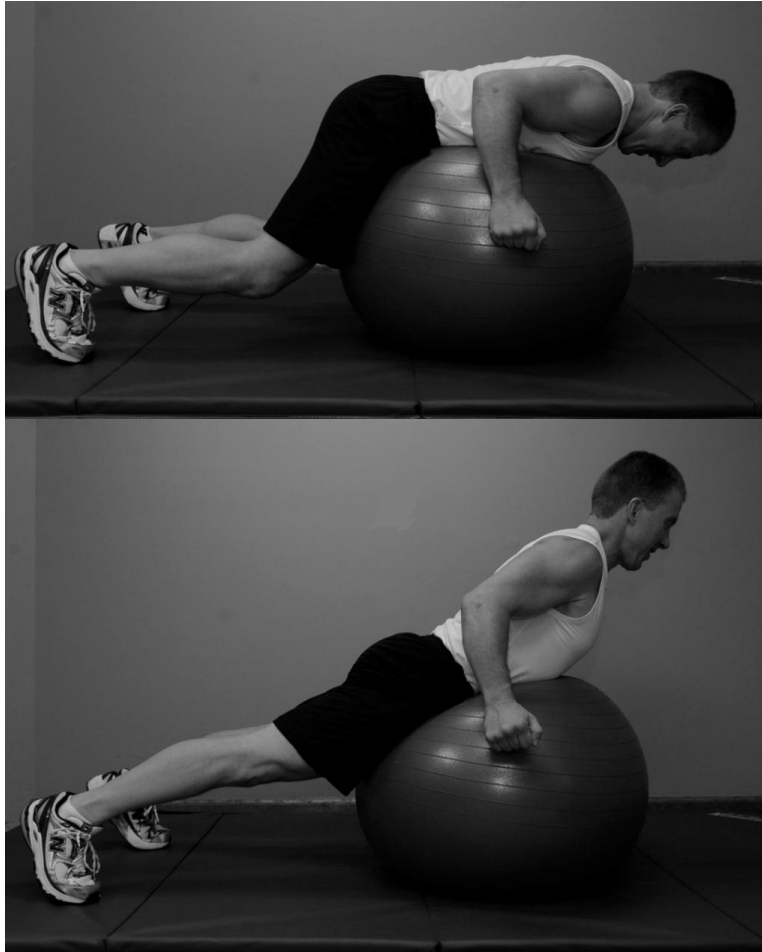


BACK EXTENSION

- Feet apart for stability
- Start with bent knees, hips, and stable spine
- Finish with straight knees, hips, and spine; but short of the end range



Loading the muscles around the spine is easy. Barbell squats, all versions of the deadlift and row, Olympic lifts, “lower back machines”, hyperextensions on the floor and off benches, and kettlebells all unavoidably involve the erector spinae and the “transversospinalis” muscle groups (semispinalis, multifidis, and rotatores).

They also unavoidably involve the discs and connective tissue, which is where the risk lies. A normally curved spine puts even pressure on the discs; the curve of the overall spine comes from the non-symmetrical shape of each individual vertebrae, stacked on each other, separated by the (flat) discs. Maintaining the curves in the spine protects the discs and muscles. Twisting the spine, and exaggerating or flattening the curves in the spine, while exerting force, or under load, or with excessive repetitions, deforms the discs and strains the muscles, potentially leading to herniations, spasms, arthritis, etc.

There are several concerns with most “back” exercises. First, you don’t really know what is happening at the level of the discs, at least until symptoms occur. The consequence of mis-loading the discs may not be immediate; it may just accelerate long term wear. You may voluntarily try to keep your back tight during a squat, deadlift, (etc.), you may appear as if you are, but the weight is definitely trying to bend your spine

forward. Since you can't see into the spine, you don't really know if each of the deep muscles is holding the vertebra in place; they may not be, creating the impingement/herniation, just not yet at a noticeable level. You may squat/deadlift/etc. for years, then tie your shoes and "throw your back out".

