The Muscles of the Core

- Rectus abdominis abdominal muscle that attaches at the fifth through seventh ribs, the lower sternum and the front of the pubic bone. This muscle flexes the spine, compresses the internal organs of the abdomen and transmits forces laterally from the obliques. It is a common fallacy that the upper and lower rectus are isolated differently. Training the rectus can be done with one exercise.
- Erector Spinae help to counterbalance all the forces involved in spinal flexion. They begin as the sacrospinalis tendon that attaches at the sacrum and ilium. This tendon then gives rise to different muscles that run up the spine and obliquely to attach at lateral parts of the vertebrae and the ribs. In the cervical region, these muscles attach at the base of the skull.



Muscles of the Core

- Quadratus Lumborum attaches at the 12th rib and the upper 4 lumbar vertebrae and the pelvis. It stabilizes the lumbar spine in all planes of motion, stabilizes the 12th rib and the attachment of the diaphragm during respiration, and laterally flexes the trunk.
- Latissimus Dorsi this is the largest spinal stabilizer. It attaches via the thoracolumbar fascia to the lumbar vertebrae, sacrum and pelvis, and runs upward to the humerus. It assists in lumbar extension and stabilization, and also performs pulling motions through the arms



Posterior

Posterior

deltoid

Latissimus

Teres major

Infraspinatus

The Muscles of the Core

- Thoracolumbar Fascia connects the latissimus dorsi, gluteal muscles, internal obliques and transverse abdominis, supplies tensile support to the lumbar spine, and is used for load transfer throughout the lumbar and thoracic regions.
- Abdominal Fascia connects to the obliques and rectus abdominis, and to the pectoralis major. Fascial connections that cross the midline transmit forces to the muscles of the opposite side of the body.

The Muscles of the Core

External Obliques –

abdominal muscles that attaches at the lower ribs, pelvis, and abdominal fascia.

- Internal Obliques abdominal muscles that attaches at the lower ribs, rectus sheath, pelvis and thoracolumbar fascia.
- Transverse Abdominis

 abdominal muscles that attaches at the lower ribs, pelvis, and thoracolubal fascia, and rectus sheath.



The Spine

- Three Sections
 - Cervical: Consists of 7 vertebrae
 - Thoracic: Constists of 12 vertebrae
 - Lumbar: Consists of 5 vertebrae



Structures of the Vertebrae



The Muscles of the Spine

- <u>Multifidus</u> deep spinal muscles that run segmentally from the neck (C2) to the sacrum. They produce extension and, to a lesser degree, rotation and lateral flexion forces that provide stability to joints at individual levels of the spine.
- Interspinalis, Intertransverssarii, Rotatores – deep structures that attach directly to the spinal column. These are very important for rotatory motion and lateral stability.



Training the Core

Key Terms to Know

- Proprioception: the sense of the relative position of neighbouring parts of the body.
- Dynamic Stabilization: Strengthening of the Core Muscle Stabilizers of the spine (transversus abdominus & multifidus) while keeping the client in a 'Neutral Spine' position.

Training the Core

- The common myth is that training the core simply involves sit ups and back extensions. An efficient core routine consists of multiplanar movements - training in all planes of motion. As the body moves, the center of gravity changes, and forces exerted by, and on, the body's tissues are constantly changing.
- Dynamic stabilization must be included to increase proprioception and stability in the trunk, as well as in the rest of the body. This allows the parts of the body to react efficiently to external forces and stresses, such as gravity, changes in terrain, and carrying loads, as well as the internal forces exerted by other muscles.



Functional Core Routine

- A functional core routine consists of dynamic movements, challenges the center of gravity and isometric exercises. To completely train the core, you must also include dynamic stabilization, isometric and proprioceptive movements not just for the mid section but the entire trunk.
- Medicine balls, balance boards, foam rollers and physio balls are great tools for core training and should be integrated into every program. It is a fact that training on the physio ball (challenged environment) is superior to traditional floor exercises. As a person ages, balance and stability become compromised. If balance and stability are not addressed, they will consistently degrade.
- A weak core contributes to poor stability and inhibits proper limb movements causing muscle imbalances in the kinetic chain. This is why falls are common in the geriatric population. Many back and hip injuries are related to weak core muscles.
- There are many small muscles in the core that the general population knows little about or addresses during exercise. MRI images show atrophy in these small muscles in most spinal injuries. These little muscles need to be trained in order to maintain a healthy spine. Without stability, even the strongest person can not effectively propel a force into the environment.



Tests to evaluate your clients core stability

Core Stability Testing

Flexor Endurance

- Have the patient sit up 3-4 inches
- Time how long patient can stay up.
- 50 to 60 seconds is an average time for this test



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Core Stability Testing

Trunk Curl

- Have client lay supine with knees bent
- Ask client to sit up
- Check to see if they clear their scapula
- Look for heel elevation
- Check for abdominal yoking



Core Stability Testing

Side Bridge

Endurance Test

- Have patient perform a side bridge
- Test to see how long they can hold
- Pay attention to hip dropping
- This test will reveal core weakness
- 30 to 45 seconds is an average time for this test





Sports Specificity



Core Training for Runners

Although opinions about the '*ideal running form*' vary greatly, most authorities will agree that the less energy that is expended, the more effective and efficient the running style will be.

 Now consider how a shortened rectus abdominis affects an runners performance during running.

Running Analysis

When performing a biomechanical analysis, it is very common to see numerimbalances of which the athlete is completely unaware. By video taping an athlete during activity the practitioner can show and explain what is happening then correct it.

