

Introduction

Pilates focuses on the deep postural muscles, including the pelvic floor, the transversus abdominis (TA) and the multifidus. These deep postural muscles are also referred to as the core. Improving core muscle control, coordination, flexibility and strength will create a balance within the body. Combined with developing proper techniques, the body will learn to move in a safer, more efficient pattern of motion. The benefits of a body trained for core strength and flexibility are many. It provides an optimal foundation for sports training and performance, good posture and overall well-being.

The Inner Core Muscles

The *inner core* refers to a group of deep muscles in the trunk that, under normal circumstances, work together to provide the first step in stabilization of the trunk and pelvis. In the moving body stability refers to precise joint control through motion. The *inner core* muscles play a key role in stability of the trunk and pelvis. In normal function these muscles are programmed to contract automatically and simultaneously before any - movement or other muscle contraction. We use these muscles at about 20 to 30% of maximum to create stiffness of the lower spine not rigidity. The *inner core* group of muscles are:

- The diaphragm - your primary breathing muscle attached to the lower ribs and spine;
- The pelvic floor - attached to the bony ring of the pelvis from the tailbone to the pubic bone and side. to side between the 'sit bones'.
- The lumbar multifidus - deep in the low back.
- The transverse abdominis - the deepest layer of the abdominal muscles.

Why Train The Inner Core?

There are several reasons to train the *inner core* muscles:

- Ensure a normal muscle strategy for stabilization of the back during functional activities.
- Prevent injury.
- Enhance athletic performance.
- Restore normal muscle function lost due to injury.

How Do You Train The Inner Core?

It is important to know how to appropriately contract (tighten) the *inner core* muscles before you begin a program to improve strength and trunk stability. The following pages go over each of the muscles individually and ways to specifically contract each one.

The Diaphragm

The diaphragm is a dome shaped muscle that forms the roof of the *inner core* and is located at the base of the ribs. It is your primary breathing muscle. During higher-level activity, including running and sports activities there are additional muscles attached to the rib and neck areas that assist the diaphragm for deeper breathing capability, increasing the amount of air going into the lungs. The diaphragm actually attaches to the spine and has a mechanical influence on spinal stability. It is important to be able to contract the other *inner core* muscles while breathing with the diaphragm. We often call diaphragmatic breathing "belly" breathing because the abdomen distends somewhat as the lungs fill with air. As the diaphragm contracts it is pulled downward. This pushes on the organs in the abdominal area causing the abdomen to distend. The focus of diaphragmatic breathing should not be just on the 'belly' distending but also on *lower rib movement*: outward in all directions (forward, lateral and backward).

We train the diaphragm with the rest of the inner core by breathing correctly. We are not talking about deep breathing or shallow breathing. The goal is to breath using the diaphragm to expand the lower ribs in all directions at a depth and rate of respiration that matches the activity.

Exercise #1:

Lie on your back. Place your hands on your lower ribs with the heels of your hands at your sides and the fingers towards the front. Observe the movement of the ribs during 'quiet breathing'. If you do not feel movement both forward and to the sides then try to make this movement happen without changing the depth of your breath. You can also practice this breathing exercise in sitting or standing several times a day.

The Pelvic Floor

The pelvic floor (PF) muscles make up the floor of the *inner core*. There are two layers of muscles which attach to the bony ring of the pelvis. Think of the outer / lower layer as extending between the 'sit bones' and the inner / upper layer as extending from the tailbone in back to the pubic bone in front. In addition to other functions the PF muscles help to support (hold up) the organs in the pelvic region including your bowel and bladder.

Finding Your Pelvic Floor Muscles:

Exercise #2-A

Cues to think about to get the right muscle contraction: To contract the outer / lower layer of the PF think of 'closing the openings' or bringing the 'sit bones' toward each other. To contract the inner / upper layer think of 'lifting' or bringing the tailbone toward the pubic bone. Use these cues in the exercises below.

Exercise #2-B

(to be done just a few times at most) To see if you are using the right muscles: the next time or two that you need to urinate empty about half the volume of your bladder then stop the flow of urine with the least amount of muscle effort possible. Be aware of which muscle you are using. Try to hold this muscle contraction for 10 seconds. Then let a little more urine out and try holding again with the least amount of effort possible. This IS NOT to be used as a daily exercise. It is only a way for you to identify where your PF muscles are.

