometric manner. This exercise will also help runners develop more effective contraction timing to better transfer energy from the forward swing of the lower leg to the backwards extension at the hip.

(B) Challenge the limbs and core in an atmosphere of instability

The primary difference between walking and running is that runners experience a period of “double float,” where both feet are off the ground, before they land on a single leg. Walkers, on the other hand, always have at least one foot on the ground, and have two feet on the ground at the point of foot strike. This makes walking a more “stable” activity.

Runners therefore need to be capable of effectively stabilizing the contacting foot, leg, and hip as they literally jump from one leg to the other. Exercises geared toward improving running biomechanics must challenge an individual's ability to stabilize the body in a manner similar to running. This can be accomplished by incorporating single leg exercises, and challenges such as stability balls and wobble boards.



Running technique will suffer when an individual cannot effectively stabilize the core.

Core Stability and Postural Control

Let's take a moment to address an important question; What exactly is "core stability"? Many individuals intuitively associate this term with abdominal strength. In fact, it is not uncommon to see many "core strength" classes that take participants through a long series of abdominal exercises with an emphasis on "making the abs burn". It is important to understand though, that although general abdominal strength plays a role in overall core stability, it is only a piece of the puzzle.

Core stability is defined as the capability to control movement of the pelvis and low back. This control is attained through the coordination of 29 pairs of muscles that attach to and cross the lumbar spine, pelvis and hip regions. Several of these muscle groups, called "local stabilizers", attach directly to the spine and provide stability between the spine segments themselves. Local stabilizers include the multifidus, transverses abdominis, and the internal obliques.[6] The other muscles of the core region are referred to as "Global spinal stabilizers", and are responsible for creating and resisting large movements of the trunk, pelvis, and hips.[7] These include muscles such as the rectus abdominis, erector spinae, and external obliques.

Each muscle, whether classified as local or global plays an important role in overall core stability, however, how these muscles work together is even more important. The fibers of all the core muscles are intertwined (through fascia) and oblique to one-another, allowing them to work together as a coordinated unit to maintain postural alignment during functional movement.

The forces placed on and created by the core region during running are quite complex. A runner must achieve a certain amount of stiffness to endure unexpected loads (especially when running on uneven surfaces), speed changes, and unilateral forces between the lower and upper body. An exercise program geared toward improving core stability during

running should therefore train all the various muscles of the trunk to work in unison against similar forces. This means that exercises should mimic body movements occurring during running, and should be focused on teaching the muscles to work in a stabilizing fashion.

As our awareness for the need of the core musculature coordination has increased, there has been a strong shift toward fitness and healthcare specialists teaching a core activation method known as "abdominal bracing". In this method, an individual is taught to lightly co-activate of all the abdominal muscles together, giving the feel of a girdle surrounding the abdomen and low back. [3]

Creating an Abdominal Brace

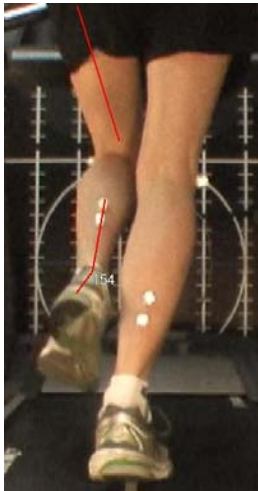
1. **Find an optimal low back curve:** Stand with your lower back flexed forward slightly and your hand placed on the muscles of your lower back. Slowly extend your back, bringing your torso to a more upright position until you feel the muscles of the lower back relax. **This is your "neutral back position."**
2. Now flex your stomach muscles; **not by "sucking in"**, but by simultaneously contracting all of your abdominal muscles (upper, lower, front, side, and back), creating the feeling of a brace around your stomach and lower back. You will feel pressure taken off your lower spine when this is done properly. **Only a moderate level of muscle contraction is necessary** to maintain a sufficient amount of stability. Avoid "clenching" too hard [4]

The next step is to maintain a neutral back position through a series of motions, using an abdominal brace to do so. You may find that you can apply this abdominal brace while running or walking right away with little difficulty. For the rest of us we can develop to this point through a working on maintaining a brace through ALL the strength exercises described in this chapter.

(C) Train the movement, not individual muscle groups

When a runner exhibits excessive rotations or movements in the legs, arms, or trunk, many specialists will spend a significant amount of time trying to pinpoint the exact muscle culprit responsible for these movements. One or two muscles, they figure, must be too weak or too tight, so the body is forced to compensate. They will often even administer a series of static muscle tests to help identify exactly what is going awry so that they can address each muscle individually with strength or flexibility training.

Not that this way of thinking is wrong. If a certain muscle group is extremely weak or tight compensatory movement patterns will indeed



Excessive internal rotation of the swing leg may occur when muscles such as the TFL and rectus femoris become dominant over other hip flexors

occur during running. This way of addressing movement, however, is quite limited.

There are many factors that can affect how muscles work together during any dynamic movement. In some cases, there can be a developed “over-dominance” of one or two muscle groups that take on a greater role than they should for a particular movement. As a result, an excessive pull will be placed on

a joint from one direction creating a noticeable rotation or deviation from “optimal movement”.

In other cases, the running stride of an individual may appear to be somewhat restricted (making a runner look “tight”) because muscles that are responsible for controlling certain actions of the limbs are “over-active” and co-contract

excessively against the primary muscles responsible for creating a movement.

Lastly, it is not uncommon where muscles responsible for stabilizing the core or various joints do not “activate” at the appropriate time to stabilize an important region during movement. These stabilizer muscles may test individually as being strong, however, they fail to contract appropriately during critical times in the running cycle. As a result, excessive movements in the side-to-side or rotational directions tend to occur at the hips, knees, and/or ankles.

These are just a few examples of how overall running biomechanics can be altered by improper muscle action, and it is no wonder that many running analysts get regular headaches trying to figure out the chain of events causing abnormal movements. The good news is, even though the cause is often complex, correction is much more simple! If an individual simply focuses on executing specific strength exercises with proper technique (especially those that more closely resemble movements occurring during running), the most effective muscle activation patterns will automatically occur and can be trained into the “memory” of the nervous system.

(D) Develop muscle contraction and coordination quality

This principle is an extension to the previous point. Exercises should function to improve **muscle contraction quality** through proper execution and through heightened body awareness. There are some individuals, however, who have an extremely difficult time performing certain movements. These individuals either lack the necessary amount of body awareness or are experiencing significant muscle inhibition, often due to previous injury or postural related muscle impairment syndromes. In this case, demonstrating or explaining proper technique for execution of specific exercises is simply not enough. These individuals require more education on what primary muscle regions should be working to perform an exercise, and

how the various stabilizer muscles should work together to complement the movement. They will have to do a lot more “thinking” on how their body is achieving movement in order to teach the nervous system how to automatically move the body properly. When “thinking” is not enough, increased muscle awareness can also be gained by:

- Placing a hand over the “right” muscle region so that they may feel it contract during a movement
- Pushing a thumb quick and hard into the “right” muscle region to initiate a contraction reflex (when the above does not work)
- Increasing muscle activation with therapeutic interventions such as Kinesio Taping, Electrical Muscle Stimulation, and other soft tissue treatment methods (ex. Active Release Technique)

Putting it All Together

You will find that the strength exercises recommended in this chapter will progress as the above principles suggest. Most level 1 exercises are focused on increasing muscle awareness and contraction quality. As the levels increase, focus then shifts to more full body movements that closely resemble the various movements that take place during running. Although the exercises have been categorized by the region they are training, you will notice that many of the higher level exercises will address, and are included in more than one category. This is because the higher level exercises require more full body control and coordination and thus involve several regions of the body.