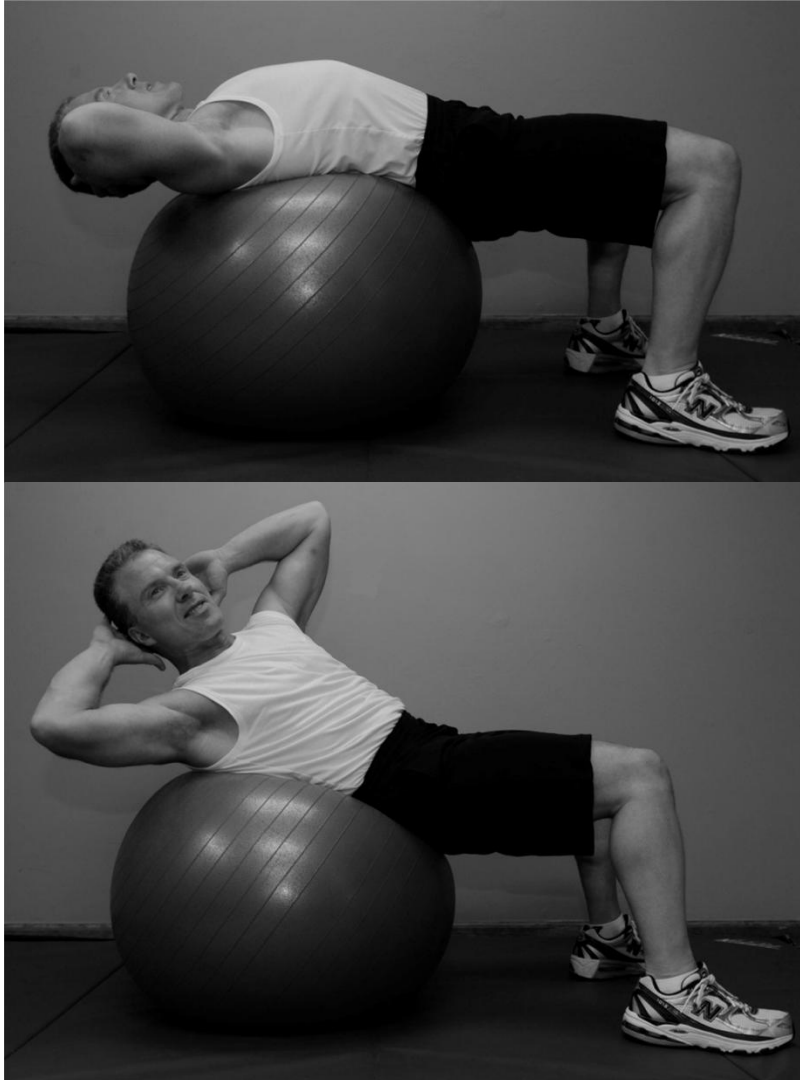
You may, however, notice immediately if one of those muscles overstretch and goes into spasm, so the second concern is whether the muscle action for the exercise is appropriate. Only a small part of the erector spinae attaches to the pelvis; the rest attaches vertebrae to ribs (and again a small part to the head). The rest of the muscle groups connect vertebrae to vertebrae in various directions. Combine the short muscle connections, with the fact of the deep muscles having no room to hypertrophy (so any strength displayed comes from static strength), with the fact of the non-twisted curves being the safe position for the discs, with the fact of limited flexion-extension in the lumbar spine, and it strongly suggests that the function of these muscles is to prevent motion more so than to create it. An appropriate exercise would require the muscles to prevent spine flexion more than create extension, and to prevent rotation more than create it.

In order to do that, the pelvis has to be able to follow the spine. If the pelvis is locked in place, say by locking out your knees, and then bending forward, the hamstrings go taut, lock the pelvis in place, and so any upper body motion happens through the spine, not the hip joint. The more your torso moves forward, the more taut the hamstrings, the more the lumbar curve flattens or reverses, the more bad stress to the discs and muscles trying to control the vertebrae. Any exercise to benefit the back has to avoid this.