Exercise #2-C

Sit on a chair or on the floor. Use your hands to feel each of the bones you are sitting on. Remove your hands but remain aware of your "sit bones" being in contact with the chair or the floor. Contract the PF muscles as noted in #2-A. You should feel a pressure change against the chair seat / floor. Try to hold this contraction for ten seconds while you breath normally. Then relax and feel the PF muscles relax with respect to the chair floor.

Exercise #2-D

The Elevator: 'Close the openings' then lift up the 'elevator' one floor, then a second floor, etc. Go up then down floors, one floor at a time.

The Transverse Abdominis

The transverse abdominis (TA) muscle is the front wall of the *inner core*. It is the deepest layer of the abdominal muscles and the fibers of the muscle run horizontally across the abdomen. When this muscle contracts the abdomen pulls inward. There needs to be balance between the four layers of the abdominal muscles. We often find that the more superficial muscles tend to be used more than the deep TA creating a situation of muscle imbalance and poor stabilization. An isolated TA contraction feels firm and flat (not bulging) like a piece of fabric that has been pulled taut versus bulging like the biceps of 'your arm'.

Exercise #3-A

Lie on your back on the floor. Place the index finger of each hand one inch in and one inch down from the front hipbone on each side. Use one of the following cues to try to contract the TA:

- Try to gently pull the two front hipbones toward each other a small amount.
- Gently pull the lower abdomen (below the belly button) inward.
- Gently pull the 'belly button' toward the spine.

You should feel tension under your fingers. The tension should feel 'flat' versus 'bulging'. (Any bulging would mean that other, more superficial muscles, are contracting.) Some people have trouble breathing normally while contracting the TA because the distention of the abdomen caused by the diaphragm contracting is opposite the inward pull of the TA contraction. It is possible however to do both: breath using the diaphragm and contract the TA.

Exercise 3-B

Monitoring the TA while contracting other parts of the inner core: Place the index finger of one or both hands one inch in and one inch down from the front hipbone on each side. When the TA contracts you should feel tension under your fingers. The tension should feel 'flat' versus 'bulging'. (Any bulging would mean that other, more superficial muscles are contracting.) As you focus on other pieces of-the inner core you should feel the TA contracting under your finger(s).

The Lumbar Multifidus

The lumbar multifidus LM is the back wall of the *inner core*. These are deep muscles along the spine and are most developed (largest) in the low back area. These are often the most difficult muscles for a person to find and contract.

Exercise #4:

Lie on your back or on your stomach on the floor. Use one of the following cues to try to contract the LM:

- Find the top of the 'hip' bones at your sides with your thumbs. Follow the curve of the bones backward toward your back until your thumbs are about three to four inches apart on your back. Now, think of bringing these points of bone under your thumbs a tiny bit toward each other using your deep low back muscles, the LM. You can switch your hand position and using the fingers of one hand up against but not over the bones that stick out at the center of your back to see if you feel the LM contract. This is not easy to feel so don't be discouraged if you can't feel it on yourself.
- Think of initiating a very tiny tilt of the sacrum, the bottom tip of it moving away from the pubic bone.
- Think of 'lifting' your tail- 'happy dog';
- Think of trying to initiate a tiny arch of the low back (although when using the lumbar multifidus with the inner core there should be no actual movement of the spine! Do this with effort;

Contracting All Of The Inner Core Muscles Together

In normal function all of the *inner core* muscles come on simultaneously and automatically. If a person conscientiously contracts one part, the PF for instance, the other parts (the TA and the LM) should contract automatically. However, this doesn't always happen secondary to a variety of possible reasons including a back injury. If a person has trouble with one part of the *inner core* more than the other parts that person should contract the troublesome part first and then add in the other parts. With practice the troublesome part will improve and then the person needs to practice contracting all of the *inner core* muscles simultaneously.