Keep in mind that this program is geared more toward movement training through teaching the muscles to contract most efficiently and effectively during the running motion. Although noticeable strength gains will occur as an individual progresses through the various levels of exercises, this program is not meant to replace heavier weight training. In fact, many elite level runners will find that progressing

through these exercises during their base training season will prepare them for better control, and improved body awareness during more intense strength training later in the season.

General Exercise Prescription Guidelines

- A series of levels have been listed here for each muscle region/movement. The exercises you choose to use with your client will depend on their current level of strength and overall body awareness. In your first session always begin with the level 1 exercise. If the client can master these exercises without any significant fatigue in the first session than you may move onto the next level.
- The client should maintain a certain exercise within their routine for as long as it poses a challenge to them. You may find that they progress through exercises in certain regions faster than others. This is ok. You can upgrade exercises for certain regions while holding them back on others. It is essential that you do not progress them until they are ready.
- **Frequency:** Exercises should be done **3-4 times per week**, with a day off in between. Exceptions are some level 1 exercises that focus primarily on neural activation of particular muscle regions, which can be done every day.
- **When:** It is optimal to do these exercises after a run or strenuous workout. In most cases going through an exercise program just prior to a run will not benefit a runner, and may even be harmful (ex. By fatiguing important joint stabilizers).

There are a few cases, however, where it may in fact be beneficial to perform a few repetitions of an exercise prior to running. For instance, performing a single leg squat on a wobble board with proper technique will

require many of the core and joint stabilizer muscles to activate. As a result, the action of running can feel more “stable” as these stabilizer muscles contract more readily.

- **Repetitions:** Exercises are usually performed with **10-30 repetitions**, and **1-3 sets** unless it is considered a “static” exercise, in which case it’s held for 10-60 seconds. Build upon endurance before intensity is increased (with higher level exercises, harder resistance bands, etc.) Because these are movement training exercises, repetition is key.
- **Number of exercises:** Try to keep a client’s program to a maximum of **5-6 exercises** per session. Any more than this may decrease the likeliness that they stay compliant to their program.
- **Vary the exercises:** For many of the muscle regions, several exercises are given here for

each level. The reason for this is that it allows a runner to change up their routine each day if they are easily bored. There are also an endless number of exercises that are not listed here that will target similar regions.

- **Proper technique is essential:** Clients should be carefully monitored throughout a correctional exercise program to ensure that they remember and maintain proper technique. It is often necessary to perform only supervised exercises for the first few weeks of a program before allowing them to go out on their own.

Strength Exercises

Level			Level		
Hip Flexion			Anterior/Posterior Pelvic Control		
Standing wall hip flexion	1	p.8	Supine abdomen draw with limb movement (A,B, and C)	1	p.25
Supported resisted hip flexion	2	p.9	Neutral back curl	1	p.28
Ball bridge marching	2	p.29	Ball bridge marching	2	p.29
Standing resisted hip flexion	3	p.10	Kneeling plank - to side bridge	2	p.30
Single leg ball knee tucks	4	p.34	Plank - to side bridge	3	p.31
			Ball knee tucks	3	p.32
			Ball hip extension and leg curl	3	p.33
			Single leg ball knee tucks	4	p.34
			Plank to side bridge with leg lifts	4	p.35
			Single leg ball hip extension and leg curl	4	p.36
Lateral and Rotational Pelvic and Hip Stability			Trunk/Pelvic Torsional Control		
Side lying hip abduction	1	p.11	Ball weight pass	1	p.37
Hip drops	1	p.12	Standing arm swing	1,2,3	p.38
Resisted standing hip abduction	2	p.13	Ball bridge marching	2	p.29
Supported single leg half squats	2	p.14	Single leg knee tucks	4	p.34
Single-leg half squats	3	p.15	Single leg ball hip extension and leg curl	4	p.36
Plank to side bridge with leg lifts	4	p.35	Standing resisted hip flexion	4	p.10
Hip Extension					
Bridge	1	p.16			
Ball Bridge	2	p.17			
Supported single leg half squats	2	p.14			
Ball hip extension and leg curl	3	p.38			
Single leg half squats	3	p.15			
Single leg bridge	3	p.18			
Lunges	3	p.19			
Wobble board lunges	4	p.20			
Reactive elastic hip extension	4	p.21			
Single leg ball bridge	4	p.22			
Single leg ball hip extension and leg curl	4	p.36			
Plank to side bridge with leg lifts	4	p.35			
Ankle and Foot					
Heel rise	1	p.23			
Standing arm swing (on balls of feet)	2	p.44			
Forefoot wobble board half squats	3	p.24			

Muscle Regions Targeted

1. Hip flexors
2. Hip stabilizers
3. Core musculature

Exercise Goals

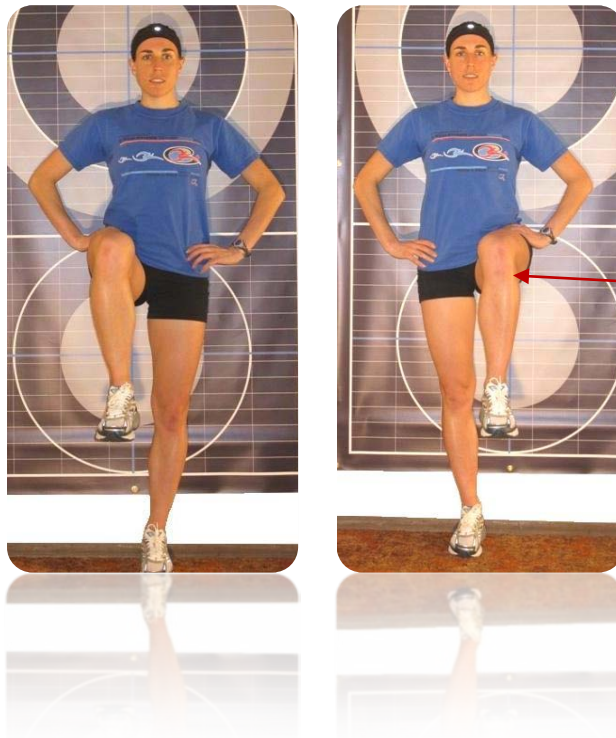
- Improved ability to maintain a stable core as the leg/hip flexes forward
- Improved hip flexion mechanics – training the movement along a straight plane with no excessive rotations occurring

Starting Position

- Stand tall with the back against a wall and your feet together. The shoulders, back, and low legs should be in contact with the wall
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times

Execution

- Lift one leg in front of the body with a bent knee, while simultaneously tightening the gluteal muscles on the side of the stance leg to maintain stability of the pelvis.
- Slowly return the leg back to its initial position and repeat with the opposite leg.



Minimal rotation should be seen at the thigh and lower leg.

Technique Tips

- Ensure that the shoulders and pelvis are held level and square
- The foot of the stance leg should be held in a neutral position (not excessively pronated or supinated)
- The thigh of the stance leg should not rotate medially or laterally
- The leg being lifted should drive forward as straight as possible with no rotation occurring in the thigh or lower leg. It may adduct slightly toward the midline, but should not pass the midline

Muscle Regions Targeted

1. Hip flexors
2. Hip stabilizers
3. Core musculature

Exercise Goals

- Improved ability to maintain a stable core as the leg/hip flexes forward
- Improved hip flexion mechanics – training the movement along a straight plane with no excessive rotations occurring

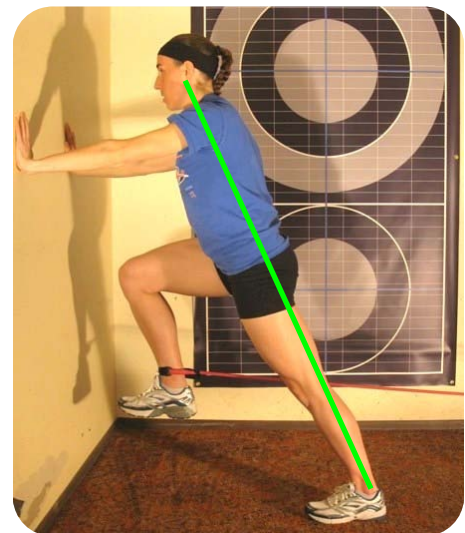
Starting Position

- Stand tall with anchored resistive band around one ankle. While maintaining a straight body position, place your hands against a wall and lean into it.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Drive the knee (of the leg with the resistive band) forward and slightly toward the midline until the thigh is parallel to the ground.
- Lower the leg back to the starting position in a controlled manner and repeat.