When analyzing a runner, some of the most common biomechanical faults looked for are:

- Over-pronation (rolling in as arches collapse) in the feet this can cause a series of biomechanical imbalances from the foot up to the cervical spine.
- Excessive hip adduction due to tight hip adductors and can cause increased load in the lateral tissues such as the iliotibial band, tensor fascia lata and gluteus medius.
- Lack of trunk rotation due to restrictions in trunk rotators or shoulder extensors. This can cause overload in the hip musculature, spinal joints, and other trunk rotators.
- Lack of hip extension caused by tight hip flexors restricting extension, and weak gluteal muscles. This causes the extensors and rotators of the lumbar spine to become overloaded in order to compensate for the lack of hip extension.
- Lack of shoulder extension caused by restrictions in anterior shoulder muscles or poor trunk rotation.

Core Training for Cyclists

Most cyclists focus on their hamstrings, quadriceps and gluteal muscles, and forget about the importance of core stability.

- Consider how many hours the cyclist spends bent over in a flexed position on the aero bars, with no rotational or side bending motions. A strong core is needed to counter-balance these forces.
- With a focus on the core, a cyclist can generate more power and can sustain a higher level of intensity for longer periods.
- A stronger core also means less stress on the primary muscle movers and a delay in the build up of lactic acid.



Exercises that can be incorporated into your clients exercise routines

Ab Crunch

Lying on your back, with the knees bent, and your arms folded across your chest or hands behind your head, slowly roll your shoulders away from the floor until a strong contraction is felt in the abdominal. Return to the starting position under control and repeat for the prescribed number of repetitions. Remember to press the lower back into the floor, exhale on the exertion, and avoid tucking the chin towards the neck.





- Place dyna disc under low back.
- Start with back off the floor, crunch up and return to start.
- Aviod touching the floor.





Unilateral Knee Lift

- Lie on foam roller with feet flat on floor.
- Place arms alongside roller. Raise one knee toward chest.
- Maintain a 90 degree angle between knee and hip.
- Lower leg to floor.
- Repeat with opposite side.



Overhead Medicine ball Abdominal Bracing

- Lying on foam roller with feet flat on the floor.
- Hold medicine ball in both hands over the chest.
- Keeping arms straight, extend ball behind head and return to starting position.
- Keep abdominals tight through the entire movement.



Cross Bridge on Foam Roller

- Lie on foam roller with feet on the floor and holding medicine ball.
- With arms straight and keeping abdominal hollow and back on foam roller, move med ball from side to side.
- Return and repeat.

Sit Up to Throw

Lie with lower back resting on gym ball, keeping shoulder blades off the ball. Throw medicine ball to partner as you exhale and contract the abdominals, then inhale and release as you go back to start.



Side Step Chop

Hold a medicine ball in front of body. Step to side and raise ball diagonally overhead. Bring ball down and to opposite side, keeping abdominals tight.





Step Back Medicine Ball Twists

- Stand with med ball held out straight out in front of you.
- Take step back while twisting torso to the opposite side of the drop back leg.
- Return and repeat.

Downward Cable Chop

Grasp handle of cable with both hands, keeping arms straight, but elbows not locked out. Keep abdominals tight and shoulders down, twist from the torso and pull cable in a downward diagonal motion.







Upward Chop

- Keeping abdominals tight and back straight.
- Twist from the trunk while pulling arms upward.
- Repeat



Transverse Cable Chops

- Keeping abdominals tight and back straight.
- Twist frombyour trunk while pulling through with your arms.
- Repeat



Cable Pull Through

- Start in a sqatting posture with a rope handle attached to a cable between your legs.
- Stand up and as you stand pull the rope through your legs and lock out at the hips.

Pike on Ball

Get in pushup position, then rest the tops of your feet on a Swiss ball. Keeping your legs as straight as possible, bend your hips and try to pull your feet toward your chest so that the ball rolls forward. Hold at the top for three to four seconds, then slowly roll back to the starting position. Continue rolling the ball backward (letting it move up your legs) until your body forms a straight line. That's one rep. Save this exercise for the *end* of your workout.





The Jacknife

Start in push up position with your feet on the Swiss ball and hands on floor below shoulders. Hold spine in perfect alignment. While maintaining neutral spine throughout the movement, draw knees towards chest. Hold and then return to start position. The further the ball is away from you the harder the exercise. Repeat as many times as you can hold perfect alignment. Do not comprise technique for reps.





Bosu Ball Spike

Maintain balance while standing on a Bosu ball.

Hold a medicine ball overhead, then spike ball on floor to partner.





<u>Plank</u>

- Lie face down on mat resting on the forearms, palms flat on the floor.
- Push off the floor, raising up onto toes and resting on the elbows. Make sure elbows are underneath shoulders.
- Keep your back flat, in a straight line from head to heels.
- Tilt your pelvis and contract your abdominals so that your hips do not to sag towards the ground.
- You want to tighten your abdominals to as if bracing for a punch to the stomach.
- Make sure your elbows are lined up with your shoulders.



Crossovers

- Start in a push up position. Legs spread wider than shoulder width.
- With back straight, touch one hand to another and return to starting position without shifting your body.
- Immediately do the same thing with the other hand and continue to alternate.

Why Train the Core?

- The core is where the majority of the body's power is derived. It provides the foundation for all movements of the arms and legs.
- The core must be strong, have dynamic flexibility, and function synergistically in its movements in order to achieve maximum performance. Motion of the human body is not isolated to one muscle or tissue moving in one specific direction. Rather, it is a complex event involving agonist and antagonist structures that work together to create changes in position and/or location, and to stabilize the body in all three directional planes.
- Regardless of whether you play sports or not, it is essential to have core strength and trunk stability to improve the routine of your daily life and prevent injury.