advance
for Physical Therapists & PT Assistants®

Core Relations

Poor posture compromises the core's ability to support the upper torso.

Poor posture compromises the core's ability to support the upper torso.

By Brian P. Lambert, PT

Most people can tell you that the abdominal muscles support the back, but if you really press them for specifics, they may tell you that they are part of the "core" and, as part of the core, they support the back. A lot of attention is devoted to the transverse abdominus and multifidi, but dysfunction in these muscles may be more like a "canary in the mine shaft" than the actual problem.

The transverse abdominus and multifidi do not have super powers. They are relatively small muscles that do provide some support and probably provide some positional feedback to the nervous system, but they are simply too small to do much of the work needed to support the trunk.

Using the abdominal muscles to increase abdominal and intrathoracic pressure may have long-term ill effects. The abdominal cavity has several weak areas that include inguinal canals, openings for the vena cava, aorta, and esophagus, the pelvic floor and the linea alba. Chronic pressurization of the abdominal cavity may cause eventual failure in one or more of these areas.

Abdominal muscles are often strengthened with crunches, curls, sit-ups and ab machines. These forms of exercise do "strengthen" the abdominal muscles, but they also over-recruit accessory musculature such as the anterior intercostals, pectoral and scalenes. Tightness in these muscles is often implicated in patients that have poor posture, neck and shoulder problems.

A strengthening exercise such as a sit-up may also train the trunk to be very good at doing a sit-up, but the action of doing a sit-up is not used during upright posture. A good strengthening exercise should incorporate elements used in upright posture.

Cylinder and Guy-Wires

When we are upright, the muscles between the ribcage and pelvis need to perform two functions *simultaneously*.

First, when contracted, the muscles in this area form a cylinder. A cylinder or upright tube is able to resist a compressive load. Imagine taking a cardboard tube from a spent roll of toilet paper. When you stand it upright on a table, you could place several books on top of the roll and the "cylinder" could easily support the load. Our core should support our upper body on the pelvis the same way. This could be referred to as the cylinder method of support.

Secondly, the muscles between the ribcage and the pelvis may also function as a guy-wire system. Radio antennas use a system of cables to hold them up. As we move, the muscles of the core may also function like these guy-wires.

When we are upright, both methods of support, cylinder and guy-wires, must function simultaneously at all times. Failure in one part of the cylinder/guy-wire system will overload another part. What we generally see in our clients is failure of the abdominals and overloading of the back.

Postural Influences

Both cylinder and guy-wire systems work best when the skeletal system is "plumb," a construction term that describes an absolutely vertical wall. If the walls of a building are not plumb, then the building will eventually collapse. Our vertical spines are very much like an antenna mast. When we stand up, our sending and receiving equipment (eyes, ears, nose, mouth) is placed relatively high in the air. If the antenna mast is not plumb, leaning in one direction or another, then the guy-wire system is no longer balanced. If posture is poor, then control of our guy-wire system is no longer balanced. If a cylinder is bent, it will no longer support its load. Poor posture compromises the core's ability to support the upper torso.

For optimal function of the core, we need reasonably good posture. A prerequisite for good posture is the ability of each vertebral segment to achieve a neutral position.

How To Start

For the vertebral segments to get to a neutral position, there must be reasonably good flexibility in the scalenes, pectorals, anterior intercostals, hip flexors, and the low back and neck extensors, and each segment of the spine must have the mechanical ability to get to neutral.

For the body to effectively use the core muscles, some work on posture is often necessary. To specifically work on the guy-wire/cylinder section, we will generally start with a coordination exercise to retrain these muscles in their specific function.

The main function of the abdominal muscle is flexion of the spine. This can be done from the top down with a sit-up or from the bottom up with a posterior pelvic tilt. The main function of the back extensors is to extend the spine. Most patients can do an anterior pelvic tilt that isolates only the back extensors, but when they attempt a posterior pelvic tilt, they won't use the abdominal muscles. Instead, they will use the hip flexors, quadriceps and/or the upper chest musculature. The abdominal muscles will generally be dormant. This indicates a gross imbalance in the ability of the patient to recruit the core muscles. If a patient cannot selectively recruit a muscle group, they probably are not using it during upright activity.