NOTE: The speed of the exercise may be increased in order **to train hip flexor reactivity**. In this case, allow the hip to extend to a greater extent before driving the leg forward, this will allow the elastic components to pre-load, and the muscle to pre-stretch (inducing the stretch reflex)



Technique Tips

- Ensure that the shoulders and pelvis are held level and square
- The foot of the stance leg should be held in a neutral position (not excessively pronated or supinated)
- The thigh of the stance leg should not rotate medially or laterally
- The leg being lifted should drive forward as straight as possible with no rotation occurring in the thigh or lower leg. It may adduct slightly toward the midline, but should not pass the midline.

Muscle Regions Targeted

1. Hip flexors
2. Hip stabilizers
3. Core musculature

Exercise Goals

- Improved ability to maintain a stable core as the leg/hip flexes forward
- Improved hip flexion mechanics – training the movement along a straight plane with no excessive rotations occurring



Starting Position

- Stand tall with anchored resistive band around one ankle.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- While maintaining a straight body position, allow the leg with the resistive band to extend back behind the body, then drive the knee forward and slightly toward the midline until the thigh is parallel to the ground.
 - Lower the leg back to the starting position in a controlled manner and repeat.

NOTE: The speed of the exercise may be increased in order **to train hip flexor reactivity**. In this case, allow the hip to extend to a greater extent before driving the leg forward, this will allow the elastic components to pre-load, and the muscle to pre-stretch (inducing the stretch reflex)

Technique Tips

- Ensure that the shoulders and pelvis are held level and square
- The foot of the stance leg should be held in a neutral position (not excessively pronated or supinated)
- The thigh of the stance leg should not rotate medially or laterally
- The leg being lifted should drive forward as straight as possible with no rotation occurring in the thigh or lower leg. It may adduct slightly toward the midline, but should not pass the midline.

Muscle Regions Targeted

1. Hip abductors
2. Core musculature

Exercise Goals

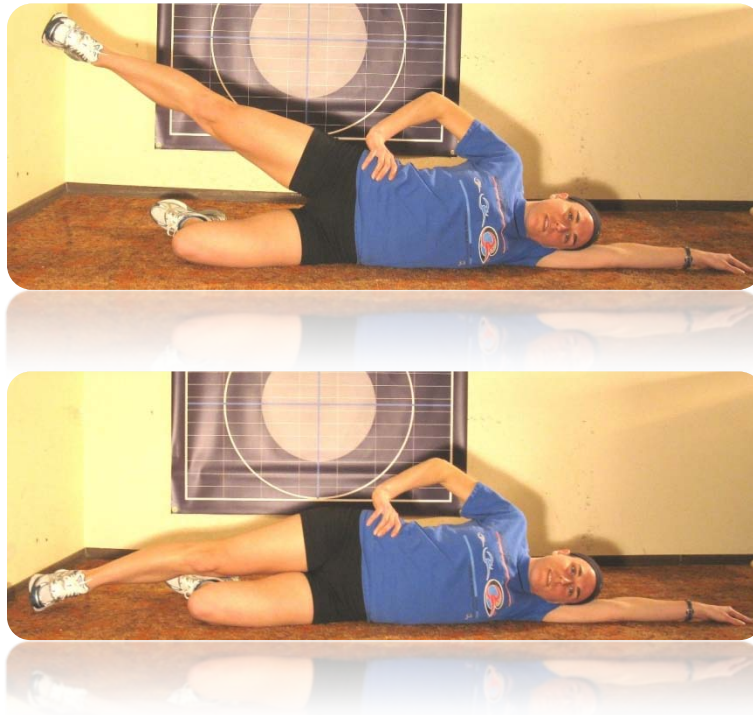
- Activate and strengthen the hip abductor muscles
- Improved hip abduction mechanics – training the movement along a straight plane with no excessive rotations, forward, or backward movement

Starting Position

- Lie on your side with the head resting on an outstretched arm. Bend the bottom knee to help with balance.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Raise the top leg upward to about 30°, using the lateral hip muscles to do so.
- Lower the leg back to the starting position, and repeat.



Technique Tips

- Ensure that the knee is straight and the hip does not flex forward (the leg does not raise in front of the body)
- The toes of the lifting leg should point directly forward
- Ensure that the top aspect of the pelvis does not drop backward and that the body and leg are aligned throughout the exercise.

Muscle Regions Targeted

1. Hip abductors
2. Hip stabilizers
3. Core musculature

Exercise Goals

- Improved ability to use the hip abductor muscles to stabilize the pelvis from the side of the stance leg

Starting Position

- Stand balanced on one leg on a step or ledge while focusing on holding the pelvis level and square
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Allow the non-supporting leg and hip to drop downward.
- Use the side hip muscles on the stance leg to pull the hip back up to level. Repeat.

Technique Tips

- Ensure that the shoulders and pelvis remain square (no rotations should occur)
- If you are having trouble feeling the lateral hip muscles working to perform this motion, push your fingers into these muscles to help with activation
- The foot of the stance leg should be held in a neutral position (not excessively pronated or supinated)



Muscle Regions Targeted

1. Hip abductors
2. Hip stabilizers
3. Core musculature

Exercise Goals

- Improved ability to use the hip abductor muscles to stabilize the pelvis
- Improved hip abduction mechanics – training the movement along a straight plane with no excessive rotations, in a direction that activates the posterior lateral gluteal muscles (an area that is often weak in runners)



Technique Tips

- Ensure that the pelvis and torso remain level and square (no rotations or flexions should occur)
- If you are having trouble feeling the lateral hip muscles working to perform this motion, push your fingers into these muscles to help with activation
- The foot of the stance leg should be held in a neutral position (not excessively pronated or supinated) and the thigh should not rotate medially or laterally

Starting Position

- Stand tall with an anchored resistive band around one ankle. Take a step or two back from where the band is anchored so that the band will not rub against the stance leg.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- While maintaining straight knees, lift the leg with the band to the side and slightly to the back of the body.
- The lateral gluteal muscles on the side of the stance leg should work to maintain pelvic stability, while both the lateral gluteal muscles and the gluteus maximus on the opposite leg should work together to pull the resisted leg
- Return the leg to the starting position in a controlled manner, and repeat

Muscle Regions Targeted

1. Hip abductors
2. Gluteus maximus
3. Hip stabilizers
4. Core musculature

Exercise Goals

- Improved ability to use the hip abductor muscles to stabilize the pelvis from the side of the stance leg
- Improved ability to use the gluteus maximus as the primary mover to “pull” the pelvis back to the starting position

Starting Position

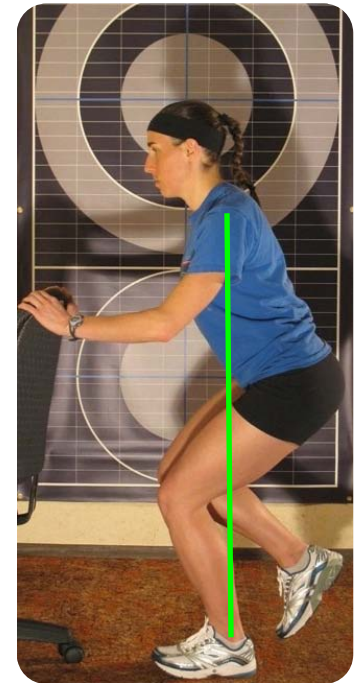
- Stand tall on one leg with the opposite knee bent in a comfortable position. Grasp a stable waist-height bar or chair.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Bend at knee and hip and pull the pelvis back as if you are going to sit on a chair. Squeeze the gluteal muscles (both the lateral and gluteus maximus) to pull the pelvis back to the starting position.
- The lateral gluteal muscles on the side of the stance leg should work to maintain pelvic stability throughout the exercise

Technique Tips

- The shoulders should remain directly over the ankle, and the knee of the stance leg should not push forward beyond the toe.
- Ensure that the pelvis and torso remain level and square (no rotation or lateral flexion should occur)
- The foot of the stance leg should be held in a neutral position (not excessively pronated or supinated) and the thigh should not rotate medially or laterally
- Performing “Hip Drops” at regular intervals throughout this exercise will help in activating the proper muscles to hold the pelvis level.



