

A Closer Look at Abdominal Training

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A strong midsection or core is important for athletes and nonathletes alike. The focus of this article will be on training the abdominal muscles and a future article will be on training the low back.

Anatomical and Kinesiological Overview:

In order to effectively train a muscle group it is important to understand its origin and insertion as well as its function or action.

Abdominal Muscles:

	Rectus Abdominis	Internal Obliques	External Obliques	Transversus Abdominis
Origin	The crest of the pubis	The lumbar fascia, the anterior two-thirds of the crest of the ilium, and the lateral half of the inguinal ligament	The lower eight ribs, in alternation with those of the serratus anterior	Inner surfaces of cartilages lower six ribs
Insertion	The cartilages of the fifth, sixth, and seventh ribs.	The cartilages of the eighth, ninth, and tenth ribs and the linea alba.	Iliac creast and abdominal aponeurosis	Linea alba
Function (Action)	Prime mover for spinal flexion; contraction of one rectus abdominis alone assists with lateral flexion to the same side.	Prime mover for flexion, lateral flexion to the same side.	Prime mover for flexion, lateral flexion to the same side, and rotation to the opposite side.	It is not a mover of the spinal column; its pull is inward against the abdominal viscera. It does help to stabilize the trunk when acts requiring great effort are performed.

Effective Abdominal Exercises

In order to examine some common abdominal exercises some terminology needs to be addressed. The term 'sit-up' refers to an action where one moves from a supine or lying to a sitting position by performing hip flexion without lumbar flexion. The term 'trunk curl' refers to flexion of the trunk, without hip flexion. It is important to make this distinction because it is

apparent that some individuals may be able to do fifty or one hundred sit-ups yet perform only a handful of trunk curls. The reason for this is that the individual has strong hip flexors and weak abdominals. It is not uncommon to go into a gym and see someone stacking the abdominal machine. Ten out of ten times the person doing this is not performing any degree of trunk flexion but is instead performing hip flexion.

Key factor #1 to keep in mind when training the abdominals is to flex the spine. If on the ground in a supine position, initiate the movement by attempting to drive your low back into the ground as you lift your head and then your shoulders off the ground. This is necessary for proper spinal flexion. It does not matter if one is exercising on the ground, with an AB roller, or on an abdominal exercise machine. The key to remember is to contract the abdominals first to initiate the movement. If your spine stays straight it is generally a sign of strong hip flexors and weak abdominals.

A person with strong abdominals can perform a supine straight leg trunk curl with their low back on the floor at all times. In this same exercise, a person with weak abdominals and strong hip flexors will have their pelvis-tilted anteriorly and the pull on the lumbar spine can be dangerous.

Key factor #2 when performing abdominal exercise is to avoid rapid, full speed, movements. Such movements are not recommended because they can stress the posterior structures (facet joints and spinal discs) excessively and can ultimately lead to hypermobility and facet degeneration.

Key factor #3 is determining the ideal arm position (straight or bent) and leg position. It is generally recommended that the hands not be placed behind the neck or head. This placement may force the neck into hyperflexion; stretching the posterior ligaments and increasing pressure on the cervical vertebrae. Arm placement can be across the body or along side of the body. An individual with weak abdominals may need to start out with their arms by their side because the added weight of the arms across the body may add too much overload for the beginner.

In researching the ideal leg and hip position I did come across some differences of opinion as to whether the legs should be bent or straight. The text entitled Muscles: Testing and Function by Kendall, Kendall, and Wadsworth, states the following: “The need for exercises to strengthen abdominal muscles without further strengthening hip flexors has been recognized because of the undesirable effects of over-development and shortness of hip flexors. The knee-bent sit-up does not answer this need.

Exercising the abdominals while at the same time elongating the hip flexors does provide an answer, and this is accomplished by doing the posterior pelvic tilt and the trunk curl (not the sit-up) from a supine position with legs extended. After all, in the standing position one aims to maintain the pelvis in good alignment while the knee and hip joints are in extension, and exercises should be directed toward attaining this end result.”

In Luttgen’s and Hamilton’s text Kinesiology: Scientific Basis of Human Motion, they state that...”It is generally agreed that any sit-up motion should be done in a bent-knee position as opposed to a straight-leg position. In the straight-leg sit-up the hip flexors are on more of a stretch than in the bent-knee position, and the extended legs provide a greater force moment to resist the pull of the trunk. As might be expected, the action potentials of the hip flexors are greater in the straight-leg position than in the bent-knee, while the action potentials of the rectus abdominis are greater in the bent-knee than in the straight-leg sit-up. Moreover, the results of X-ray studies suggest that there are possible dangers in the straight-leg sit-up because it causes the

lordosis angle of the spine to increase, forward displacement of the fifth lumbar vertebra, and increased disc compression. For these same reasons, double leg raising and slow leg lowering from the supine position are not recommended as abdominal strengthening exercises."

It is possible to perform trunk curls effectively from a supine straight-leg position with no harm to the lumbar spine for individuals with strong abdominals. However, most individuals encounter too much lumbar hyperextension with the legs straight and would be better off performing their trunk curls with the legs bent. It also helps to keep the legs abducted to minimize hip flexor involvement.