To assess and teach the patient to retrain these muscles, we use a modified pelvic clock exercise where 6:00 is an anterior pelvic tilt and 12:00 is a posterior pelvic tilt. The patient will lie on their back with the hips and knees at a 90/90 position, supported on a chair or ottoman. We do not recommend using an exercise ball. Have the patient execute a very gentle anterior or 6:00 pelvic tilt and hold this position for five seconds. The low back extensors should be the only muscles working.

The next step is the transition to 12:00 or a posterior pelvic tilt. The patient must do three tasks simultaneously. We tell them to relax the thighs and chest, relax the back muscles and think about pulling their belly button towards their chin to cause a posterior pelvic tilt. Lately, we have been instructing patients to grab their upper thigh for inhibition of the quadriceps and hip flexors and to spread their fingertips of the other hand across the abdominal muscles and literally pull the belly button towards their chin. This usually facilitates recruitment of these muscles. Once they can execute a 12:00 tilt using the abdominal muscles only, we have them hold this position for five seconds, then relax.

Then, they repeat the entire sequence. Initially, the 12:00 movement may be much less than the 6:00 movement. We usually have the patient do five repetitions at least twice a day. We always have the patients work within their pain-free range of motion.

It may take a patient as little as two to three days to become proficient at executing a pelvic clock. Some clients have taken two to three weeks. Many clients report that this exercise relaxes their tight back muscles. Once they are proficient with this exercise, they are ready to be switched to a strengthening exercise.

Strengthening

Again, crunch and sit-up exercises pull the upper body into a flexed position. This may worsen posture and is not a functional movement used during upright posture. We will generally use modified leg lifts for abdominal strengthening. The most basic leg lift we use is called "supine heel touchdowns." The patient lies on their back with their fingers placed under the small of the back (not under the pelvis). We ask the patient to do a very strong 12:00 (posterior pelvic tilt) to mash the small of the back against their fingers. Now, the knees are brought towards the chest, one at a time, so that both hips are flexed at 120 degrees to 130 degrees.

In the beginning, the patient is asked to keep the knees fully flexed throughout the exercise and tuck their chin without lifting their head. Without straightening the knee, the patient is to let one hip extend so that the heel moves towards the floor while keeping the back pressed tightly against the fingers. Let the heel lightly touch the floor, then slowly return the leg to the flexed position and repeat on the other side. The patient must keep the back firmly pressed against the fingers that are under their back throughout the entire exercise. Patients with very poor abdominal control may only move their leg one-quarter to one-half distance towards the floor, again, with the emphasis on keeping the small of the back pressed firmly against the floor. If done correctly, the patient should feel fatigue in the abdominal muscles.

A more advanced version of this exercise would be accomplished by letting the patient straighten the knee as the hip is extended, but they must be able to keep the back firmly against the floor.

If the patient needs more challenge, then the supine heel touchdowns can be done with the patient lying on a 6 inch by 36 inch foam log. The patient should lie lengthwise fully supported on the log with the arms abducted to 90 degrees. Their elbows should be straight with palms facing the ceiling. The patient is instructed to flatten the small of the back against the log, tuck the chin and bring both knees towards the chest, one at a time. The arms are used as "outriggers" to balance the patient on the log.

From here, the instructions are similar to the previous exercise, where you lower one leg at a time. This exercise has the advantage of also working on the upper back extensors while strengthening and retraining the abdominal musculature.

A few clients find the above-discussed exercises too easy. We place them on a weight bench with a bath towel folded in several layers so that it is a 12 inch by 12 inch square placed under their back approximately 1 inch above their pelvis. The knees are bent with the feet resting on the bench and they hold onto the bench above their head, keeping the arms close to the side of the head. For a warmup exercise, the patient is instructed to bring the knees tightly towards the chest causing the pelvis to lift off of the bench. This must be done very slowly. The leg and pelvis are then lowered back down to the bench, very slowly. This can be repeated 12 to 15 times for two to three sets.

For even more challenge, bring the knees towards the chest as described above. Now, lower one foot towards the bench without letting the pelvis touch the bench. In the beginning, most clients can only move the foot halfway to the bench while keeping the pelvis up.

In conclusion, we can use some version of these exercises with almost any patient at any level of pain or debilitation. We often find relatively fit clients struggling with the pelvic clock exercise. These exercises will retrain and strengthen the abdominal muscles without the negative side effect of increasing thoracic flexion.

Brian P. Lambert, is the owner of Physical Therapy in Charlottesville, VA.