Muscle Regions Targeted

1. Hip abductors
2. Gluteus maximus
3. Hip stabilizers
4. Core musculature

Exercise Goals

- Improved ability to use the hip abductor muscles to stabilize the pelvis from the side of the stance leg
- Improved ability to use the gluteus maximus as the primary mover to “pull” the pelvis back to the starting position

Starting Position

- Stand tall on one leg with the opposite knee bent in a comfortable position.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Bend at knee and hip and pull the pelvis back as if you are going to sit in a chair. Squeeze the gluteal muscles (both the lateral and gluteus maximus) to pull the pelvis back to the starting position.
- The lateral gluteal muscles on the side of the stance leg should work to maintain pelvic stability throughout the exercise



Technique Tips

- The shoulders should remain directly over the ankle, and the knee of the stance leg should not push forward beyond the toe.
- Ensure that the pelvis and torso remain level and square (no rotation or lateral flexion should occur)
- The foot of the stance leg should be held in a neutral position (not excessively pronated or supinated) and the thigh should not rotate medially or laterally
- Performing “Hip Drops” at regular intervals throughout this exercise will help in activating the proper muscles to hold the pelvis level.

Muscle Regions Targeted

1. Gluteus maximus (and other hip extensors)
2. Core musculature

Exercise Goals

- Increased ability to extend the hip using the gluteus maximus as the primary mover
- Improved ability to extend at the hip while maintaining a stable pelvis and torso

Starting Position

- Lie on your back with your knees bent and feet flat on the floor. Place your arms 45° at your sides with the palms up.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Squeeze your gluteal muscles and slowly raise the pelvis off the floor into a bridge position.
- Lower the pelvis in a controlled manner to the starting position and repeat.



Technique Tips

- Relax your muscles between each repetition and continue to re-initiate the movement each time with the gluteal muscles, minimizing the action from the hamstrings
- **If you are having a hard time activating the gluteus maximus:** Focus on pushing through your heels as your pelvis rises.
- Ensure that the pelvis and torso remain square (no rotations or flexions should occur)

Muscle Regions Targeted

1. Gluteus maximus (and other hip extensors)
2. Core musculature
3. Hip stabilizers

Exercise Goals

- Increased ability to extend the hip using the gluteus maximus as the primary mover
- Improved ability to extend at the hip while maintaining a stable pelvis and torso

Starting Position

- Support the upper back on a ball, and form a bridge position
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Roll forward on the ball and lower the pelvis down as far as is comfortable
- Squeeze the gluteal muscles to push back up to the starting position, repeat



Technique Tips

- All movement for this action should occur at the hips, while the lower back maintains a neutral position
- Try to minimize the action from the hamstrings
- **If you are having a hard time activating the gluteus maximus:** Focus on pushing through your heels as your pelvis rises.
- Ensure that the pelvis and torso remain square (no rotations or flexions should occur)

Muscle Regions Targeted

1. Gluteus maximus (and other hip extensors)
2. Hip stabilizers
3. Core musculature

Exercise Goals

- Increased ability to extend the hip using the gluteus maximus as the primary mover
- Improved ability to extend at the hip while maintaining a stable pelvis and torso

Starting Position

- Lie on your back with your knees bent and feet flat on the floor. Place your arms 45° at your sides with the palms up.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Bend the hip and knee of one leg in front of the body and hold it there throughout the exercise.
- Squeeze the gluteal muscles of the support leg and slowly push the pelvis off the floor and into a bridge position.
- Lower the pelvis in a controlled manner to the starting position and repeat.



Technique Tips

- Relax your muscles between each repetition and continue to re-initiate the movement each time with the gluteal muscles, minimizing the action from the hamstrings
- **If you are having a hard time activating the gluteus maximus:** Focus on pushing through the heel of the support leg as the pelvis rises.
- Ensure that the pelvis and torso remain square (no rotations or flexions should occur)

Muscle Regions Targeted

1. Gluteus maximus (and other hip extensors)
2. Hip stabilizers
3. Core musculature

Exercise Goals

- Improved ability to use the gluteus maximus as the primary mover to “pull” the body back up to the starting position
- Improved ability to extend at the hip while maintaining a stable pelvis and torso

Starting Position

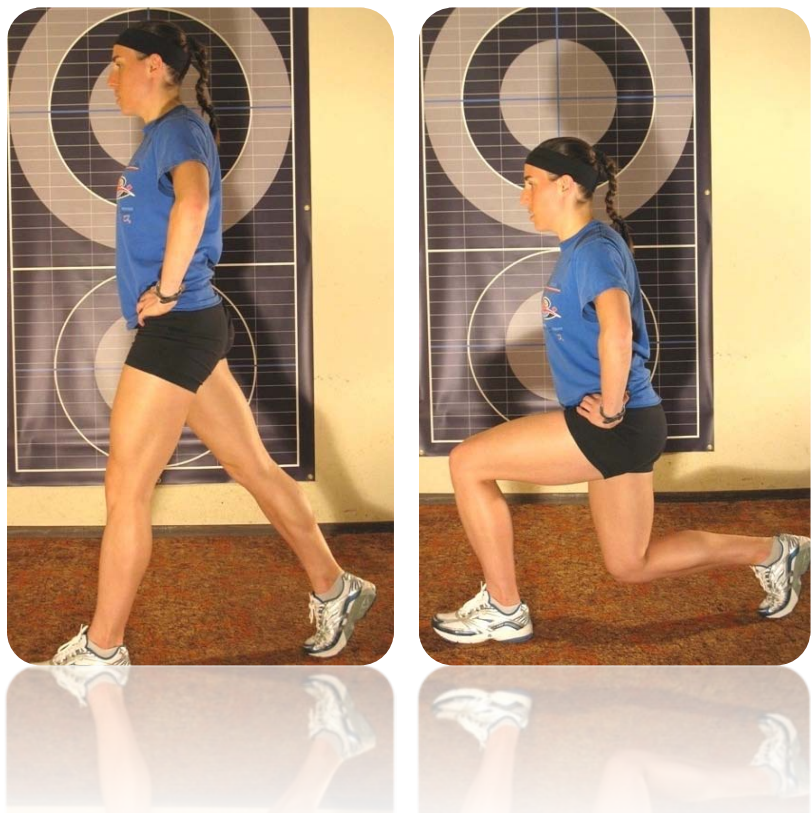
- From a standing position, begin by stepping forward with a stride that is slightly longer than a normal. Shift your weight to the front leg, and use the back leg more for balance.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Lower your body straight down until your back knee almost touches the floor. The front knee should not push forward beyond the toe.
- Use the gluteal muscles of front leg to push body back up to start position, and repeat.
- The lateral gluteal muscles on the front leg should work to maintain pelvic stability throughout the exercise