The demonstrated exercise starts with the knees and hips bent, with a stabilized torso over the ball. The horizontal orientation means the weight of your torso is trying to pull your spine into flexion. The bent knees and hips allows the pelvis to tilt forward and maintains the lumbar curve. If you were to try to lift the torso with the knees bent and the pelvis tilted forward, the erector spinae would pull the lumbar into an exaggerated curve until the bony spines stopped the motion (and pinch the discs). Instead, you move from bent knees/bent hips to straight knees/straight hips, while holding the back posture. The hamstrings and glutes are the prime movers, pulling on the pelvis, while the erector spinae (and quadratus lumborum) hold the pelvis to the spine, and the deep muscles hold the spine posture. The overall effect is to raise the torso approximately in line with the legs, but short of the maximum arch of the spine. The side-to-side instability of the ball requires the muscles to prevent rotation. If a bench is used, ideally, it would allow the same knee/hip coordination. If it doesn't, it's more important to start with the bent knees/forward torso to protect the lumbar curve, than to lock the knees at the finish. Simply make a point of stopping the upward movement before exaggerating the lumbar curve.

TWISTING CRUNCH

- Feet apart for stability
- The ball supports the lumbar curve
- Move one shoulder towards the opposite hip, without lifting the lower back off the ball



Exercises for the sides and front of the trunk can also risk the lumbar spine. The conventional sit-up and leg raises fell out of favor, to be replaced by versions of the crunch, which turn out to have their own issues. Since the attachments, shapes, and sizes of the front and side muscles are significantly different from the deep back muscles, they need specific positioning and actions, but the exercises also need to protect the discs by maintaining the curves of the spine.

The muscles on the side and front are the external and internal obliques, rectus abdominus, and the transverse abdominis, all of which are more superficial than the transversospinalis groups. Unlike the tvs groups, which connect vertebrae to vertebrae, the obliques and rectus generally connect ribs to pelvis in various directions. A static contraction supports the spine by preventing movement around the trunk, keeping the deep muscles from being overpowered in stabilizing the spine. An active contraction brings the ribs towards the hips (and vice versa), which is where the complications are.

The issue with old school sit-ups and leg raises is that other muscles are involved in bending the body in half. Part of the quadriceps (rectus femoris) connects hip to leg, so while it (and multiple other hip flexors) can pull the front of the thigh towards the pelvis, it also pulls the front of the pelvis towards the thigh. This creates an “anterior pelvic tilt”, which can exaggerate the lumbar curve, especially during leg raises. With sit-ups, while the “abs” pull ribs to pelvis, and the hip flexors pull the pelvis towards the quadriceps, neither raises the torso off the floor. This is done by the psoas, a deep muscle that connects the femur to the lumbar spine. The pull of the psoas, plus the anterior tilt, further increases the lumbar curve.

The crunch appeared to be the solution. However, overdoing the crunch, moving to the end point of bending the spine, reverses the lumbar curve, also an issue for disc health. At this point, you feel a cramping sensation, which is commonly accepted as a sign of an effective ab work, but is actually active insufficiency. By itself, the cramping isn’t necessarily negative, just not productive. The issue is the stress on the discs from reversing the lumbar curve. This also happens if the pelvis is free to move during the crunch: the same action that pulls the ribs to the pelvis pulls the other way, too, creating a “posterior pelvic tilt” (the back side of the pelvis tilting towards the hamstrings). Contracting the hamstrings and glutes during ab exercise also creates the posterior tilt. By themselves, the anterior and posterior tilts aren’t necessarily to be avoided; but load, effort, speed, and high repetitions puts extra strain on the discs.

In the demonstrated exercise, the feet are apart to provide a stable base; as you progress, you can move the feet closer together to make it more challenging. Hips are slightly in front of the center of the ball, to avoid an extreme anterior tilt and excessive lumbar curve. Stay in the midrange of possible movement over the ball; you want the ball to support the lumbar curve, not reverse the thoracic curve. Start well short of fully arched over the ball. The bent knees will keep some tension on the quads, but also consciously tighten the quads in a static contraction to help lock the pelvis in place. Avoid tightening the hamstrings and glutes. Only lift your shoulders off the ball, towards the opposite hip, again stopping well short of the maximum bend in the spine. Hands on the head is optional, if you find your neck straining before your abs. Don’t pull on the head; feel the weight of your head in your hands. Crossing your arms across your chest removes the weight of your arms from the load; if you do this, keep a tight neck without thrusting with the chin or letting your head fall back.