Exercise #5:

Lie on your back on the floor. Place a finger one inch in and one inch down from the front hipbone. Using the following sequence, initiate your inner core contraction:

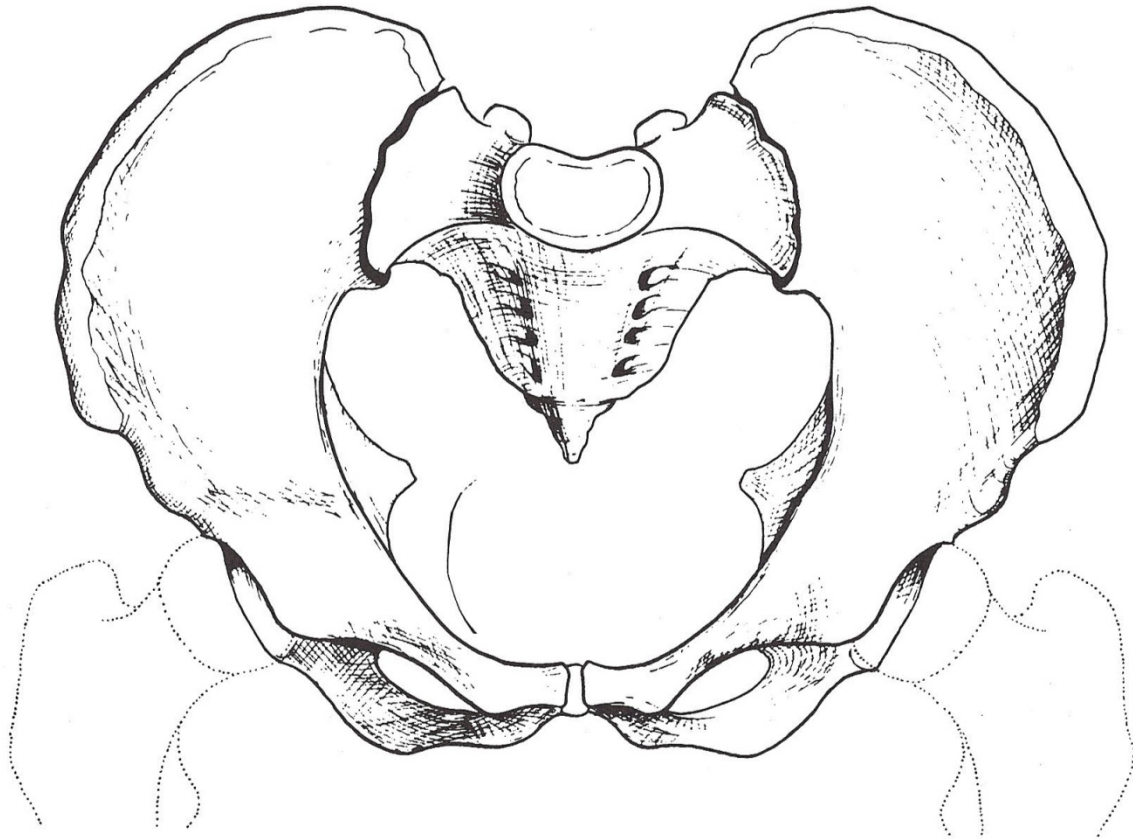
- Pelvic floor (PF)
- Lumbar multifidus (LM)
- Transverse abdominus (TA)
- Breath

Feel the TA contraction under your finger ("flat tension" NOT bulging). Breath normally (not deep, not shallow, don't hold breath). Hold 10 seconds and repeat 10 times.

Conditioning Program For The Inner Core

Now you are ready to begin a conditioning program for progressive strengthening of the *core* musculature -- that is the *inner core* plus additional trunk muscles used for stabilization. The following is a list of possible exercises. Your physical therapist will help you determine which exercises are appropriate for you.

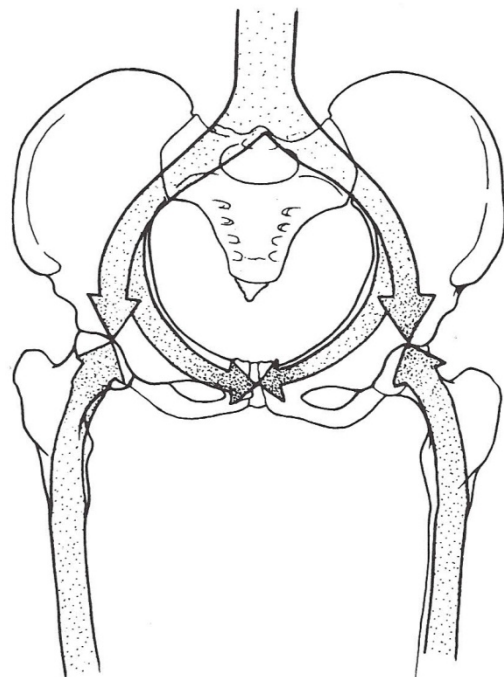
- Simple Heel Slides
- Bent Knee Fallout
- Marching
- Heel Slide With Foot Lift
- Advanced Heel Slides
- Advanced Heel Glides
- Advanced Double Heel Slides / Glides