Technique Tips

- The torso will tilt slightly forward to help emphasize the use of the gluteus maximus of the front leg, however, the torso should be straight with no excessive flexions occurring along the spine
- Ensure that the pelvis and torso remain level and square (no rotation or lateral flexion should occur)
- The feet should be held in a neutral position (not excessively pronated or supinated) and the thighs should not rotate medially or laterally



Muscle Regions Targeted

1. Gluteus maximus (and other hip extensors)
2. Hip stabilizers
3. Core musculature

Exercise Goals

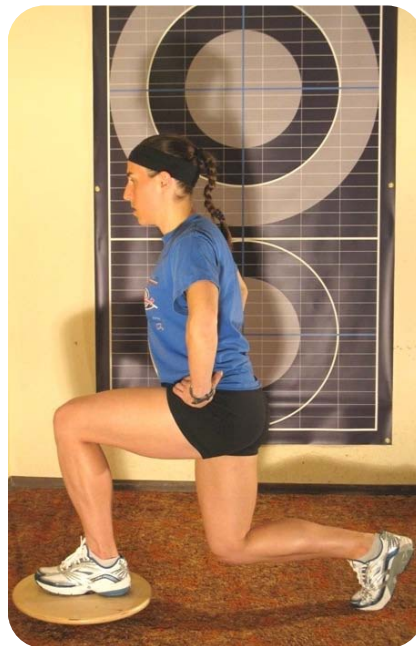
- Improved ability to use the gluteus maximus as the primary mover to “pull” the body back up to the starting position
- Improved ability to extend at the hip while maintaining a stable pelvis and torso

Starting Position

- From a standing position, begin by stepping forward with a stride that is slightly longer than a normal. Center the front foot onto a wobble board. Shift your weight to the front leg, and use the back leg more for balance.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Lower your body straight down until your back knee almost touches the floor. The front knee should not push forward beyond the toe.
- Use the gluteal muscles of front leg to push body back up to start position, and repeat.
- The lateral gluteal muscles on the front leg should work to maintain pelvic stability throughout the exercise



Technique Tips

- The torso will tilt slightly forward to help emphasize the use of the gluteus maximus of the front leg, however, the torso should be straight with no excessive flexions occurring along the spine
- Ensure that the pelvis and torso remain level and square (no rotation or lateral flexion should occur)
- The feet should be held in a neutral position (not excessively pronated or supinated) and the thighs should not rotate medially or laterally

Muscle Regions Targeted

1. Hamstrings, gluteus maximus (and other hip extensors)
2. Hip stabilizers
3. Core musculature

Exercise Goals

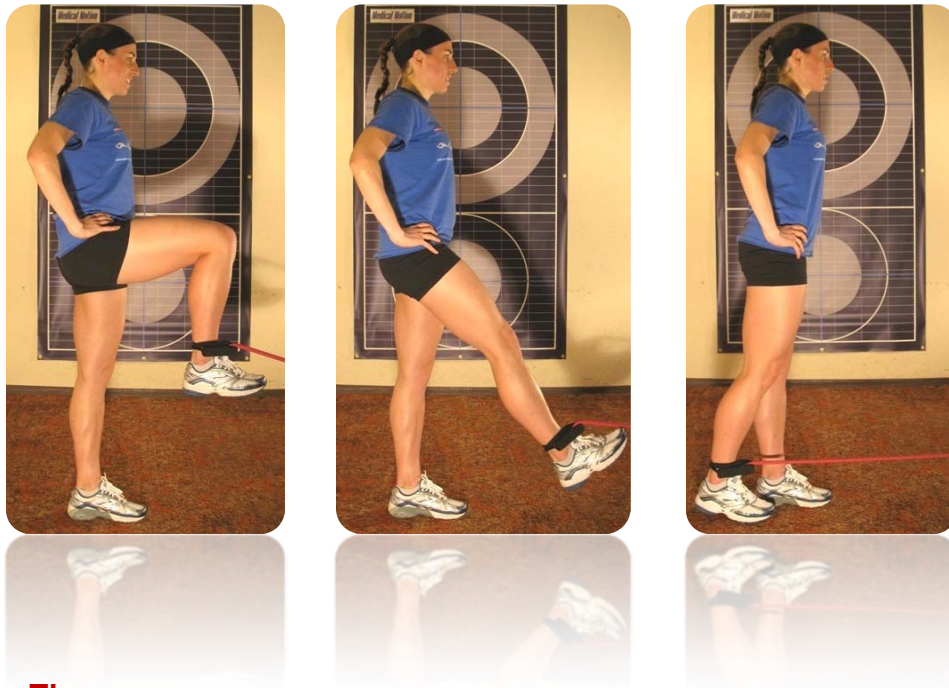
- Increased ability to extend the hip using optimal hamstring usage and contraction timing.
- Improved ability to extend at the hip while maintaining a stable pelvis and torso

Starting Position

- Stand tall with an anchored resistive band around one ankle. Flex the knee and hip so that the thigh is parallel to the ground.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Straighten the knee while simultaneously pulling the leg down and back behind the body.
- Quickly drive your knee back up to the starting position, and repeat.



Technique Tips

- A slight stretch in the hamstrings should be allowed before these muscles work to pull the leg back
- As you are pulling the leg back you should also squeeze the gluteus maximus to aid in this action
- The feet should be held in a neutral position (not excessively pronated or supinated) and the thighs should not rotate medially or laterally
- Ensure that the pelvis and torso remain level and square (no rotations or flexions should occur).

Muscle Regions Targeted

4. Gluteus maximus (and other hip extensors)
5. Hip stabilizers
6. Core musculature

Exercise Goals

- Increased ability to extend the hip using the gluteus maximus as the primary mover
- Improved ability to extend at the hip while maintaining a stable pelvis and torso

Starting Position

- Support the upper back on a ball, and form a bridge position.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Lift one leg with a straight knee parallel to the ground and hold it there throughout the exercise.
- Roll forward on the ball and lower the pelvis down as far as is comfortable
- Squeeze the gluteal muscles of the support leg to push back to the starting position, and repeat



Technique Tips

- All movement for this action should occur at the hips, while the lower back maintains a neutral position.
- Try to use a minimal amount of hamstring contraction to perform this exercise. **If you are having a hard time activating the gluteus maximus:** Focus on pushing through the heel of the support leg as the pelvis rises.
- Ensure that the pelvis and torso remain square (no rotations or flexions should occur)

Muscle Regions Targeted

1. Ankle plantar flexors (“calves”)
2. Ankle and foot stabilizers
3. Core musculature

Exercise Goals

- Increased strength and contraction quality of the muscles supporting and moving the foot and ankle
- Improved ability to resist forces pushing the toes and forefoot upward during the stance phase of running.



Starting Position

- Stand on one leg with one or two hands against a wall for balance.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Push downward with the toes and forefoot, and concentrate on applying equal pressure across the region as you do so.
 - While maintaining downward pressure raise up onto the ball of the foot in a controlled manner.
 - Lower the foot back to the starting position, and repeat.

Focus on maintaining straight toes (no curling)



Technique Tips

- The joints of the toes should remain straight. Avoid “curling” your toes if possible.
- Ensure that the pelvis and torso remain level and square (no rotation or lateral flexion should occur)
- The feet should be held in a neutral position (not excessively pronated or supinated) and the thighs should not rotate medially or laterally

Note: The intensity of this exercise on the foot and ankle stabilizer muscles will be increased by performing this exercise on a wobble board.