The need to perform a full sit-up can be questioned because the rectus abdominis serves as a prime mover only during the first 30 to 45 degree of motion and acts as a stabilizer there after as the hip flexors finish the movement.

If during a trunk flexion exercise, the trunk is rotated, by pulling the right shoulder toward the left leg for example, extra stress is imposed on the oblique abdominals. The hard part of working the rotational aspects of the obliques is providing progressive resistance. This is best achieved with the use of a well-designed machine.

Key factor #4 is progressive overload is necessary for muscle development. One study found greater activity in the upper portions of the rectus abdominis when no resistance other than body weight was employed, but an equal activity in upper and lower portions when an extra 10 lb. Weight was harnessed to the shoulders. The typical sequence of muscle activation in most trunk flexion exercises is the upper portion of the rectus, followed by the lower portion of the rectus and the internal oblique. It is difficult and awkward to progressively increase resistance for most abdominal exercises without the aid of some type of machine. However, for every good abdominal machine on the market there are five bad machines on the market. My advise is to first master trunk flexion on the floor then take this movement to a machine that will allow for incremental resistance increases.

Common Questions:

Can one spot reduce abdominal fat by performing sit-ups?

No. Research performed by Katch et al. examined this very question. Fat biopsies were taken at the abdominal, subscapular, and buttock sites before and after a 27-day period of progressively increased sit-up exercise training. The experimental group performed an average of 185 sit-ups daily in comparison to a control group who did not exercise. Sit-up intensity increased from 140 sit-ups at the end of the first week to 336 sit-ups on day 27. The sit-up program did not cause the abdominal fat cells to become significantly smaller than fat cells in the relatively unexercised buttocks or subscapular regions. There were no significant changes in fatfolds, girths, or total fat content assessed by underwater weight.

I am afraid of training my abs for fear that they will get large and will protrude, especially my obliques. Is this fear real?

This fear could be the result of seeing the bloated, distended abdomens of top professional bodybuilders. However, this distention is the result of growth drugs, which have caused some of their internal organs to hypertrophy leading to this unsightly protrusion.

The fear of training the midsection is unfounded. A strong abdomen and low back is essential for athletics as well as for a vital active life. If you train your midsection as part of a well-rounded strength training program and create a negative caloric balance you will generally

lose inches from your waistline. A large abdominal area is usually the result of excess calorie ingestion and not the result of performing abdominal exercises.

Is it possible to take the hip flexors out of an exercise?

As mentioned previously, this topic has some controversy surrounding it. It is extremely hard if not impossible to completely take the hip flexors out of an abdominal exercise. The key is to try to minimize its involvement to the extent that it causes excessive anterior pull on the pelvis creating an extreme lordosis. For most individuals, bending and abducting the legs aids in minimizing hip flexor involvement.

Is it possible to isolate the lower rectus abdominis?

The lower rectus is involved in normal trunk flexion. However, there are other exercises which have shown the lower rectus to be worked effectively. Exercises such as the reverse trunk curl or hanging knee ups work the stabilizing function of the lower rectus. Since none of the abdominal muscles actually crosses the hip, they are not prime movers of these movements. However, the action is an important one as it emphasizes the pelvic stabilizing function of the lower rectus. The rectus works isometrically to fix the pelvis against the strong pull of the hip flexors.

While these exercises can be performed effectively by individuals with strong abdominals and healthy backs, caution should be taken with individuals with weak abdominals and strong, tight hip flexors. Knee-ups and reverse trunk curls can pull the lumbar spine into dangerous hyperextension in some individuals. The key to performing these exercises correctly is perform a reverse flexion of the spine and not to pull back with the femur and hips flexors.

Should I have someone hold my feet down when I perform sit-ups?

No. The unanchored foot position is safer and requires more abdominal and less hip muscle participation than having your feet anchored. Anchoring the feet during the sit-up facilitates action of the hip flexors because it gives those muscles a firm anchor against which to pull. The action does result in diminished activity in the abdominals. Anchoring the feet has also been shown to produce increased lumbar curve, placing stress on the low back.

What are some common problems in performing a trunk curl?

A common problem is people tend to come up too quickly, using momentum rather than gradual muscle contraction. This diminishes the value of the exercise. The progression should be contract the abdominals to flatten out the low back, bring the head off the ground, and then bring the shoulders off the ground. When performed properly, trunk curls are hard and nobody is going to be performing hundreds of repetitions at a time.

Do I need to perform specific abdominal exercises each workout?

No. If you perform a variation of hard pulling movements (i.e. negative chin-ups, front lat pulldown), it is my opinion that you do not need to specifically work the abdominals every workout. However, some individuals find that specifically working their abdominals allows them to perform the hard pulling movements more effectively. Some individuals with low back

problems find benefit in performing specific spinal flexion movements each workout. As with a lot of things, individual variations are the rule.

How many repetitions do I need to perform for abdominal exercises?

You should treat abdominal exercises just like any other exercise. Perform the repetitions in a controlled fashion for a designated time frame or time under load (TUL). Once you can lift a given resistance for target rep range or time under load, increase the resistance. Since the range of motion is small for most abdominal exercises the total number of repetitions will be higher than a leg press or pulldown movement.

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