Pelvis

The pelvis (the word means "basin"), also called the pelvic ring, is a roughly cylindrical structure composed of several articulating or fused bones plus associated muscles (e.g., those making up the "pelvic floor") and ligaments (**above**).

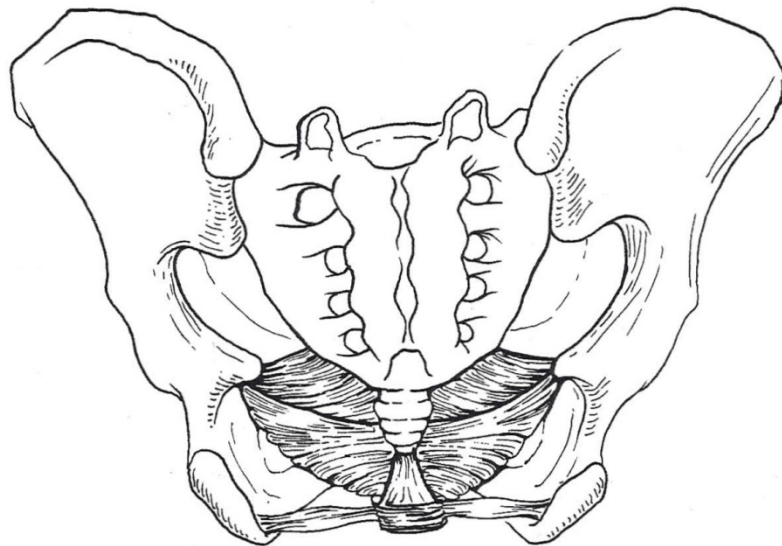
It receives the weight of the upper body, and passes this weight on to with the femurs. Conversely, it must absorb stresses from the lower limbs, e.g., in walking or jumping (**right**).



The Two Levels of the Pelvic Floor Muscles

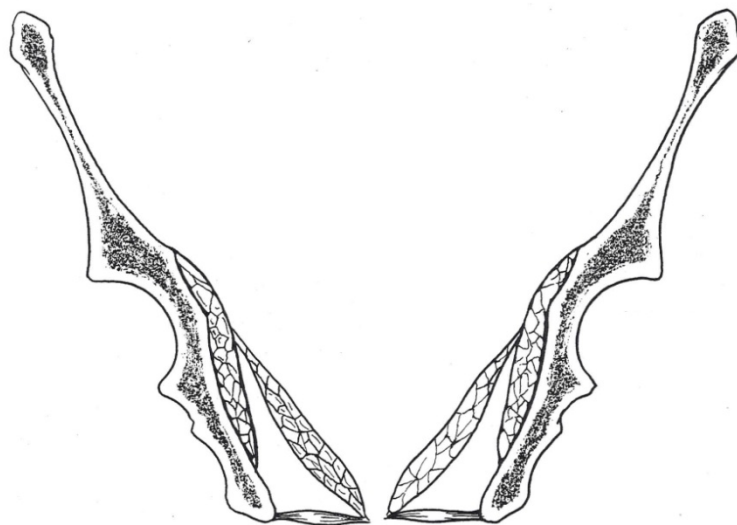
The two layers of muscles described in the preceding pages—the superficial and deep layers—are situated at different levels in the lesser pelvis. They also have different shapes and orientations.

pelvis, seen from the back



The deep layer forms the upper level. It is made up of muscles forming a large surface attached to the middle opening. As seen in cross-section from the front, the layer is funnel shaped, wide at the top, and narrows as it descends.

pelvis, seen in frontal cross-section



The superficial layer forms the lower level. It is made up of thin, interlaced bundles of muscle attached to the inferior opening. As seen in cross section from the front, this layer is horizontal.