Muscle Regions Targeted

1. Ankle plantar flexors ("calves")
2. Ankle and foot stabilizers
3. Hip abductors and stabilizers
4. Gluteus maximus
5. Core musculature

Exercise Goals

- Increased strength and activation in the foot and ankle stabilizers during the stance phase of running.
- Improved ability to use the hip abductor muscles to stabilize the pelvis from the side of the stance leg
- Improved ability to use the gluteus maximus as the primary mover to "pull" the pelvis back to the starting position

Starting Position

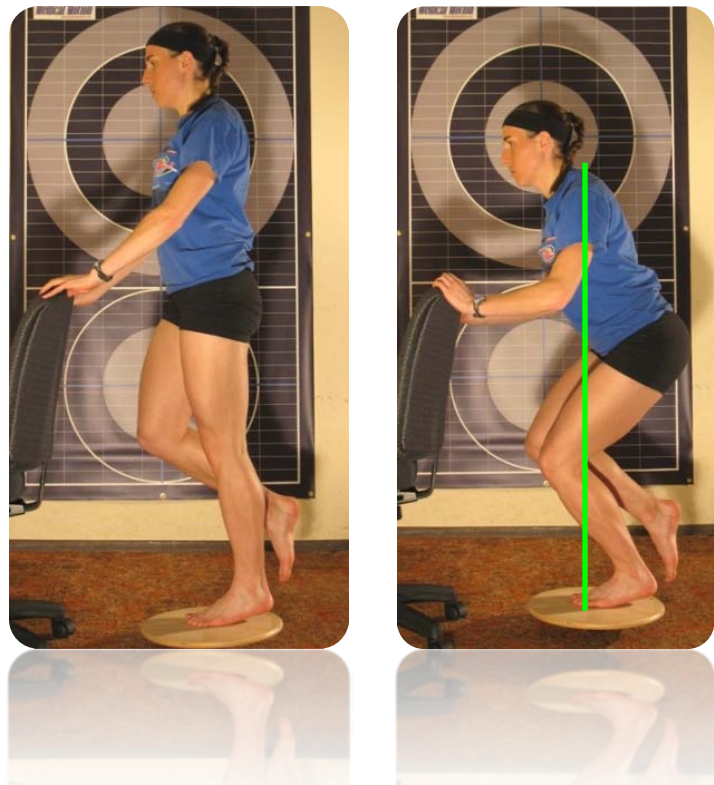
- Stand tall on one leg with the forefoot centered on a wobble board (heel slightly raised) and the opposite knee bent in a comfortable position. Grasp a stable waist-height bar or chair.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- While maintaining a balanced position on the forefoot, bend at knee and hip and pull the pelvis back as if you are going to sit on a chair. Squeeze the gluteal muscles (both the lateral and gluteus maximus) to pull the pelvis back to the starting position.
- The lateral gluteal muscles on the side of the stance leg should work to maintain pelvic stability throughout the exercise

Technique Tips

- Focus on pushing the toes and forefoot down into the board, with equal pressure across the region. The foot and ankle should be held stable in a neutral position (no excessive pronation) throughout the exercise.
- Ensure that the pelvis and torso remain level and square (no rotation or lateral flexion should occur), and that the thigh does not rotate medially or laterally



Muscle Regions Targeted

1. Core - **Local spine stabilizers** (ie. Transverse abdominis, internal obliques, multifidus)

Exercise Goals

- Increased ability to activate the muscles responsible for locally stabilizing the spine
- Improved ability to perform flexion and extension movements of the arms and legs while maintaining a stable pelvis and torso
- **This exercise is highly recommended for individuals who have a history of low back pain (master before attempting abdominal bracing)**

Starting Position

- Begin by lying on your back with your knees bent, feet flat on the floor, and the hands under the low back.
- Form a neutral low back curve and be maintained in this position throughout the exercise (avoid flattening the spine).
- Draw the abdomen in and up without holding your breath. As the abdomen is drawn in, there should not be increased pressure felt on the hands (indicating that the back is maintaining its position).

Execution

- Rise one arm until it is perpendicular to the ground. Return to the starting position, and repeat with the other side.
- Alternate the arms at increasing speeds until the movement becomes rapid while still maintaining an abdominal draw and a neutral low back curve.



Technique Tips

- An abdominal draw can be accomplished by “sucking in” the belly button toward the spine. Ensure that you do not hold your breath while you do this
- All movement for this action should occur only at the arms, while the rest of the body is held completely stable

Muscle Regions Targeted

1. Core - **Local spine stabilizers** (ie. Transverse abdominis, internal obliques, multifidus)

Exercise Goals

- Increased ability to activate the muscles responsible for locally stabilizing the spine
- Improved ability to perform flexion and extension movements of the arms and legs while maintaining a stable pelvis and torso
- **This exercise is highly recommended for individuals who have a history of low back pain (master before attempting abdominal bracing)**

Starting Position

- Begin by lying on your back with your knees bent, feet flat on the floor, and the hands under the low back.
- Form a neutral low back curve and be maintained in this position throughout the exercise (avoid flattening the spine).
- Draw the abdomen in and up without holding your breath. As the abdomen is drawn in, there should **not** be increased pressure felt on the hands (indicating that the back is maintaining its position).

Execution

- Flex one leg at the hip, pulling the thigh toward the chest about 6-12". Return to the starting position and repeat on the other side.
- Alternate the legs at increasing speeds until the movement becomes rapid while still maintaining an abdominal draw and a neutral low back curve.



Technique Tips

- An abdominal draw can be accomplished by “sucking in” the belly button toward the spine. Ensure that you do not hold your breath while you do this
- All movement for this action should occur only at the hips, while the rest of the body is held completely stable

Muscle Regions Targeted

1. Core - **Local spine stabilizers** (ie. Transverse abdominis, internal obliques, multifidus)

Exercise Goals

- Increased ability to activate the muscles responsible for locally stabilizing the spine
- Improved ability to perform flexion and extension movements of the arms and legs while maintaining a stable pelvis and torso
- **This exercise is highly recommended for individuals who have a history of low back pain (master before attempting abdominal bracing)**

Starting Position

- Begin by lying on your back with your knees bent, feet flat on the floor, and the hands under the low back.
- Form a neutral low back curve and be maintained in this position throughout the exercise (avoid flattening the spine).
- Draw the abdomen in and up without holding your breath. As the abdomen is drawn in, there should not be increased pressure felt on the hands (indicating that the back is maintaining its position).

Execution

- Rise one arm until it is perpendicular to the ground while simultaneously flexing the opposite leg at the hip. Return to the starting position, and repeat with the other side.
- Alternate sides at increasing speeds until the movement becomes rapid while still maintaining an abdominal draw and a neutral low back curve.



Technique Tips

- An abdominal draw can be accomplished by “sucking in” the belly button toward the spine. Ensure that you do not hold your breath while you do this
- All movement for this action should occur only at the arm and hip of the moving limb, while the rest of the body is held completely stable

Muscle Regions Targeted

1. Core musculature

Exercise Goals

- Increased ability to activate the muscles responsible for stabilizing the core region

Starting Position

- Begin by lying on your back one knee bent, with the foot flat on the floor, and the hands under the low back.
- Form a neutral low back curve and be maintained in this position throughout the exercise (avoid flattening the spine).
- Draw the abdomen in and up without holding your breath and then brace the remainder of the larger abdominal muscles.

Execution

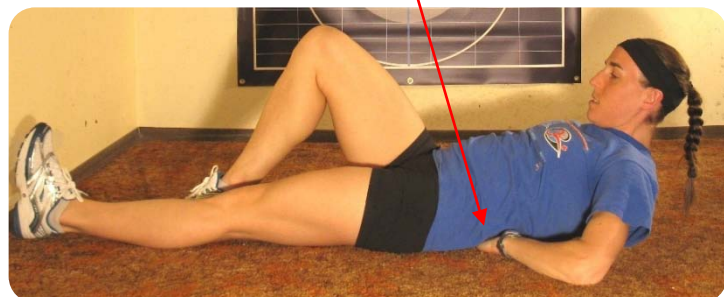
- Slowly curl the upper body up until the shoulder blades are off the floor. Slowly lower back to the starting position, and repeat.
- Alternate the legs half way through the set.

Technique Tips

- All movement for this action is slight and should occur only at the upper back
- Keep the head in line with the shoulders by tucking the chin downward
- If your neck becomes sore during the exercise you may place one hand behind the head, however, ensure that you do not pull the head forward



Even pressure should be felt on hands throughout the entire exercise.



Muscle Regions Targeted

1. Hip flexors
2. Gluteus maximus (and other hip extensors)
3. Hip stabilizers
4. Core musculature

Exercise Goals

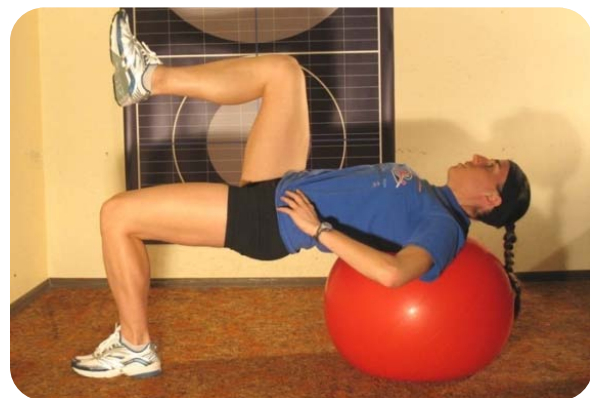
- Improved hip flexion mechanics – training the movement along a straight plane with no excessive rotations occurring
- Increased ability to maintain a stable pelvis and torso

Starting Position

- Place your upper back on a ball while holding the body in a bridge position.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Bend the hip and knee of one leg and drive it forward in front of the body and hold it there for 1-2 seconds.
- Return the leg back to the starting position in a controlled manner, and repeat on the other leg.
- Squeeze the gluteal muscles of the support leg to help maintain a proper bridge position.



Technique Tips

- Ensure that the pelvis and torso remain square (no rotations or flexions should occur)
- The thigh of the lifting leg should move along a straight plane. The thigh should not rotate medially or laterally

Muscle Regions Targeted

1. Core musculature

Exercise Goals

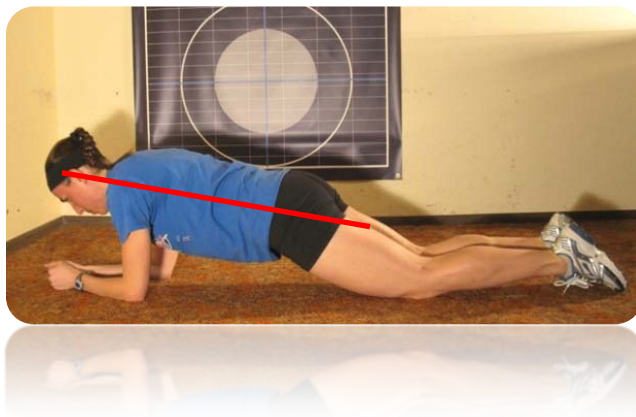
- Increased ability to activate the muscles responsible for stabilizing the core region

Starting Position

- Face down in a kneeling position with the legs together and the forearms on the ground in a comfortable position. Form a straight line (plank) through the pelvis, and torso
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Hold the front kneeling position for 10-30seconds
- Turn the body as a unit into a side bridge position by pivoting on the knees and shifting your weight over one shoulder. Hold for another 10-30 seconds, than pivot back to the front
- Repeat on the other side



Technique Tips

- Do not allow the shoulders to hunch forward
- As the body turns to each position, the torso should remain completely stable, with no twisting or flexing.

Muscle Regions Targeted

1. Core musculature

Exercise Goals

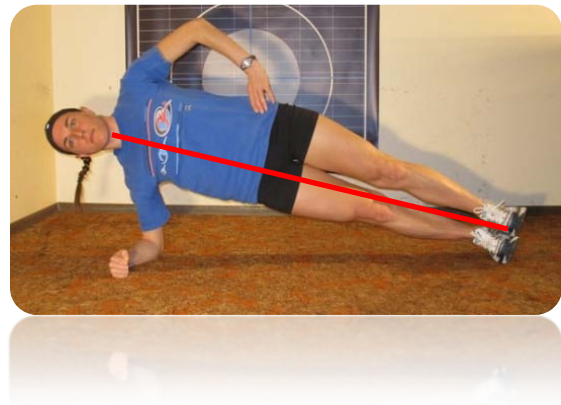
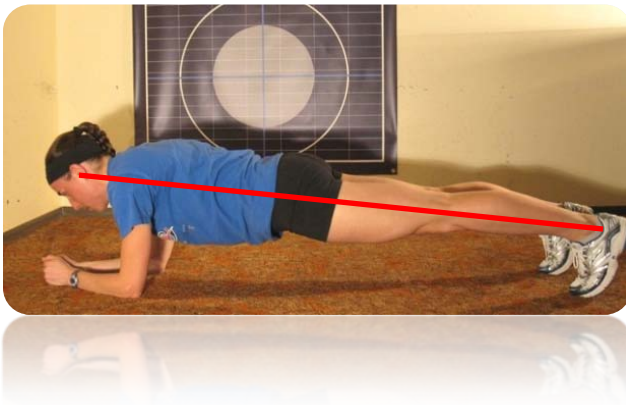
- Increased ability to activate the muscles responsible for stabilizing the core region

Starting Position

- Face down in a full body plank position with the legs together and the forearms on the ground. Form a straight line through the pelvis, and torso
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times

Execution

- Hold the front position for 10-30seconds
- Turn the body as a unit into a side bridge position by pivoting on the feet and shifting your weight over one shoulder. Hold for another 10-30 seconds, than pivot back to the front
- Repeat on the other side



Technique Tips

- Do not allow the shoulders to hunch forward
- As the body turns to each position, the torso should remain completely stable, with no twisting or flexing.

Muscle Regions Targeted

1. Core musculature
2. Hip flexors
3. Quadriceps

Exercise Goals

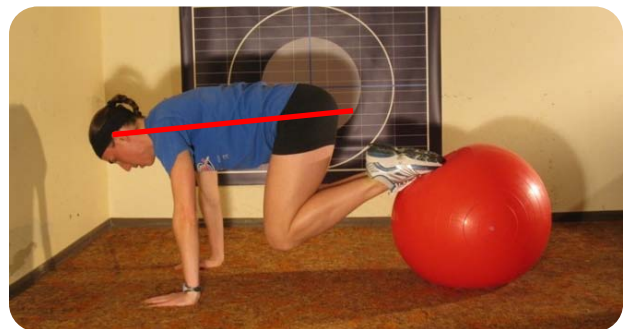
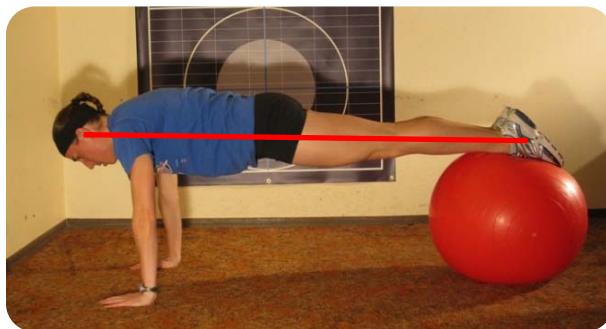
- Activate and strengthen the muscles responsible for stabilizing the core region
- Improve ability to stabilize the pelvis and torso while the leg flexes in front of the body

Starting Position

- Face down in a plank position with the legs together on a ball and the hands on the ground. Form a straight line (plank) through the pelvis, torso, and legs
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- While maintaining a stable torso, pull the ball toward you by tucking your knees toward your chest.
- Push the ball back to the starting position by extending the knees, and repeat.



Technique Tips

- Do not allow the shoulders to hunch forward
- The torso should remain completely stable, with no twisting or hunching permitted.

Muscle Regions Targeted

1. Core musculature
2. Gluteus maximus, hamstrings, and other hip extensors

Exercise Goals

- Activate and strengthen the muscles responsible for stabilizing the core region
- Activate and strengthen the hip extensors with optimal contraction patterns
- Improved ability to stabilize the core while the leg/hip pulls back (extends)



Technique Tips

- The main focus should be on initiating a gluteal contraction before the hamstrings come significantly into play
- Relax all the hip extensor muscles before each repetition, so that the gluteus maximus has to be actively re-initiated each time.

Starting Position

- Lying on the ground face up with the legs on a ball and the arms 45° to the sides with palms up.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times

Execution

- Squeeze your gluteal muscles and raise your pelvis up off the floor into a full body plank position with your shoulders still on the ground
- Proceed to bend your knees to pull the ball toward you using the hamstrings. This knee bend can begin just prior to the body reaching a full plank position.
- Reverse the action in a controlled manner, and repeat.



Muscle Regions Targeted

1. Core musculature
2. Hip flexors
3. Hip stabilizers
4. Quadriceps

Exercise Goals

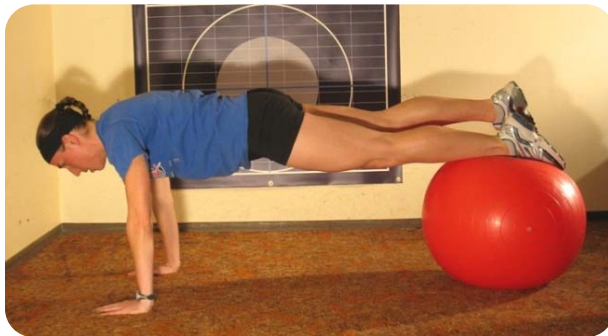
- Activate and strengthen the muscles responsible for stabilizing the core region
- Improved ability to stabilize the pelvis and torso while the leg flexes in front of the body
- Improved ability to drive the knee forward along a straight plane (with no internal or external rotations occurring)

Starting Position

- Face down in a plank position with one shin on a ball, the opposite leg outstretched above the ball, and the hands on the ground. Form a straight line (plank) through the pelvis, torso, and legs
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- While maintaining a stable torso, pull the ball toward you by tucking your knee toward your chest.
- Push the ball back to the starting position by extending the knee, switch legs, and repeat.



Technique Tips

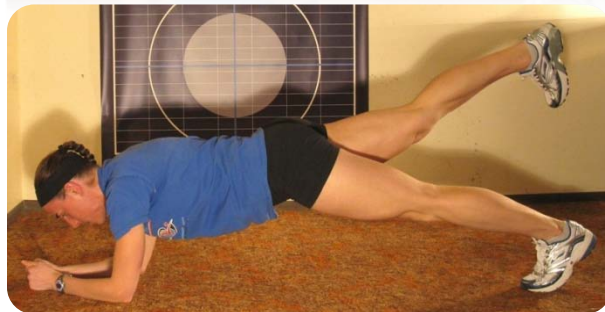
- Do not allow the shoulders to hunch forward
- The torso should remain completely stable, with no twisting or hunching permitted.
- Focus on driving each knee forward in a straight plane. Avoid excessive rotations in the thigh or pelvis.

Muscle Regions Targeted

1. Core musculature
2. Lateral gluteal and hip stabilizer muscles
3. Gluteus maximus (and other hip extensors)

Exercise Goals

- Activate and strengthen the muscles responsible for stabilizing the core region
- Activate and strengthen the hip abductor muscles
- Improved ability to stabilize the pelvis and torso



Technique Tips

- Do not allow the shoulders to hunch forward
- As the body turns to each position, the torso should remain completely stable, with no twisting or flexing.

Starting Position

- Face down in a full body plank position with the legs together and the forearms on the ground. Form a straight line through the pelvis, torso, and legs
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times

Execution

- Hold the front position for 5-15 seconds then lift the right leg up and down behind the body, initiating this movement with the gluteus maximus
- Turn the body as a unit into a side bridge position by pivoting on the feet and shifting your weight over one shoulder. Hold for another 5-15 seconds, then lift the top leg up and down with the lateral gluteal muscles.
- Pivot back to the front, and repeat with the other leg and on the other side



Muscle Regions Targeted

1. Core musculature
2. Gluteus maximus, hamstrings, and other hip extensors
3. Hip stabilizers

Exercise Goals

- Activate and strengthen the muscles responsible for stabilizing the core region
- Activate and strengthen the hip extensors with optimal contraction patterns
- Improved ability to stabilize the core while the leg/hip pulls back (extends)



Technique Tips

- The main focus should be on initiating a gluteal contraction before the hamstrings come significantly into play
- Relax all the hip extensor muscles before each repetition, so that the gluteus maximus has to be actively re-initiated each time.
- Ensure that the pelvis and torso remain stable with no twisting
- Ensure that the thighs of both leg remain straight with no medial or lateral rotation

Starting Position

- Lying on the ground face up with one foot on a ball, the opposite hip and knee flexed in front of the body, and the arms 45° to the sides with palms up.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times

Execution

- Squeeze the gluteal muscles of the leg on the ball and raise your pelvis up off the floor into a full body plank position with your shoulders still on the ground
- Proceed to bend the knee to pull the ball toward you using the hamstrings. This knee bend should begin just prior to the body reaching a full plank position.
- Reverse the action, and repeat.



Muscle Regions Targeted

1. Core musculature

Exercise Goals

- Activate and strengthen the muscles responsible for stabilizing the core region – Especially against torsional forces

Starting Position

- Begin seated on the edge of a ball with your feet against a wall and your torso angled slightly back. Hold a light dumbbell with both hands in front of you with the elbows bent slightly.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Execution

- Slowly pass the weight to one hand and move the weight laterally away from the midline, maintaining a slight bend in the elbow. Return to the starting position and repeat on the other side.



Technique Tips

- Maintain a slight bend in the elbows
- As the weight is being brought to the side, do not allow it to drop behind the plane of the shoulder
- The torso should remain completely stable, with no twisting or hunching permitted.

Muscle Regions Targeted

1. Core musculature
2. Foot and ankle stabilizers

Exercise Goals

- Activate and strengthen the muscles responsible for stabilizing the core region – Especially against torsional forces
- Improved ability of the arms to swing independently from the torso – ie. By allowing a larger active range of motion at the shoulder

Starting Position

- Stand tall with your arms relaxed at your sides, and your feet shoulder width apart. Focus on forming a good postural alignment, and imagine a string pulling you up tall from the top of your head to aid with this.
- **Form an abdominal brace and maintain it throughout this exercise.** The low back should be held in a neutral position at all times.

Technique Tips

- Allow your shoulders to relax as the arms move
- The abdominal muscles (especially the obliques) should be working throughout the exercise to maintain a stable torso

Execution

- Start swinging your arms at your sides, focusing on relaxing at the shoulders to allow for a more “free” swing to occur. The torso should stay completely stable with no twisting.
- Bend your elbows and begin to swing your arms more vigorously as though you are running. Continue for about 1 minute.

Level 2 – Raise up **on your toes** and stay on the balls of your feet throughout the exercise.

Level 3 – While still on the balls of your feet, hold a **light dumbbell** (2 – 5 lbs) in each hand as you are performing the exercise.

